TEACHING & LEARNING IN HIGHER EDUCATION

UNIT PENERBITAN JSKM
UiTM CAWANGAN PULAU PINANG
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TEACHING AND LEARNING IN HIGHER EDUCATION(TLHE)

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Foreword

First, I would like to express my utmost appreciation to the editorial team for their support, commitment, and expertise in making this issue published on time. On behalf of the editorial board, I wish to express my sincere appreciation to our coordinator, Mrs. Muniroh Hamat whose help in the completion of this issue. My sincere thanks also go to all authors for their participation and supported in the issue. Without your persistent support, this work could not have reached its goal.

Dear readers, this issue is a guide for educators and students focuses on building educators' skills in the teaching, most important, it provides effective strategies to students in learning. If you are an educator who seeks to improve your understanding of your students, desires to build confidence in your students, among your students, you are in our audience. It is important to teach students skills that are based on research from the field of teaching, learning and other related disciplines. To handle change of teaching and learning nature, educators need a base of theory and knowledge that will provide a solid foundation for their teaching, no matter what changes or pressures they face. This issue places a clear emphasis on teaching skills first but also ensures that those skills are based on current research. A framework and a set of guidelines are suggested for making decisions about your teaching, while understanding that every subject is different, and every educator has something unique and special to bring to their teaching.

If you are a student and seeks improved learning, you can gain much from this issue. This issue allows students to place new information and skills development into a larger context. This issue uses realistic examples to help students identify the practices they wish to adopt to improve their learning. In the end, though, the issue isn't really about educators and students, if you are the target group, it's about you, helping our community to develop the knowledge and skills they will need in a digital age: not so much digital skills, but the thinking and knowledge that will bring them success. This issue is your coach.

Dr. Rozita Kadar
Chief Editor
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Taking Notes vs Listening: Which is More Important?

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Introduction

Lecture slides are usually a summary of the lecture content. In lectures, note taking supports to concentrate on what the lecturer is saying, and they guide how your note taking and help you recognize the key topics and concepts. Take note of what seems on them, but don't confine your notetaking to simply copying it. Taking your own notes will encourage a deeper understanding of the content of the lecture. You can also take notes from a written source which will help you in writing an essay. You can include notes showing your own thoughts about a written source or a lecture to determine how you are going to use the information in your essay.

The information is usually very limited compared to what the lecturer says, so it's more effective to listen to the lecture and take notes from that. Most lecturers make their slides accessible before class, so print them out and take additional notes in the lecture. You'll get most out of lectures if you do both, but don't focus on getting everything down to the extent that you miss what the lecturer is saying. But remember that actively listening and thinking are what is important.

Regarding the encoding function, two aspects of notetaking are probably most relevant: (a) what method students use to take notes and (b) whether students try to organize their notes as they take them. With respect to note-taking methods, students can take notes by longhand in a notebook or using an electronic device (e.g., a tablet or eWriter), or they can type notes on a laptop computer or tablet. In realistic research of which method is best, taking notes longhand has generally produced as good or better performance outcomes when studied in real-life progresses and in the laboratory (Carter, Greenberg, & Walker, 2017; Luo, Kiewra, Flanigan, & Peteranetz, 2018; Mueller & Oppenheimer, 2014; for one exception, see Bui, Myerson, & Hale, 2013).

Listening Note Taking Strategies

Taking effective notes in lectures and tutorials is a necessary skill for university education. Good notetaking tolerates a permanent record of key information that you can join in with your own writing and use for exam revision. Attractive and precise notes also reduce the risk of plagiarising. It helps you discriminate where your ideas came from and how and what you think about those ideas.

Figure 1: Six good reasons to take notes

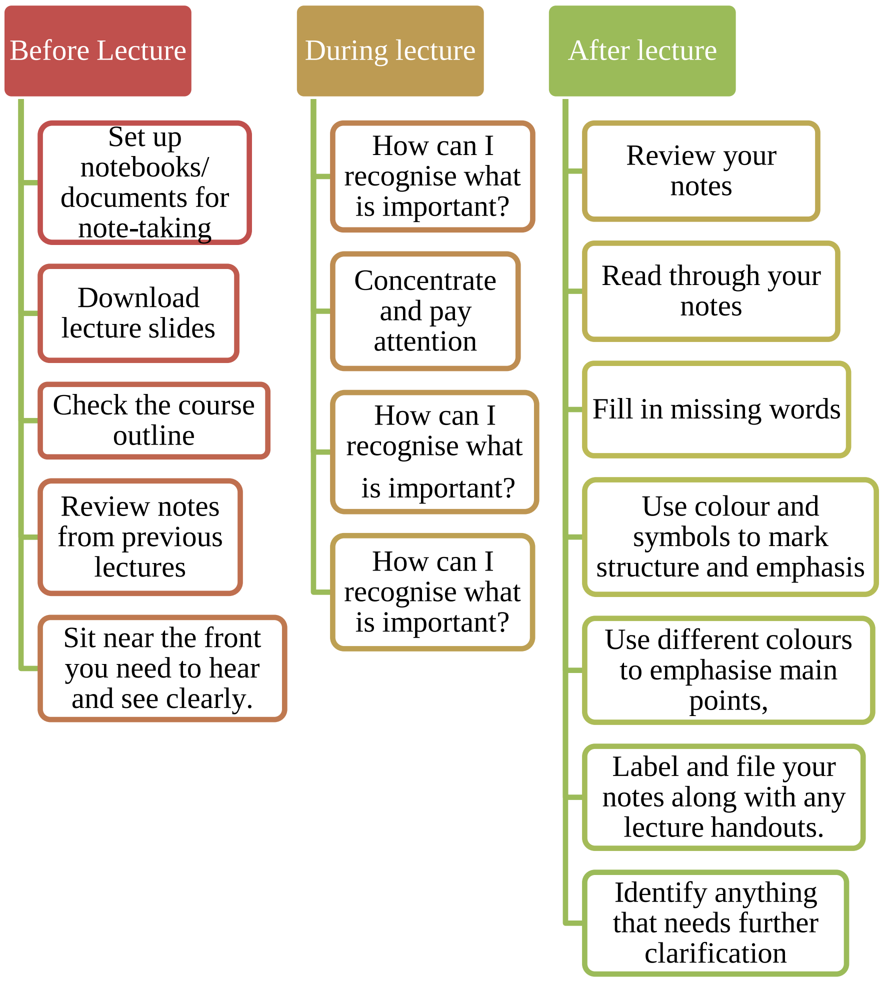

Figure 2: Action to do in lecture

Techniques and Tips for Listening and Note Taking

1. ***Write phrases, not full sentences -*** record the key words- to get the idea of the point.

2. ***Take notes in your own words*** - Paraphrase what you hear - helps you to understand and remember what you hear.

3. ***Structure your notes with headings, subheadings and numbered lists*** - Use headings to indicate topic areas or to include bibliographic details of the sources of information.

4. ***Code your notes -*** use colour and symbols to mark structure and emphasis.

5. **Use colour** to highlight major sections, main points and diagrams. Do most of the highlighting and underlining when you're revising your notes later.

6. ***Underline, circle, star, etc -*** to identify key information, examples, definitions.

7. ***If you miss something -*** write key words, skip a few spaces, and get the information later. Leave a space on the page for your own notes and comments.

Use Symbols and Abbreviations

When taking notes, you can reduce the amount of language by shortening words and sentences. It is important to remember that you will need to know what the abbreviations and symbols stand for when you review your notes later.

Table 1: Suggestion symbol for note taking

Symbol	Meaning
=	equals/is equal to/is the same as
≠	is not equal to/is not the same as
≡	is equivalent to
∴	therefore, thus, so
∵	because
>	more than, greater than
<	less than
→	gives, causes, produces, leads to, results in, is given by, is produced by, results from, comes from
↑	rises, increases by
↓	falls, decreases by

Table 2: Abbreviations and acronyms for note taking

etc. (etcetera)	**and the rest**
e.g.	for example
i.e.	that is
pg.	page
ch	chapter
no.	number
ASAP	As soon as possible
bff	Best friend forever
UNICEF	The United Nations International Children's Emergency Fund

Taking Notes from Your Reading

To get the most, due to the time that you use reading, it is important to develop effective note-making skills. Jotting down notes on a reading in the limitations and/or highlighting important segments can help you to focus and better understand what you read. Though, as your reading becomes more extensive and purposeful, writing effective notes will save you valuable studying and writing time. Good note-making can help you to keep a record of what you read and record your thoughts about it while they are fresh. Good notes can help you to:

- organise your ideas
- keep focused while reading
- keep a record of what you read so you can detect it again
- keep a record of what you thought whereas you were reading
- think critically about what you read
- examine a text
- absorb more effectively with what you read
- draw links to other research
- draw conclusions highlight parts that you need to improve further

Conclusion

Note-taking needs to be concise. You do not need to write down everything word for word. Using symbols and abbreviations when you take notes can allow you to take more accurate notes more quickly.

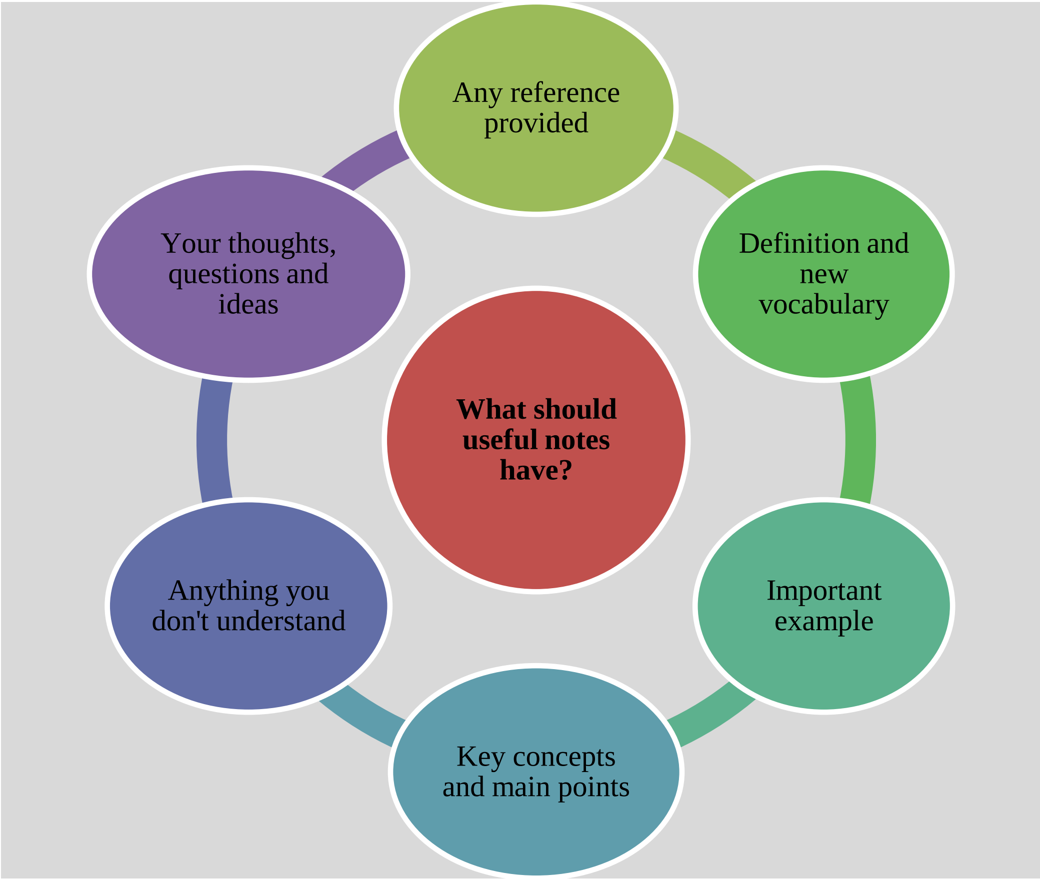

Figure 3 : Conclusion

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https://student.unsw.edu.au/notetaking-tips

Teknik Mudah Menghafal dan Mengingati Pembezaan Fungsi Trigonometri dengan Kaedah PERMATA

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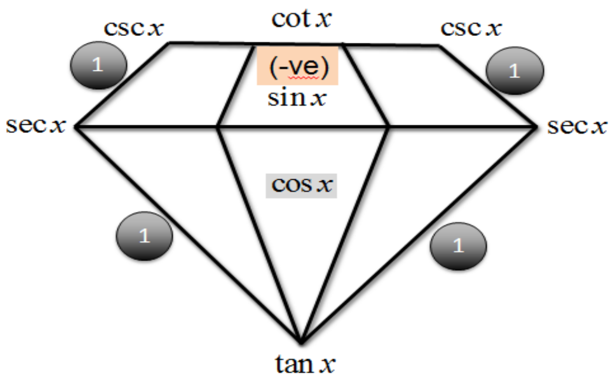
Pengenalan

Trigonometri adalah salah satu topik penting dalam pembelajaran Matematik bermula dari peringkat sekolah menengah sehinggalah di peringkat pengajian tinggi sama ada Pra-Sains, Diploma atau Ijazah. Dalam bidang Kejuruteraan khususnya, fungsi trigonometri memainkan peranan penting dalam penyelesaian masalah matematik terutama dalam subjek Kalkulus.

Pelajar sering melakukan kesilapan dalam menyelesaikannya kerana sukar mengingati dan menghafal pembezaan fungsi trigonometri malah mereka lupa dengan identiti asas trigonometri itu sendiri. Oleh itu, satu teknik telah diperkenalkan untuk memudahkan pelajar dalam mengingati dan menghafal fungsi trigonometri ini iaitu “Teknik PERMATA”. Bentuk permata digunakan kerana lebih menarik dan pelajar lebih mudah menghafal identiti asas trigonometri dan seterusnya dapat mengeluarkan formula pembezaan fungsi trigonometri.

Teknik PERMATA

Rajah di bawah menunjukkan bentuk permata digunakan untuk membina hubungan identiti asas trigonometri sabagai kaedah untuk membantu pelajar mengingati dan menghafal pembezaan fungsi trigonometri dengan lebih mudah. Identiti trigonometri yang dipadankan dalam teknik permata ini termasuklah identiti nisbah trigonometri dan identiti terbitan atau pembezaan fungsi trigonometri. Rajah 1 menunjukkan gambar rajah berbentuk permata. Jelas menunjukkan dalam rajah ini merangkumi semua fungsi trigonometri iaitu sin (*sine),* kosin *(cosine),* tangen *(tanget)*, kotangen*(co-tangent)*, sekan *(secant)* dan kosekan (*co-secant)*.



Rajah 1: Bentuk PERMATA Sebagai Hubungan Dalam Membina Identiti Trigonometri

Langkah-langkah Pembinaan Teknik PERMATA

Langkah 1 : Lukis bentuk permata iaitu dibina dalam lima sisi.

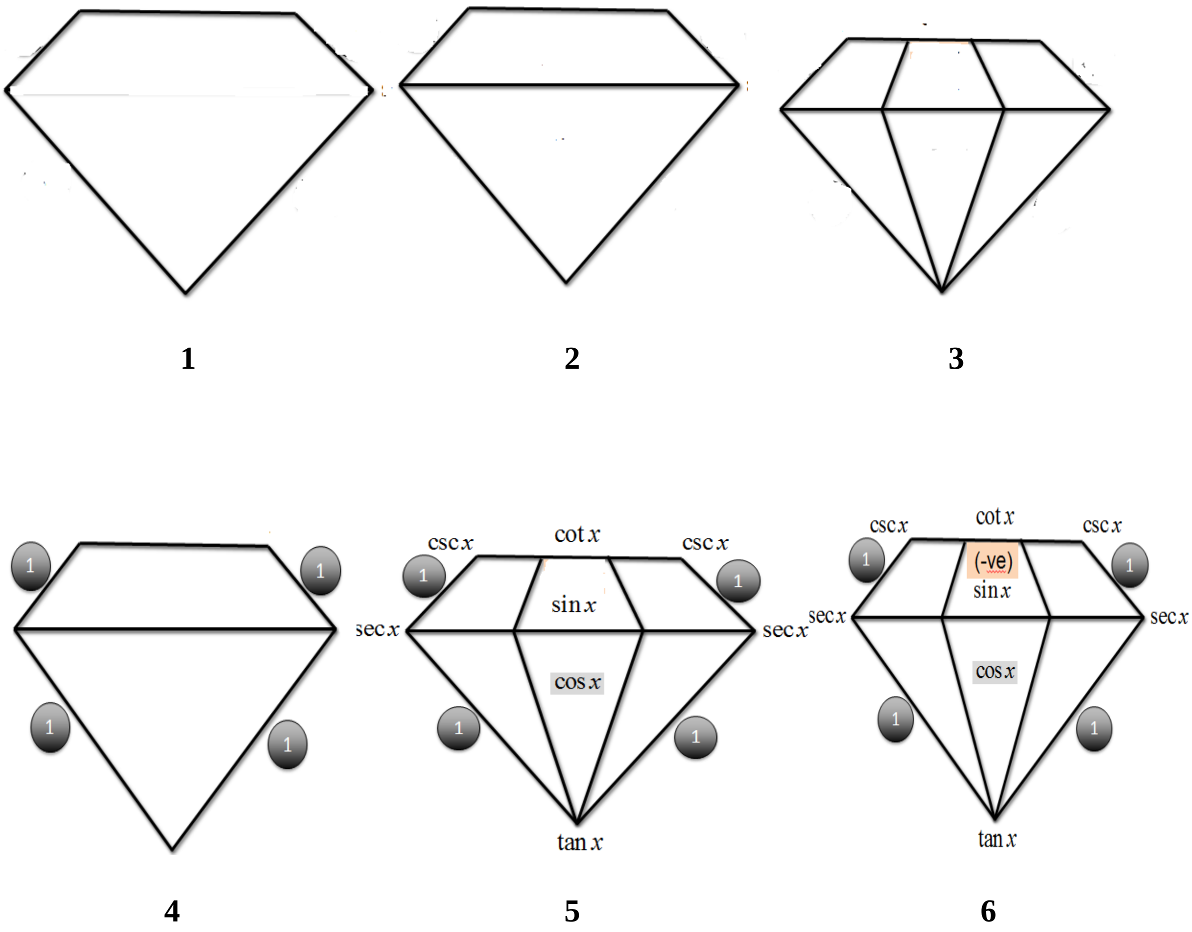
Langkah 2 : Sambungkan 2 sisi secara mendatar.

Langkah 3 : Bentukkan supaya menjadi enam bahagian seperti gambar yang ketiga di atas.

Langkah 4 : Letakkan nombor 1 di setiap sisi tepi.

Langkah 5 : Masukkan 3 trigonometri asas iaitu sin(x), cos(x) [di bahagian dalam] dan tan(x) [di bucu bawah].

Langkah 6 : Dengan menggunakan identiti asas bahagi, bentukkan supaya menjadi enam bahagian seperti gambar yang keenam di atas.



Rajah 2: Langkah –langkah dalam membina Diagram Berbentuk PERMATA.

Carta Alir Garis Panduan untuk Menggunakan Teknik PERMATA

1
- Lukis diagram pentagon berbentuk PERMATA.

2
- Pecahkan diagram kepada dua bahagian iaitu bahagian atas dan bawah.

3
- Labelkan bahagian atas dengan fungsi t sin(x) dan bahagian bawah dengan fungsi cos(x).

4
- Labelkan bahagian bucu bawah dengan fungsi tan(x).
  Nota: Guna identiti hasil bahagi, $\frac{\sin(x)}{\cos(x)} = \tan(x)$

5
- Labelkan bahagian bucu atas dengan fungsi cot(x).
  Nota : Guna identiti asas bahagi, $\frac{\cos(x)}{\sin(x)} = \cot(x)$

6
- Labelkan setiap sisi di bahaian tepi dengan nombor 1.
  Nota : Guna identiti asas bahagi, $\frac{1}{\sin(x)} = \csc(x)$
- dan seterusnya labelkandua bucu di bahagian atas dengan fungsi csc(x).

7
- Labelkan dua bucu dibahagian tengah dengan sec(x) .
  Note : $\frac{1}{\cos(x)} = \sec(x)$

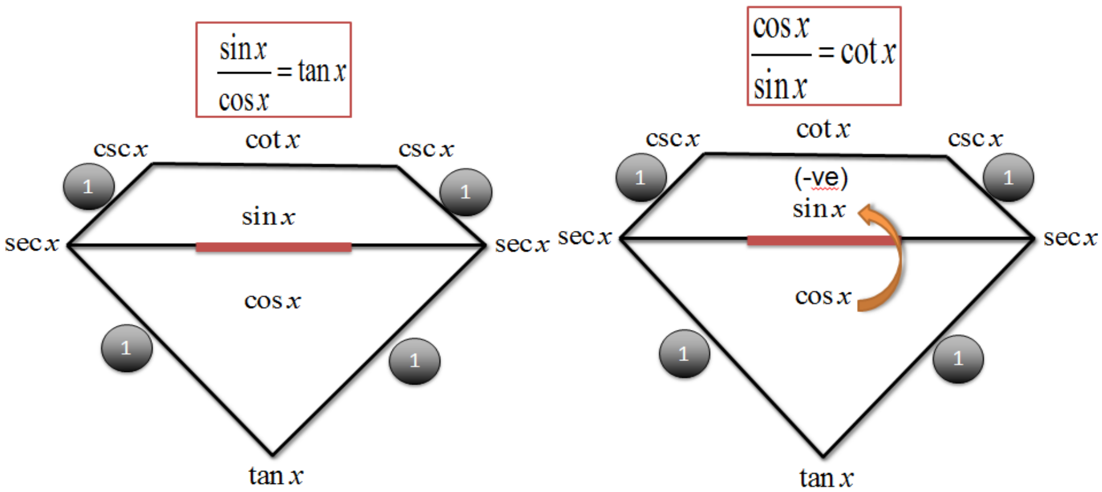
8
- Semak dan pastikan setiap bucu dan sisi telah dilabel dengan sempurna.

9
- TAMAT

Gambar rajah seterusnya menunjukkan bagaimana fungsi trigonometri dihubungkaitkan antara satu sama lain dengan menggunakan teknik PERMATA bagi membentuk identiti trigonometri yang dikehendaki

i. Identiti Nisbah Trigonometri

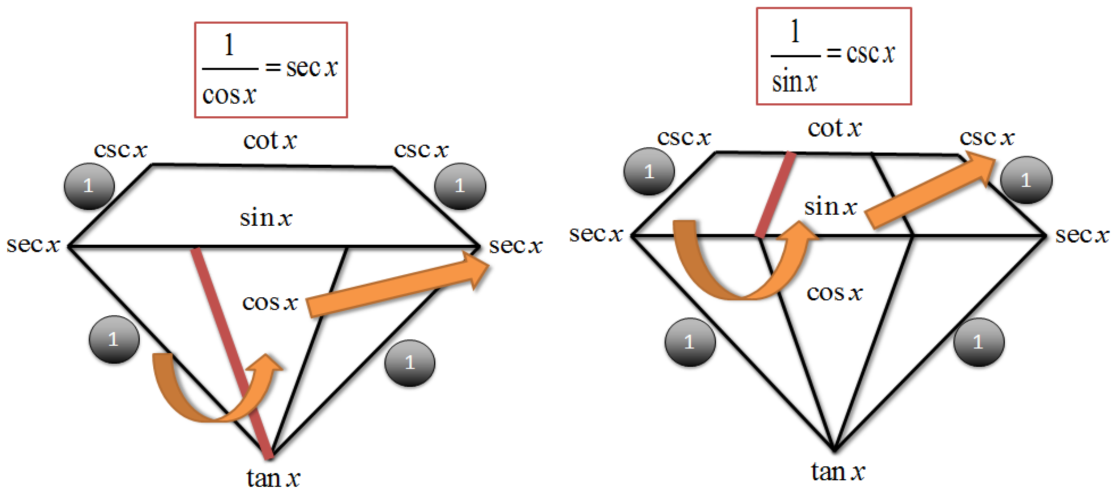
Identiti nisbah trigonometri diperolehi melalui pembahagian dua fungsi asas di bahagian dalam bentuk permata iaitu $\frac{\sin(x)}{\cos(x)}$ dan $\frac{\cos(x)}{\sin(x)}$. Hasilnya diambil dari sisi atas dan bucu bawah iaitu tan(x) dan cot(x). Lihat Rajah 3.



Rajah 3: Identiti nisbah trigonometri diperolehi Teknik PERMATA

ii. Identiti Salingan Trigonometri

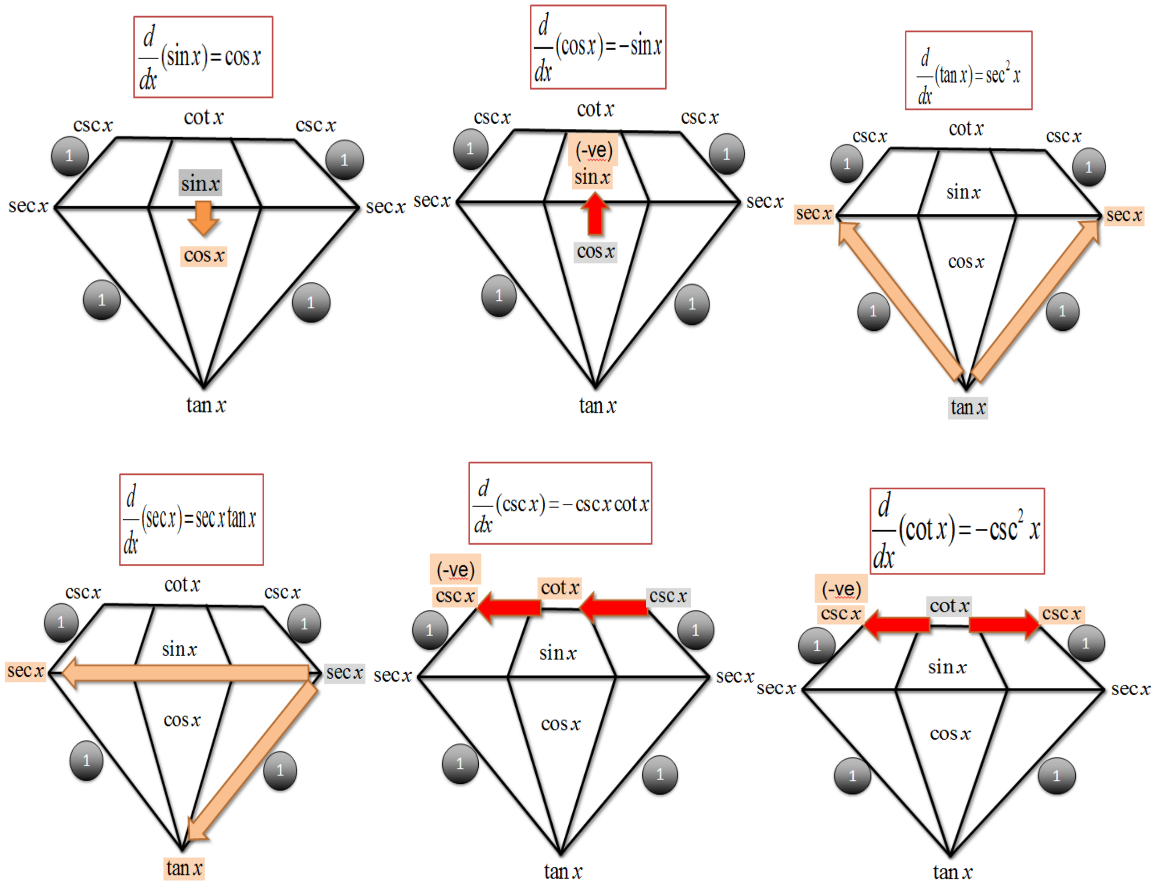
Identiti salingan trigonometri dikaitkan apabila nombor 1 dibahagikan dengan fungi trigonometri dibahagian dalam dan hasilnya ditulis dibucu atas dan bucu tengah. Lihat Rajah 4.



Rajah 4: Identiti salingan trigonometri diperolehi daripada Teknik PERMATA

iii. Identiti Terbitan atau Pembezaan Fungsi Trigonometri

Seterusnya dari identiti asas trigonometri yang diperolehi di setiap bucu seperti yang digambarkan di atas, pelajar akan dapat mengeluarkan formula pembezaan trigonometri. Terdapat 6 formula pembezaan trigonometri yang boleh diperolehi. Dua formula pembezaan dari dua fungsi trigonometri sin(x) dan kos(x) boleh diperolehi dari bahagian dalam bentuk permata manakala empat formula pembezaan trigonometri yang lain diperolehi dari sisi dan bucu di bahagian luar bentuk permata tersebut. Lihat Rajah 5.



Rajah 5: Identiti Pembezaan Fungsi Trigonometri diperolehi daripada Teknik PERMATA

Kesimpulan

Teknik PERMATA ini adalah salah satu teknik yang diperkenalkan dalam memudahkan pelajar untuk menghafal dan mengingati Pembezaan Fungsi Trigonometri di samping mengingati Asas Identiti Trigonometri itu sendiri. Jika sebelum ini kebanyakan pelajar hanya menghafal formula pembezaan tanpa sebarang teknik, jadi teknik PERMATA ini diharapkan dapat memudahkan pelajar dalam menyelesaikan masalah pelajar dalam menjawab soalan matematik terutamanya yang melibatkan Trigonometri.

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Differentiation and Integration: Students' Mistake and The Correction

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Introduction

Calculus 1 and Calculus 2 are compulsory subjects for engineering students in UiTM Penang. The mathematics course codes involving these two topics are MAT183 for semesters 1 or 2 and MAT235 for semesters 2 or 3. Each semester the student's weaknesses can be identified based on the topic differentiation which is learned in the subject of calculus 1 or MAT183. In this chapter, I will share a little bit of knowledge to correct what is wrong with examples of student error in the step of calculation for differentiation and integration.

Basic differentiation

Differentiation is important to understanding the concept of integration. A common weakness identified is that students cannot remember the basic concepts of differentiation for functions such as algebra, exponential, logarithmic and trigonometric. Students can also easily forget the techniques available such as product rule and quotient rule. There are some examples of students' mistake that involving basic of differentiation. Table 1 shows the question, student mistake and the correction in basic differentiation.

Table 1 : Student's Mistake and The Corrections.

Example	The mistake	The correction
1. Find $\frac{d}{dx}\frac{1}{6x^2}$	$\frac{d}{dx}\frac{1}{6x^2} = \frac{d}{dx}6x^{-2}$ $= -12x^{-3}$ • student change both positions 6 and x	$\frac{d}{dx}\frac{1}{6x^2} = \frac{d}{dx}\frac{x^{-2}}{6}$ $= -\frac{2}{6}x^{-3} = -\frac{1}{3x^3}$ • Bring the variable x only • Differentiate
2. Differentiate $f(x) = 2xe^{2x}$	$f'(x) = (2)(2e^{2x}) = 4e^{2x}$ • differentiate the function separately. • there are product of function $2x$ and e^{2x}, so must use the appropriate technique	$f'(x) = 2x(2e^{2x}) + e^{2x}(2)$ $= 4xe^{2x} + 2e^{2x}$ • suitable method is by using product rule $\frac{d}{dx}(uv) = uv' + vu'$
3. Differentiate $f(x) = \tan(x^3)$	$f'(x) = \sec^2(3x^2)$ • differentiated x^3 and replace with origanal angel • original angle was eliminate	$f'(x) = [\sec^2(x^3)](3x^2)$ $= (3x^2)\sec^2(x^3)$ • Differentiate the inside function • Multiply with $\sec^2(x^3)$
4. Differentiate $f(x) = (2x^2 + 1)^4$	$f'(x) = (4)(4x)^3 = 256x^3$ • differentiate the inside function and eliminate the real function. • need to use the appropriate technique	$f'(x) = 4(2x^2 + 1)^3 \bullet (4x)$ $= 16x(2x^2 + 1)^3$ • By using power rule: $f'(x) = n[f(x)]^{n-1} f'(x)$

Method of Integration by Part

The two important thing that student have to remembers are

1) How to choose u and dv by using acronym LIATE as follows

L	I	A	T	E
Logarithmic function	Inverse trigonometric	Algebraic	Trigonometric Function	Exponential Function

2) Formula of integration by part $\longrightarrow$ $\int u\,dv = uv - \int v du$

Figure 1 and 2 are two examples of student's mistake in the topic of integration by parts. The question is taken from the past year examination question on Jun 2019(Question 1a).

Question 1: Solve $\int \tan^{-1} x \, dx$ by using integration by parts.

Let's see what's the student have done for this topic?

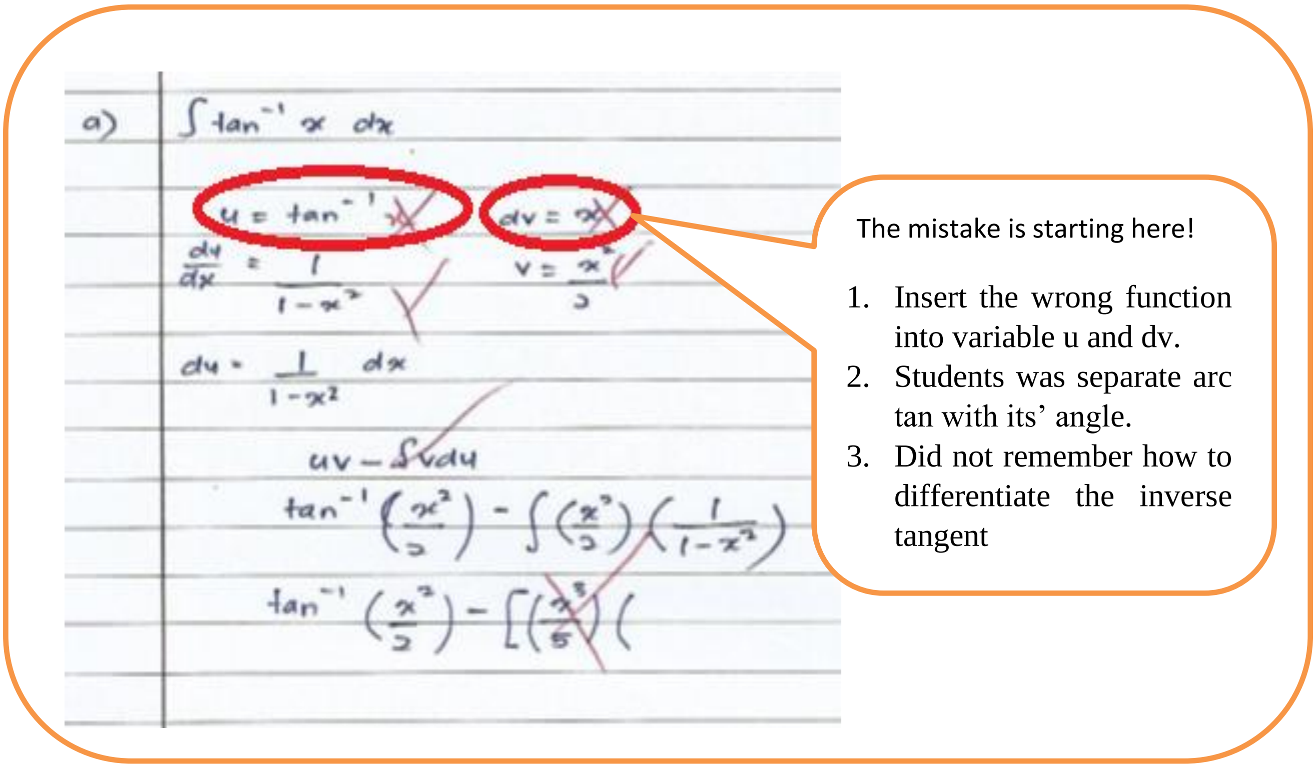


Figure 1: Student's mistake (1)

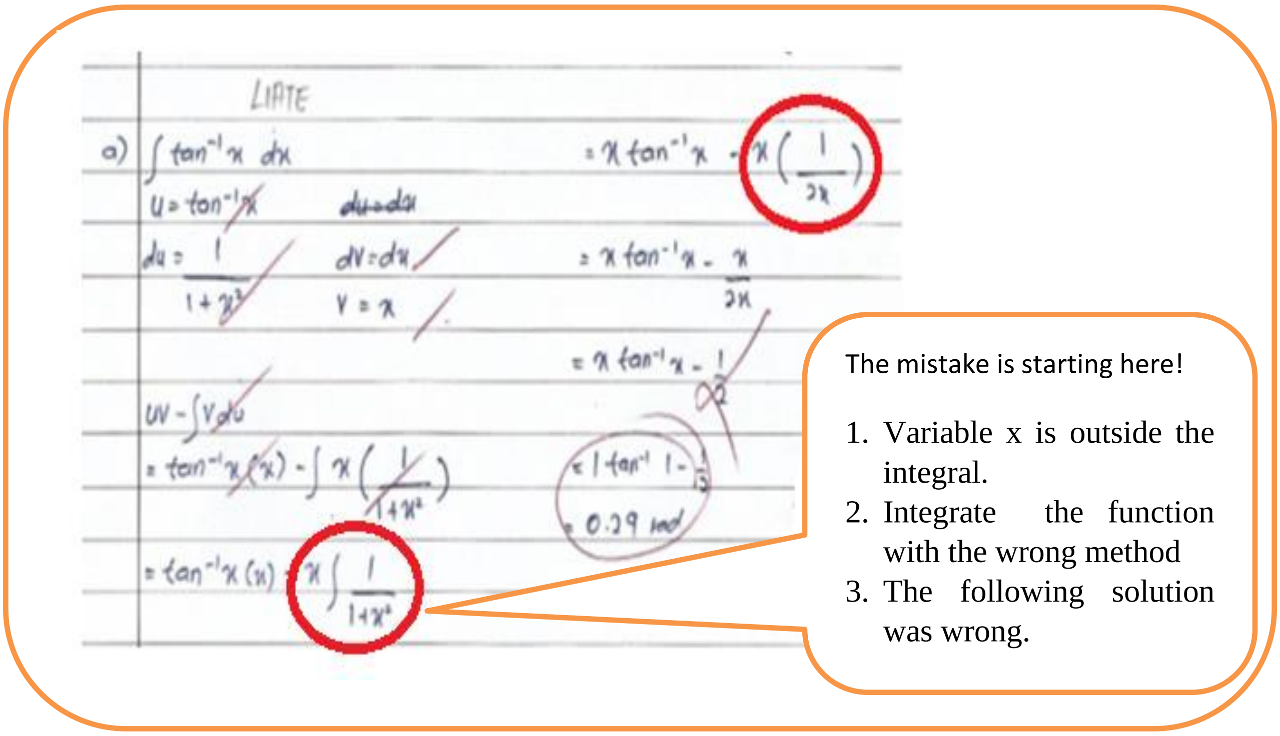


Figure 2: Student's mistake (2)

Table 2 show that the correction of the students' mistake. Make it perfect!

Table 2 : The Correction of Integration by Part

Correction:	**Method**
$\int \tan^{-1} x \; dx$ $u = \tan^{-1} x \quad , \quad dv = \int dx$	**Step 1: Choose u and dv.** *Remember!!!Single function that involving inverse trigonometric or logarithmic can be choose as u.* *Using LIATE when the integral involving product of 2 different function.*
$du = \frac{1}{1+x^2}dx \qquad v = x$	**Step 2: Differentiate u and integrate dv** *Remember the formula for integration of inverse trigonometric function!* *Basic formula:* $\frac{d}{dx}\tan^{-1} f(x) = \frac{f'(x)}{1+f(x)^2}dx$
$\int \tan^{-1} x \; dx = uv - \int vdu$ $= x\tan^{-1} x - \int x\left(\frac{1}{1+x^2}\right)dx$	**Step 3: Substitute into formula** *Substitute what do you find in step 2 into the formula of integration by part* $uv - \int vdu$
$\int x\left(\frac{1}{1+x^2}\right)dx = \int \frac{x}{1+x^2}dx$ $\boxed{\begin{aligned} &\text{let } u = 1+x^2 \\ &du = 2x \; dx \end{aligned}}$ $\int \frac{x}{1+x^2}dx = \int \frac{1}{u}\left(\frac{du}{2}\right)$ $= \frac{1}{2}\int \frac{1}{u}du$ $= \frac{1}{2}\ln u + c$ $= \frac{1}{2}\ln\left(1+x^2\right) + c$	**Step 4: Solve the integral** *Integrate by using method of substitution* *Remember!!* *Differentiate:* $\frac{d}{dx}\ln x = \frac{1}{x}$, *then* *integrate* $\int \frac{1}{x}dx = \ln x + c$ *Don't forget the last step for u substitution, that is replace* u *with* $ln\left(1+x^2\right)$.
$\int \tan^{-1} x \; dx$ $= x\tan^{-1} x - \frac{1}{2}\ln\left(1+x^2\right) + c$	**Step 5: Write the final answer** *Don't forget to combine the answers.*

Method of Trigonometric Substitution

They are many things that student have to remember:

1. Three pattern of trigonometric substitution as follows:

   $\sqrt{x^2+a^2}$, $\sqrt{x^2-a^2}$, $\sqrt{a^2-x^2}$

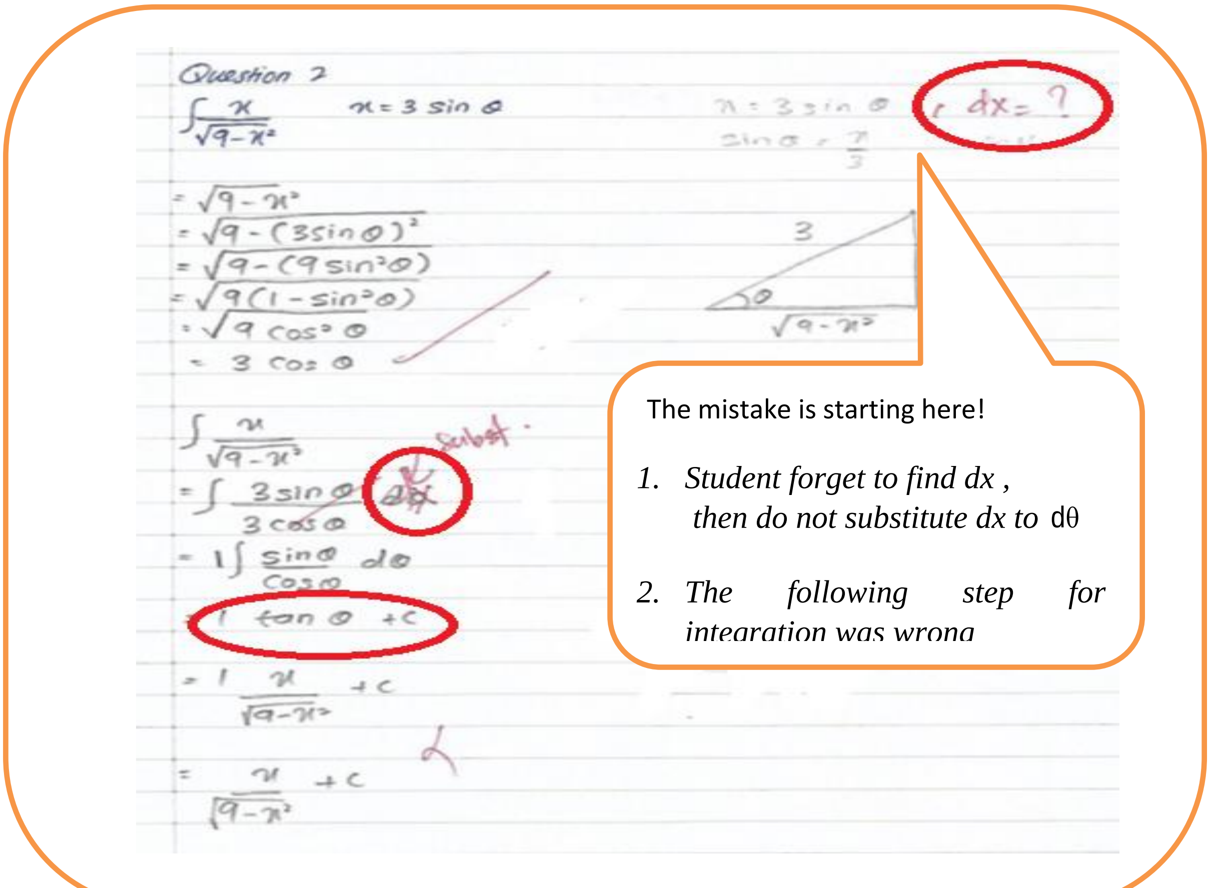
2. Each pattern have different steps to solve with different trigonometric substitution

3. Remember the basic differentiation and integration of trigonometric function

4. Using the right step for differentiation expecially the method of u substitution.

Let's see what's the student have done for this topic as shown on figure 3?

Question 2: Find $\int \frac{x}{\sqrt{9-x^2}}dx$ by using trigonometric substitution $x = 3\sin\theta$.



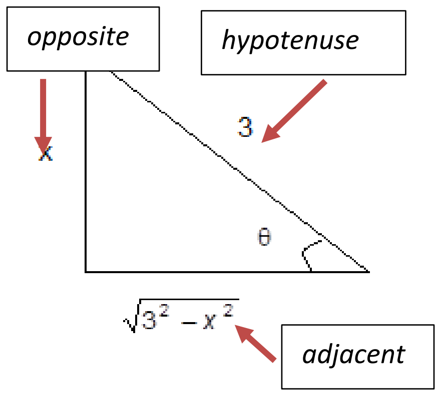
(sources: Test 1(April 2019))

Figure 3: Example of Students' Mistake on Integration of Trigonometric Substitution

The following table 3 show the correction of the above question 2.

Table 3: The Correction of Integration Trigonometric Substitution

Correction:	**Method**
$\int \frac{x}{\sqrt{9-x^2}}dx$, given $x = 3\sin\theta$	**Step 1: Simplify the radical function using trigonometric substitution given.**
$\sqrt{9-x^2} = \sqrt{9-(3\sin\theta)^2}$ $= \sqrt{9-9sin^2\theta}$ $= \sqrt{9(1-sin^2\theta)}$ $= \sqrt{9cos^2\theta}$ $= 3cos\theta$	*Substitute* $x = 3sin\theta$ *and then expand it.* *Factorize the value 9 and change the* $1-sin^2\theta$ *by using identity* $1-sin^2\theta = cos^2\theta$. *The purpose is to change the subtracting to the product and the square roots can be done.*
$x = 3\sin\theta$ $dx = 3\cos\theta\ d\theta$	**Step 2: Differentiate the given trigonometric substitution** *Differentiate x with respect to* θ
$\int \frac{x}{\sqrt{9-x^2}}dx$ $= \int \frac{3\sin\theta}{3\cos\theta}(3\cos\theta\ d\theta)$ $= \int \sin\theta\, d\theta = -\cos\theta$	**Step 3 Substitute into The Real Question** *Substitute the answer in step 1 and step 2* • $x = 3\sin\theta$ • $dx = 3\cos\theta\ d\theta$ • $\sqrt{9-x^2} = 3\cos\theta$ *into the real question.*
	Step 4 : Simplify and Integrate *The answer is in term of* θ, *so this is not the final answer. You should change to variable x.*



Step 5 : Using the triangle of θ

Using the triangle of θ to make a change from θ to variable x.

From the trigonometric substitution, $x = 3\sin\theta$,

the $\sin\theta = \dfrac{x}{3}$. *Fill the value into triangle, that is opposite , adjacent and hypotenuse of* θ

Remember!! $\quad \sin\theta = \dfrac{opposite}{hypothenuse} = \dfrac{x}{3}$

So, the adjacent is $\sqrt{3^2 - x^2}$

$$= \int \sin\theta\, d\theta = -\cos\theta$$

$$= \frac{\sqrt{3^2 - x^2}}{3} + c$$

Step 6: Write down the final answer

From the triangle,

$$\cos\theta = \frac{adjacent}{hypothenuse} = \frac{\sqrt{3^2 - x^2}}{3}$$

Write down the final answer in terms of x.

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Kitar Hayat Pembangunan Pengaturcaraan: Suatu Kaedah Bagi Memahami Asas Logik Dalam Pengaturcaraan

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Pengenalan

Kursus asas pengaturcaraan merupakan salah satu kursus keperluan universiti yang perlu diambil oleh pelajar dari aliran Sains Tulen dan Kejuruteraan selain dari pelajar yang major dalam bidang Sains Komputer. Pelajar wajib lulus kursus ini bagi tujuan pengijazahan.

Cabaran adalah agak mencabar untuk mengajar kursus pengaturcaraan khususnya pelajar-pelajar dari bidang Sains Tulen dan Kejuruteraan (Abid 2011). Memandangkan kursus pengaturcaraan adalah kursus bukan teras, maka kebanyakan pelajar tidak sangat memberi perhatian akan kepentingan kursus ini dalam bidang pengajian masing-masing. Antara alasan lain yang diberikan oleh pelajar adalah sukar untuk memahami konsep pemprograman bahkan tidak dapat menggambarkan logik bagaimana untuk menulis program menggunakan bahasa pengaturcaraan tertentu berdasarkan penyataan masalah yang diberikan (Othman 2016).

Artikel ini secara ringkas akan berkongsi idea bagaimana kaedah yang mudah untuk pelajar memahami logik dan seterusnya pelajar mampu menulis program mengikut langkah yang diperkenalkan dalam Kitar Hayat Pembangunan Pengaturcaan *(Programming Development Life Cycle – PDLC).*

Metodologi

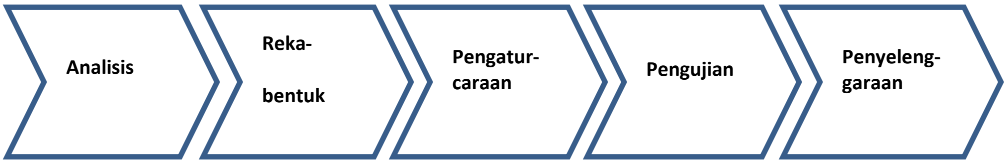
Kitar Hayat Pembangunan Pengaturcaan merupakan suatu metod yang berkesan bagi membantu pelajar memahami dan menggambarkan logik bagi sesuatu penyataan masalah. Kebanyakan pengamal dalam bidang pengaturcaraan komputer menggunakan metod ini samada bagi tujuan pembangunan sistem atau penyelidikan. Umumnya, Kitar Hayat

Pembangunan Pengaturcaraan terdiri dari lima (5) fasa utama iaitu fasa Analisis, Rekabentuk, Pengaturcaan, Pengujian dan Penyelenggaraan (Othman 2009). Kursus pengaturcaraan akan memberi fokus pada semua fasa, kecuali fasa terakhir iaitu penyelenggaraan akan disentuh secara umum sahaja. Jadual berikut menerangkan aktiviti yang terlibat dengan terperinci bagi setiap fasa dalam Kitar Hayat Pembangunan Pengaturcaraan.

Jadual 1. Fasa Kitar Hayat Pembangunan Pengaturcaraan

Fasa	**Deskripsi**
Analisis	Menakrifkan penyataan masalah dan kenalpasti elemen-elemen penting seperti keperluan data untuk input, proses-proses yang terlibat serta maklumat atau output yang diperlukan oleh pengguna sistem. Umunya adalah mengenalpasti IPO (*Input-Proses-Output*).
Rekabentuk	Hasil IPO diterjemahkan kepada kod pseudo atau carta alir, yang mana kedua-duanya juga disebut sebagai algoritma. Kod pseudo adalah arahan yang ditulis dalam bahasa tabii (eg : Bahasa Melayu atau English) langkah demi langkah dan difahami dengan mudah serta ianya tidak boleh terlalu teknikal. Carta alir adalah perwakilan dalam bentuk gambarajah menggunakan simbol atau notasi yang piawai bagi memberi gambaran yang lebih jelas.
Pengaturcaraan	Terjemahkan setiap langkah yang telah direkabentuk pada fasa rekabentuk kepada bahasa pemprograman yang ditetapkan (eg: Bahasa C, C++, Java, Python dan lain-lain)
Pengujian	Memastikan sistem pengaturcaraan yang ditulis tiada ralat samada ralat sintaksis dan ralat logik. Aspek memenuhi keperluan pengguna juga diberi perhatian semasa proses pengujian oleh pengguna-pengguna sistem.
Penyelenggaraan	Memeriksa dan melaksanakan penambahbaikan atau pemurnian sistem dari masa ke semasa.

Berikut adalah rajah Kitar Hayat Pembangunan Pengaturcaraan yang melibatkan kelima-lima fasa.



Rajah 1. Fasa-fasa Kitar Hayat Pembangunan Pengaturcaraan

Pelaksanaan

Sebelum memulakan penulisan program menggunakan bahasa pengaturcaraan tertentu bagi sesuatu penyataan masalah, pelajar akan diminta menganalisis dan merekabentuk penyataan masalah menggunakan metodologi Kitar Hayat Pembangunan Pengaturcaraan. Berikut adalah contoh penyataan masalah.

Tuliskan suatu program bagi mengira bilangan nombor dari suatu senarai nombor yang boleh dibahagikan dengan 5. Pengguna sistem perlu memasukkan bilangan nombor dan senarai nombor-nombor. Contoh sampel output adalah seperti yang ditunjukkan :

Masukkan bilangan nombor : 5
Masukkan senarai nombor-nombor : 56 80 72 35 18
Bilangan nombor yang boleh dibahagikan dengan 5 : 2

Rajah 2. Penyataan masalah

Berdasarkan dari metodologi Kitar Hayat Pembangunan Pengaturcaraan, pelajar akan diminta untuk melaksanakan Analisis bagi penyataan masalah di atas. Alat (*tools*) yang boleh digunakan semasa proses analisis adalah Spesifikasi Program dengan mengenalpasti elemen Input, Proses dan Output (IPO).

Input : bil_nombor, senarai_nombor

Proses : gelung bermula dari 1 hingga bil_nombor

masukkan senarai_nombor

semak (*if*) boleh dibahagikan dengan 5 maka

bilang satu demi satu

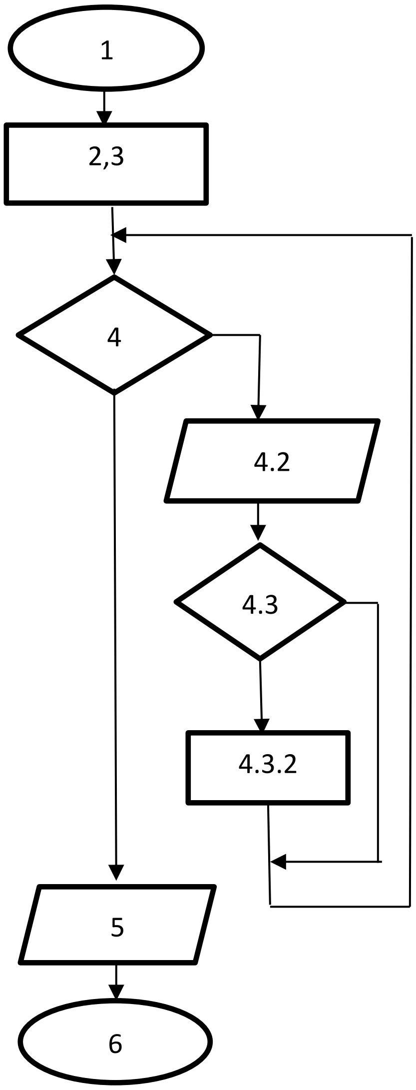
Output : bilang

Rajah 3. Spesifikasi program

Setelah Spesifikasi Program disediakan, ianya perlu disemak dan diuji bagi memastikan tiada apa-apa yang tertinggal. Langkah seterusnya adalah fasa Rekabentuk dengan menyediakan kod pseudo dan carta alir. Kedua-dua alat (*tools*) ini sebaiknya disediakan secara berselari pada mukasurat yang sama untuk memudahkan rujukan. Contoh adalah seperti yang ditunjukkan pada rajah 4.

Pelajar tidak perlu memasukkan teks pada setiap simbol dalam carta alir memandangkan kod pseudo dan carta alir disediakan secara bersebelahan. Nombor pada setiap simbol dalam carta alir sudah memadai dengan merujuk maksud pada kod pseudo di sebelahnya. Penyataan *mula* dan *tamat* pada sub-sub nombor seperti *mula for*, *tamat for*, *mula if* dan *tamat if* boleh diabaikan dalam carta alir. Setelah siap kod pseudo dan carta alir, ianya perlu diuji atau disimulasikan dengan beberapa sampel data bagi memastikan logiknya adalah betul.

Langkah seterusnya adalah menulis program dalam bahasa pemprograman yang ditetapkan. Fasa penulisan program merupakan fasa ketiga dalam Kitar Hayat Pembangunan Pengaturcaraan. Pelajar akan diminta untuk menyediakan dua lajur. Lajur pertama adalah kod pseudo dan lajur kedua merupakan program dalam bahasa yang ditetapkan.

Kod Pseudo	**Carta Alir**
1. Mula 2. Istihar pembolehubah bil_nombor, ulang dan senarai_nombor sebagai integer 3. Istihar pembolehubah bilang sebagai integer dan umpukkan dengan nilai 0 4. Gelung for bermula dengan nilai ulang = 0 dan berakhir dengan bil_nombor (tidak termasuk) 4.1 *mula gelung for* 4.2 masukkan nilai senarai_nombor 4.3 jika (if) senarai_nombor bahagi 5 tiada baki maka 4.3.1 *mula if* 4.3.2 kira bilang = bilang + 1 4.3.3 *tamat if* 4.4 *tamat for* 5. paparkan nilai bilang 6. tamat	

Rajah 4. Kod pseudo dan carta alir

Kod Pseudo	**Bahasa Pemprogramanan (eg : Bahasa pemprogramanan C++)**
1. Mula	{
2. Istihar pembolehubah bil_nombor, ulang dan senarai_nombor sebagai integer	int bil_nombor, ulang, senarai_nombor;
3. Istihar pembolehubah bilang sebagai integer dan umpukkan dengan nilai 0	int bilang = 0;
4. Gelung for bermula dengan nilai ulang = 0 dan berakhir dengan bil_nombor (tidak termasuk)	for ulang=0;ulang<bil_nombor; ulang++)
4.1 *mula gelung for*	
4.2 masukkan nilai senarai_nombor	{
4.3 jika (if) senarai_nombor bahagi 5 tiada baki maka	cin >> senarai_nombor;
4.3.1 *mula if*	
4.3.2 kira bilang = bilang + 1	if (senarai_nombor % 5 == 0)
4.3.3 *tamat if*	
4.4 *tamat for*	{
5. paparkan nilai bilang	bilang=bilang+1;
6. tamat	}
	}
	cout << bilang;
	}

Rajah 5. Kod pseudo dan program bahasa C++

Berdasarkan dari rajah 5, pelajar perlu menterjemahkan setiap baris arahan dari lajur kiri (kod pseudo) ke bahasa pemprograman C++ di lajur kanan. Melalui kaedah ini, pengajar dapat mengenalpasti kemampuan pelajar menterjemahkan setiap baris arahan dari bahasa tabii (kod pseudo) kepada bahasa C++.

Setelah selesai menulis program, pelajar perlu menterjemahkan bahasa pengaturcaraan yang ditulis tersebut kepada bahasa mesin melalui proses pengkompilan. Pada fasa ini iaitu fasa pengujian, pelajar akan membetulkan segala ralat yang melibatkan ralat sintaksis, ralat logik dan ralat masa larian sehingga program tersebut tiada ralat dan berjaya dilaksanakan (*run*). Fasa terakhir iaitu penyelenggaraan, walaupun tidak ditekankan, namun pelajar perlu tahu iaitu sebaik sahaja sistem diimplementasikan kepada pengguna, sistem perlu ditambahbaiki dan dimurnikan dari masa ke semasa mengikut keperluan pengguna sistem.

Penutup

Penggunaan metod Kitar Hayat Pembangunan Pengaturcaraan dalam pengajaran kursus pengaturcaraan didapati telah memberi impak positif di kalangan pelajar khususnya dari segi kefahaman logik dan penulisan pengaturcaraan. Didapati pelajar dapat memahami dengan mudah penyataan masalah yang diberi, mampu merekabentuk logik dengan baik serta menterjemahkan rekabentuk kepada bahasa pengaturcaraan yang dikehendaki. Namun demikian, pelajar perlu mencuba banyak latihan penyataan masalah menggunakan metod ini sehingga mereka sudah biasa, mampu menggambarkan logik sebenar serta cekap menterjemahkannya kepada bahasa pengaturcaraan dengan mudah. Sehinggalah ke tahap yang mana pelajar tidak perlu lagi bergantung kepada Kitar Hayat Pembangunan Pengaturcaraan apabila pelajar mampu menterjemahkan logik dari penyataan masalah terus kepada penulisan pengaturcaraan.

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Active Learning Theory towards the Use of e-Learning

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Introduction to e-Learning

Teaching can be based in or out of the classrooms enabled to transfer of skills and knowledge. Now a days, most of universities have implementing e-learning method to enhance the traditional form of teaching and this method gives students much greater flexibility of study (Diana, 2005). The e-learning system based on formalized teaching but with the help of electronic resources which is utilizing the electronic media, and information and communication technologies.

The use of computers and the Internet forms the major component of e-learning. It includes numerous types of media that deliver text, audio, images, animation, and streaming video, and includes technology applications and processes such as audio or video tape, satellite TV, CD-ROM, as well as local intranet/extranet.

There are different approaches in implementing e-learning. Algahtani (2011) discovers three distinct approaches of using e-learning in education which are: *adjunct*, *blended* and *online*. Figure 1 shows the model of approaches using e-learning in education.

The three approaches of e-learning are discussing below:

i. **Adjunct** - The situation which e-learning is employed as an assistant in the traditional classroom providing relative independence to the students.
ii. **Blended** - The delivery of course materials and explanations are shared between traditional learning method and e-learning method in the classroom setting.

iii. **Online** - Devoid of the traditional learning participation or classroom participation. The e-learning is total so that there is maximum independence of the students. Zeitoun (2008) has gone further to explain that the online model is divided into the individual and collaborative learning, where the collaborative learning also consists of the synchronous and asynchronous learning.

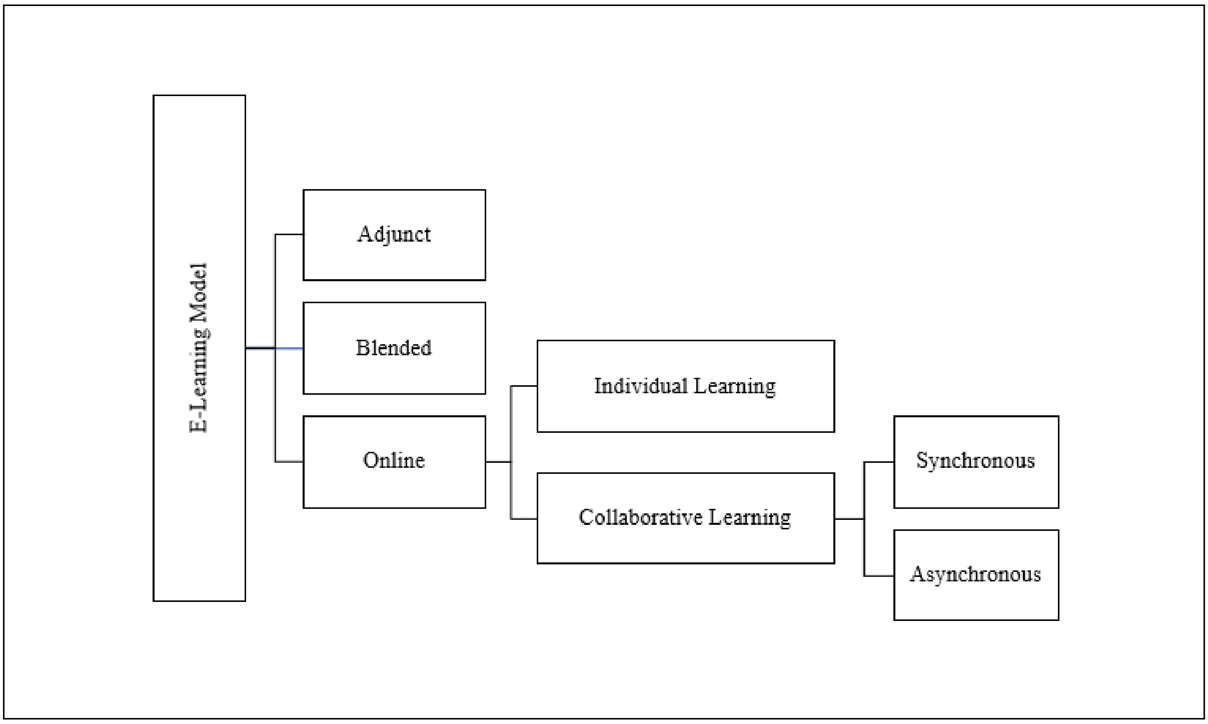

Figure 1 The model of e-Learning in Education

The Advantages and Limitations of e-Learning

Whenever students enrol for e-learning study, there are several benefits of e-learning but besides the benefits, are there also has the limitations of this practice. The next discussion has listed the advantages and limitations of e-learning.

Advantages of e-learning

- The flexible of choosing the place and time that suits to the students.
- Ease of access to the information that enhances the students' knowledge

- Improve communication skill among students using discussion forums and hindering the fear of talking to other students.
- Cost effective by offering opportunities for learning for maximum number of students with no need for many places.

Limitations of e-learning

- Makes the students undergo contemplation, remoteness, as well as lack of interaction or relation. Requires a very strong motivation and time management skills in order to reduce such effects.
- Less effective that traditional methods of learning (with respect to clarifications, explanations, and interpretations). The learning process is much easier face-to-face with instructors or teachers.
- Limit the role of instructors as directors of the educational process.
- Though students might have an excellent academic knowledge, they may not possess the needed skills to deliver their acquired knowledge to others.
- May also be subject to plagiarism, cheating, inadequate selection skills, and inappropriate use of copy and paste.
- Not all disciplines can effectively use e-learning in education

Active Learning Theory

Active learning is a process that has student learning at its centre. Active learning focuses on how students learn, not just on *what* they learn. Students are encouraged to 'think hard', rather than passively receive information from the teacher.

Active learning is based on a theory called constructivism. Constructivism emphasises the fact that learners construct or build their own understanding. Constructivists argue that learning is a process of 'making meaning' (Cambridge Assessment International Education, 2019). According to Brame (2016), active learning is commonly defined as activities that learners do to construct knowledge and understanding. Learners develop their existing knowledge and understanding in order to achieve deeper levels of understanding.

Active learning also links to other theories of learning. This article discusses the nature of Active Learning from the perspectives of four theories: *Dewey's Inquiry-Based Education, Piaget's Constructivism, Vygotsky's Social Constructivism* and *Bruner's Discovery Learning*.

a) *Dewey's Inquiry-Based Education*

Dewey, J. (2011) was talking about how children learn best when they interacted with their environments and were actively involved with the school curriculum. He rejected much of the prevalent theory of the time – behaviourism – as too simplistic and inadequate to explain complex learning processes. He argued that rather than the child being a passive recipient of knowledge, as was presumed by many educators of the time, children were better served if they took an active part in the process of their own learning. He also placed greater emphasis on the social context of learning. Dewey further argued that for education to be at its most effective, children should be given learning opportunities that enabled them to link present content to previous experiences and knowledge. Another feature in Dewey's theories was the need for learners to engage directly with their environment, in what came to be known as experiential learning, where 'knowledge comes from the impressions made upon us by natural objects'.

b) *Piaget's Constructivism*

Piaget's theory provides a solid framework for understanding children's ways of doing and thinking at different levels of their development (Ackermann, 2001). It gives us a precious window into what children are generally interested in and capable of at different ages. Their ways of doing and thinking have an integrity, a "logic" of its own, that is mostly well suited to their current needs and possibilities. This is not to say that children's views of the world, as well as of themselves, do not change through contact with others and with things. The views are continually evolving. To Piaget, knowledge is not information to be delivered at one end, and encoded, memorized, retrieved, and applied at the other end. Instead, knowledge is experience that is acquired through interaction with the world, people and things.

c) Vygotsky's Social Constructivism

This theory as known as Developmental theory. Piaget and Vygotsky are no exceptions. Both view the lengthy path towards higher forms of reasoning or 'formal operational thought' ultimately as proceeding from local to general, from context-bound to context-free, from externally supported to internally driven. Accordingly, cognitive achievements are gauged in terms of three major acts of distancing: The ability to emerge from here-and-now contingencies, The ability to extract knowledge from its substrate; and The ability to act mentally on virtual worlds, carrying out operations in the head instead of carrying them out externally.

d) Bruner's Discovery Learning

Discovery Learning was introduced by Jerome Bruner and is a method of Inquiry-Based Instruction (Takaya, 2008). It is considered a constructivist-based approach to education. This theory encourages learners to build on past experiences and knowledge, use their intuition, imagination and creativity, and search for new information to discover facts, correlations and new truths. Learning does not equal absorbing what was said or read, but actively seeking for answers and solutions. Discovery learning takes place in problem solving situations where the learner draws on his own experience and prior knowledge and is a method of instruction through which students interact with their environment by exploring and manipulating objects, playing with questions and controversies, or performing experiments.

Pappas (2015) suggested some tips that may help educators in integrating active learning into e-learning courses which are: Use a variety of learning strategies, Follow a mistake-driven learning approach, Encourage collaboration, Focus on interactivity and Connect your online training course with the real world.

One of the biggest benefits of active learning is that it allows students to apply what they are learning; thus, always remember to create fitting examples, suitable cases, and relevant problems to be addressed and solved. Use reality-based scenarios, demonstration videos that clearly explain work procedures, and e-learning simulations that inspire students to analyse their own problem-solving strategies. This way, it will make sure that students stay focused and engaged, as information is always better retained when it can be used.

Conclusion

How can active learning be applied to an e-learning and how can students benefit from it during their online learning, it all depends on the students. No matter how well designed in online training course is, it will not be of much use if it is irrelevant to students.

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Steps in Hypothesis Testing (One Mean)

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State the Null Hypothesis and Alternative Hypothesis

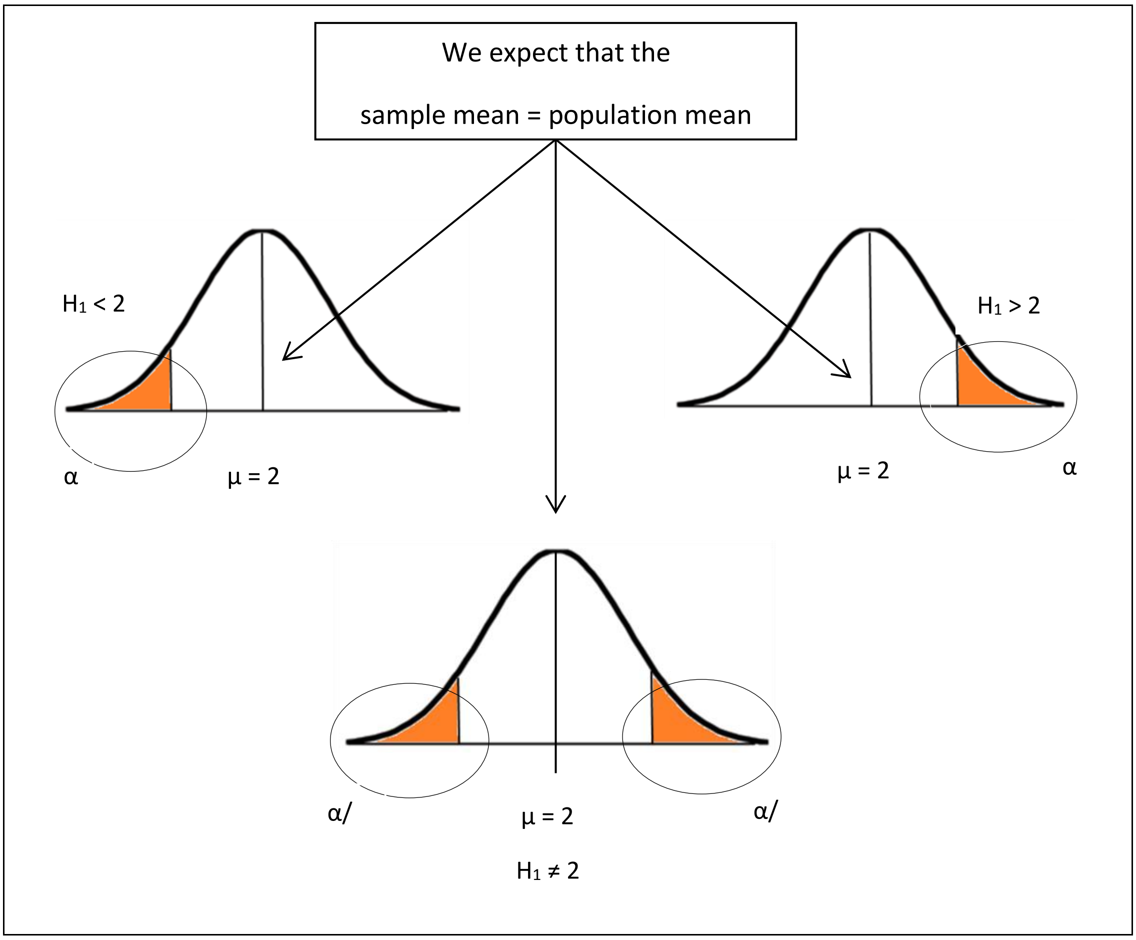
We begin by stating the value of a population mean in a null hypothesis. For example, we state that the null hypothesis that students in Universiti Teknologi MARA Cawangan Pulau Pinang, Malaysia study with an average of 2 hours per day. We will test whether the value stated in the null hypothesis is likely to be true. Keep in mind that the only reason we are testing the null hypothesis is because we think it is wrong. We may have reason to believe that students study more than 2 hours or less than 2 hours per day. We also can state that the value in null hypothesis is not equal to 2 hours.

Table 1. Hypothesis

Null Hypothesis	**Alternative Hypothesis**
$\mathrm{H}_0 = 2$	$\mathrm{H}_1 > 2$
	$\mathrm{H}_1 < 2$
	$\mathrm{H}_1 \neq 2$

The Level of Significance (α)

The alternative hypothesis determines whether to place the level of significance in one or both tails of a sampling distribution. Figure 1 show that the alternative hypothesis is used to determine which tail or tails to place the level of significance for a hypothesis test.



.Figure 1. The Alternative Hypothesis (H_1) Determines to Place the α

Compute the Test Statisic

For hypothesis testing of one population mean, we use z-test and t-test. The z-test is used when σ is known and t-test is used when σ is unknown.

Table 2. Test Statistic

t-test	z-test
$t_{cal} = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$	$z_{cal} = \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}}$

The t value or z value we get from the data is labeled as t_{cal} or z_{cal}.

Acceptance and Rejection Regions

The location of Acceptance and Rejection regions are shown in Figure 2. We can get the critical value from the Statistical Table.

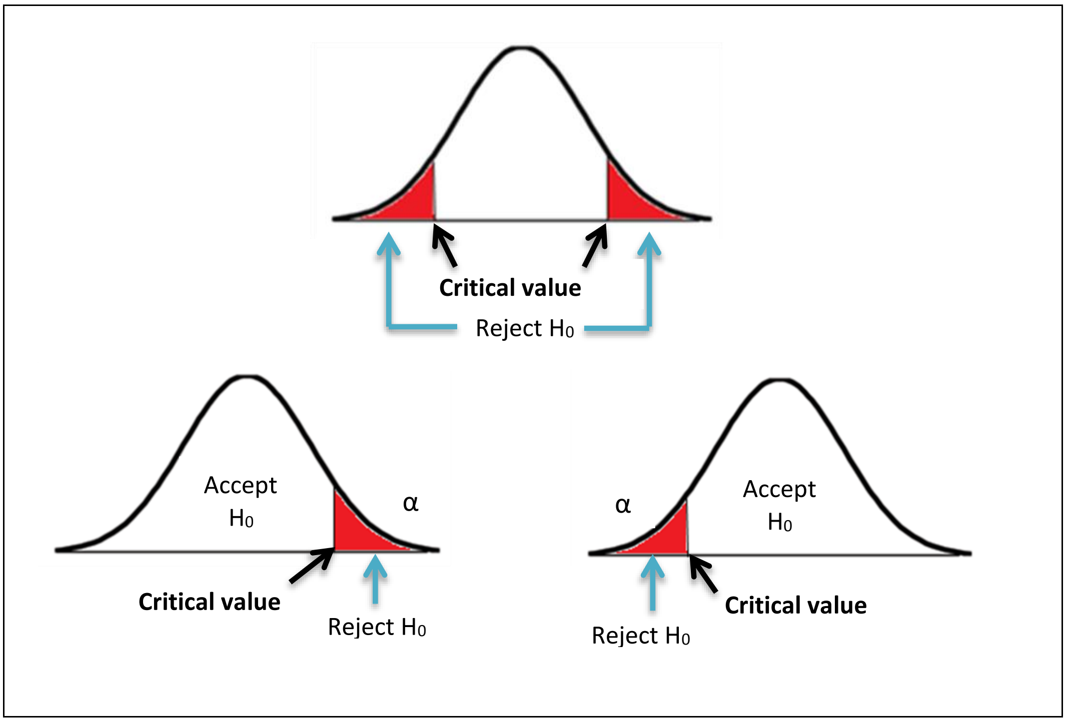


Figure 2. Acceptance/Rejection Region

Conclusion about H_0

If t_{cal} or z_{cal} falls in the critical region (the shaded region), reject H_0. Otherwise, we cannot reject H_0. We also can use the p-value method. Statistical software such as SPSS and Minitab software give an output by providing a p-value. If the p-value obtained from the output is less than α, then reject H_0 and Accept H_1.

For an example,

Given that: $n = 10$, $\bar{x} = 2.5$, $s = 1.056$

- **State the H_0 and H_1**:

  $H_0 = 2$

  $H_1 > 2$

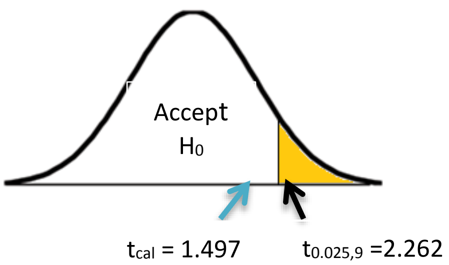
- **Specify the significance level, α**

  Alpha, $\alpha = 0.05$

- **Obtain the t_{cal}**:

$$t_{cal} = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{2.5 - 2}{1.056/\sqrt{10}} = 1.497$$

Acceptance and Rejection Regions



Critical value: $\alpha = 0.05$, $n = 10$

$t_{\alpha/2,\, n-1} = t_{0.025,\, 9} = 2.262$ (from Table t)

Conclusion about H_0

Since $t_{cal} = 1.497$ not falls in the shaded region, do not reject H_0. Thus, the null hypothesis ($H_0 = 2$) is accepted.

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Gear Up for Calculus

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Scenario mathematics anxiety among university students becomes a popular issue around the world since 1970's. Ersozlu and Karakus (2019) stated 537 papers on mathematics anxiety had been published in various databases Web of Sciences between 2000 and 2018. Numerous studies about the causes of mathematics anxiety and its impact on the students' achievement in schools or college and their career choice had been investigated (Richardson & Suinn, 1972; Tobias & Weissbrod, 1980; Hembree, 1990; Ma & Kishor, 1997; Miller & Bichsel, 2004; Vitasari et.al. 2010; Estonanto, 2017).

Mathematics anxiety has been discovered to discourage students at tertiary level from learning calculus and engineering mathematics confidently. Hence, it affects students' performance in calculus and they encounter the problem of utilizing calculus in the related engineering courses. Therefore, the issue arises the concern of all the educators to design the feasible of teaching and learning mathematics in calculus or engineering mathematics. Mastering the fundamental mathematics in calculus will ease the learning in different field. Hence, there are a few guidelines for students in calculus learning.

Tip 1: Revise basic algebra rules

You really need to revise all the basic rules in algebra such as expanding, factorising, simplifying the expression in the exponent form or the rational form. If not, you will miss a lot of marks regarding the algebra work of a calculus problem. For example, students must always beware of the distributive law of algebra $a(b \pm c) = ab \pm ac$ especially when the a is negative real numbers. The expansion of $-(b \pm c) = -b \mp c$ will be occurred when the students use the property in expression or equation.

Furthermore, students need to recall the five basic laws of exponents such as $a^m \cdot a^n = a^{m+n}$, $a^m \div a^n = a^{m-n}$, $(a^m)^n = a^{mn}$, $a^m \cdot b^m = (ab)^m$ and $a^m \div b^m = \left(\frac{a}{b}\right)^m$. They must use the property to simplify the expression or equation when they attempt to solve the derivative or integration in the calculus problem.

Tip 2: Make sense of the formulas and memorize them

Memorizing a formula without asking why and how is a time wasting in learning calculus. Students must know the formulation of the equations or theorems using logic and critical thinking. Sometimes, you need to memorize the theorem or definition to solve a practical problem.

For example, when students are required to explore the convergence or divergence in an infinite series. Firstly, they must understand the basic definition of infinite series. Then, you need to understand the hypotheses and conclusions of the theorem using the logical and reasoning thinking. You will use the accurate theorem to find out how the infinite series converge or diverge.

Students always struggle to use the formulas in finding the derivative and integrals in calculus. You need to study through all the basic rules in those formulas before solving the problem involving rate of change or optimum values in economic, estimation. Besides, you are encouraged to use mnemonic method to improve the learning in calculus.

Tip 3: Review the graphing skill

Graphs are the essential tools in all fields especially in calculus. You need to revise all the fundamental graphs such as linear function, quadratic function, absolute value function, exponential function, trigonometry functions and so on. The topics in calculus such as limits, area of functions and volume of solid in two dimensional or three dimensional require the prior knowledge. Without the solid skill in sketching the mentioned graphs, you have the difficulty to interpret, transform and model it. You also can use Geogebra or Wolfram Alpha to enhance the graphing skills because the free online softwares serve the users interactively.

Tip 4: Positive attitude

Learning calculus requires extra effort and attention. You need to pay close attention to every lecture and tutorial. Moreover, you need to do more exercises than are assigned to. Once you do not able to grasp the concept in calculus, you must approach to the lecturer immediately. The 'negative' thought of students like '*calculus is difficult and challenging*' must be avoided. Keeping those positive attitudes towards calculus will help you to achieve better performance in academic. According to Inamori (1995), I strongly believe that success = attitude x work x ability where the main three elements are the core success in your calculus. Attitude plays the major role in that formula.

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Think + Think + … Think = Overthinking

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Introduction

Do you know how many hours per day do you think? Do you find your mind keeps coming up with a variety of options and analyzing that happening without reaching any solution? Do you aware that this is an overthinking mind where thought going round and round just like playing a movie show? Do you consider overthinking is good? In fact, we are thinking all the time, and yet, we never think about these before!

What's Overthinking?

The term "Overthink" is defined as the action of using one's mind to think too much about something; or putting too much time into thinking about or analyzing something (Merriam-Webster's online dictionary, 2020).

Being an overthinker, a person is trying to control the future or constantly thinking about negative situations (Optimal Positivity, 2020). It is one of the most unhelpful mental habits. Overthinking is actually associated with uncertainty. A person probably feels that his future is being attacked or harmed, either physically or emotionally and he will try very hard to solve problems in the head; or he might be spending so much time ruminating or his mind is going over and over the same thing about something that has happened in the past.

In a study conducted by Arbor (2003), she found that 73% of adult in the age group between 25 and 35-year-olds are overthinkers, while 52% of adult in the age group of 45- to 55-year-olds are overthinkers. She also found that female tends to think too much as compared to male.

Is overthinking the same as worrying?

Although both overthinking and worrying involve too much thinking of negative thoughts, but there is a slightly different between them. Overthinking is thinking excessive about a past event. Whereas for worrying, one might think overly about a present or a future concern. Worry typically involves anxiety over future negative results. It is mostly related to asking the following two questions (Roy, n.d.):

1. What if the wrong thing happens?
2. What if the right thing doesn’t happen?

What Causes Overthinking?

Why do people overthink? Research found that there are two general causes of overthinking (Roy, n.d.):

1. Passive behavior learned from over-controlling parents.
2. Stressful, traumatic, or negative incidents from the past experience.

How Overthinking Harms Human?

Overthinking is exhausting (Optimal Positivity, 2020). It can waste human’s emotional energy and make people feel emotionally and physically drained. Overthinking can consume human’s energy and reduce our ability to make decisions. It can also hold us back and increase our risk of anxiety. It can also cause us to wake up in the middle of the night or prevent us from falling asleep. It can make us more emotional, get angry more easily and have trouble concentrating and focusing. Overthinking can make us spend too much time in your head, so that we aren’t emotionally present when we are around other people. As we are focused on our own thoughts instead of the person in front of us, it may make them feel that we aren’t interested in the topic of discussion. And it may be detrimental to our relationships.

Roy (2020) has listed the following 10 effects of overthinking that might harms human:

1. Anxiety
2. Depression
3. Fear
4. Stress
5. Fatigue
6. Indecision
7. Substance abuse
8. Loneliness
9. Sleeplessness
10. Suicide risk

11 Mechanisms to Watch Out When Overthinking:

Since overthinking can harm us, there is a need for us to aware if the moment we are overthinking. A list of eleven mechanisms for us to remember when overthinking is taking place in our mind (Optimal Positivity, 2020):

1. Overthinking is the voice of criticism, which attempts to destroy human being, because it doubts everybody and everything surrounding us. It can make us second guess everything and doubt ourselves. It can stop us from following our instinct.
2. It's the art of creating problems that is not real at all. Oftentimes, it includes thoughts about "What if?" and thoughts about all the things that could possibly not right.
3. It's the art of thinking so much about things that we ruin something before it even starts, and replay everything in our mind only.
4. If a person is an overthinker, he might get stuck in his life, since he is so curious, he wants to understand the why, and he will want to analyze and reflect. It may be his curse if he does not know how to be constructive with his voice.
5. Overthinking can be parasitic. Letting ourselves fall victim to overthinking can destroy our happiness and destroy who we are. The mind is a complex and beautiful thing, and the only person that can hurt it is ourselves.

6. We overthink things in order to control our future or change our past — both of which are futile. Rumination about our future and past can morph into feelings of distress, worry, guilt, shame, and regret. Overthinking is a bad habit that may steal our joy and cause us emotional suffering. It may not only steal our confidence, but also our ability to solve problems.
7. Our brain wants to work over-time, especially when we are trying not to think about something or trying to fall asleep.
8. Stop overthinking, as we cannot control everything. We cannot control everything, so do not even try to. We can only control what's going on in our mind. We can have influence over around the world around us, but we cannot truly control anything. It can be frustrating, particularly when we think our vision for our surroundings is superior to the natural expression.
9. Overthinking cannot empower us over things, which are beyond our control. That's why we should just let it be as well as cherish the moment.
10. Stop worrying about what happened in the past or what tomorrow may bring. Just focus on what we can control. Enjoy today, stay positive, and expect good things to come.
11. When we do not let ourselves fall victim to overthinking, we have more inner peace, we are more productive, and we are likely to be happier.

Overthinking Quiz

Table 1 is a simple quiz adapted from a website entitled "If You Overthink Too Much, This Quiz Will Tell You" (Rivas, 2018). You may take the quiz to do a self-check whether you have a sign of overthinking habit.

Table 1: If You Overthink Too Much, This Quiz Will Tell You (Rivas, 2018)

No	Item	Yes	No
1	Do you replay conversations in your head hours later because SURELY you came off the wrong way or you offended someone or it was awkward, and now you're worrying?		
2	Do you usually take longer than you should getting dressed because really, your outfit has to be JUST RIGHT?		
3	Are you indecisive about big decisions, because, what if it all goes wrong?		
4	Do you ruminate about what people really meant after saying ~that thing~ they said?		
5	Are you constantly wondering if you forgot to do something, like lock your door or turn off the stove?		
6	Do you rehearse what you're going to say just about a million times before an important conversation so that there's absolutely no way you'll stumble on your words?		
7	Do you even rehearse how you'll react to the other person's responses, then internally freak out when it doesn't play out like that?		
8	Do you stay awake at night thinking about your day, or about everything you have to do tomorrow?		
9	Are you constantly wondering why someone hasn't texted you back when they responded LITERALLY RIGHT AFTER THE TEXT YOU SENT BEFORE THIS ONE.		
10	Could you could write a whole book of irrational worst-case scenarios for different situations because, let's be honest, you can never be too prepared?		
11	Do you randomly get distracted thinking about something super embarrassing that happened years ago?		
12	Are you an expert at decoding and interpreting any and all social media statuses?		
13	Do you always end up deleting statuses or tweets because you're worried people will take them the wrong way?		
	TOTAL number of tick for each column		

To get your score, count the total number of ‘Yes’ and ‘No’ that you have ticked. If you answered ‘Yes’ more than ‘No’, it’s possible you have a tendency to overthink.

How to Stop Overthinking?

In our literature search, we found that there are hundreds over posts on how to stop overthinking. Foroux (2018) suggested that the only way to stop overthinking is to stop following through on all our thoughts and must learn to live in the present moment. The four steps are:

1. **Raise our awareness throughout the day.** We must always realize and remind that too much thinking defeats the purpose.
2. **When our awareness raises, immediately start observing our thoughts.** That is, every moment when we start thinking, don’t follow through, just observe how we start thinking. When we do that, we are able to stop it automatically.
3. **Only limit our thinking to specific moments that we need it.** For example, when we are thinking about setting our daily priorities, sit down and think. That might take 5 minutes. During that time, it’s perfectly fine to think and follow through on our thoughts. Or, when we’re journaling, we are also thinking during the process. That’s also fine. We’re trying to stop the constant thinking. We don’t want to become a monk.
4. **Enjoy our life!** We must let go of all our thoughts about yesterday and tomorrow. This is because tomorrow never come, and yesterday is already past! No matter how much we want to achieve in the future, and no matter how much we are suffered in the past — appreciate that we are still alive: NOW.

Final Words

Overthinking is one of the most vulnerable factors in our personality that puts us at a high risk of depression. It has also been linked to the anxiety spectrum of disease. Do remember that thinking is the biggest cause of our happiness. We should always keep ourselves occupied with joy and keep our mind off things that don't help us. We must aware that thinking is a tool only, and instead of using that tool during the 16 or 17 hours that we are awake, we should limited the use of it, and just use when we need it only. So, we should stay watchful and take early note if we are begun to overthink. We should try to use the four methods to stop overthinking habit before it lets in other disruptive mental disorders.

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Excel in Calculus using Calculator

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Calculus I

Calculus is one of the branches of mathematics that all engineering students at UiTM should take in their Diploma level. In UiTM, the code for the course of Calculus I is MAT183. Calculus I is very important as this subject prepares them basic skills to study further calculus in a higher level. For MAT183, there are 5 chapters in the syllabus. The chapters covered are Limits, Differentiations, Application of Differentiations, Integration and Applications of Integrations.

A Scientific Calculator

In Malaysia, most students are already familiar with the use of a scientific calculator since their high school level. Even though the price of a scientific calculator is not cheap for a student, but, most of them managed to have it to be used in Mathematics and other sciences subjects. Students at Universiti Teknologi MARA Cawangan Pulau Pinang, Malaysia mostly use Casio fx-570 series. There are three editions of fx-570 from Casio namely Casio fx-570MS, Casio fx-570ES and the latest one is Casio fx-570EX. There also can be found that some students use brands other than Casio such as Olympia, Sharp, Canon, Citizen and a few more. Even though the brand and the design are different, but the functionality is about the same with the Casio. So, any other brands can also apply the similar usage and tricks from this article as long as the calculator is a scientific calculator.

Using Calculator in Calculus

As a lecturer, based on our experience in teaching MAT183 at UiTM, we found that most students can do very well in solving calculus problems. However, at the end of the solution, many of them gave wrong answers. This was because they depend all the calculations on the calculator. Unfortunately, they did not know how to use or read their calculator. This is the problem. That is the reason they could not get the right answer whilst they can get it right if they simplify and do the calculation mentally.

How to Use a Scientific Calculator in Calculus

In this article, we provide a few examples on how to excel in Calculus using a calculator in a right way.

(a) Evaluating Numbers

i) ***To evaluate the square of negative values:***

e.g. Evaluate $(-3)^2$.

$\boxed{(}\ \boxed{-}\ \boxed{3}\ \boxed{)}\ \boxed{\wedge}\ \boxed{2}\ \boxed{=}$

Remark: $\boxed{-}\ \boxed{3}\ \boxed{\wedge}\ \boxed{2}$ means $-3^2 = -(3 \times 3) = -9$

ii) ***To evaluate numbers involving fractions:***

e.g. Evaluate $\dfrac{2}{\left(-\dfrac{5}{4}\right)}$.

$\boxed{2}\ \boxed{a\ b/c}\ \boxed{(}\ \boxed{-}\ \boxed{5}\ \boxed{a\ b/c}\ \boxed{4}\ \boxed{)}\ \boxed{=}$

or $\boxed{2}\ \boxed{\div}\ \boxed{(}\ \boxed{-}\ \boxed{5}\ \boxed{\div}\ \boxed{4}\ \boxed{)}\ \boxed{=}$

e.g. Evaluate $\frac{\left(\frac{2}{5}\right)}{4}$.

$\boxed{(}$ $\boxed{2}$ $\boxed{\text{a b/c}}$ $\boxed{5}$ $\boxed{)}$ $\boxed{\text{a b/c}}$ $\boxed{4}$ $\boxed{=}$

e.g. Evaluate $\left(\frac{2}{3}\right)^4$.

$\boxed{(}$ $\boxed{2}$ $\boxed{\text{a b/c}}$ $\boxed{3}$ $\boxed{)}$ $\boxed{\wedge}$ $\boxed{4}$ $\boxed{=}$

e.g. Evaluate $\left(5^{3/2} - \frac{4}{5}\right)^7$.

$\boxed{(}$ $\boxed{5}$ $\boxed{\wedge}$ $\boxed{(}$ $\boxed{3}$ $\boxed{\text{a b/c}}$ $\boxed{2}$ $\boxed{)}$ $\boxed{-}$ $\boxed{4}$ $\boxed{\text{a b/c}}$ $\boxed{5}$ $\boxed{)}$ $\boxed{\wedge}$ $\boxed{7}$ $\boxed{=}$

(b) The Trigonometric Functions

i) *To change the angle setting to degree or radian:*

$\boxed{\text{MODE}}$ $\boxed{\text{MODE}}$ $\boxed{\text{MODE}}$ $\boxed{\text{MODE}}$

Choose $\boxed{1}$ for degree mode or $\boxed{2}$ for radian mode.

ii) *To evaluate a trigonometric value:*

If there is no degree symbol, i.e. (°), we assume that the value is measured in radian mode.

e.g. Evaluate $\sin(3)$.

$\boxed{\text{sin}}$ $\boxed{3}$ $\boxed{=}$

Remark: A capital "R" or "D" will be displayed on the calculator if it has been set in radian mode or degree mode respectively.

iii) ***To evaluate trigonometric values involving fractional numbers:***

e.g. Evaluate $5\cos\left(\frac{2\pi}{3}\right)$.

$\boxed{5}\ \boxed{\cos}\ \boxed{(}\ \boxed{2}\ \boxed{\text{SHIFT}}\ \boxed{\pi}\ \boxed{\div}\ \boxed{3}\ \boxed{)}\ \boxed{=}$

or $\boxed{5}\ \boxed{\cos}\ \boxed{2}\ \boxed{\text{SHIFT}}\ \boxed{\pi}\ \boxed{\text{a b/c}}\ \boxed{3}\ \boxed{=}$

e.g. Evaluate $\sin\left(\frac{\pi}{4}+\frac{2\pi}{3}\right)$.

$\boxed{\sin}\ \boxed{(}\ \boxed{\text{SHIFT}}\ \boxed{\pi}\ \boxed{\text{a b/c}}\ \boxed{4}\ \boxed{+}\ \boxed{2}\ \boxed{\text{SHIFT}}\ \boxed{\pi}\ \boxed{\text{a b/c}}\ \boxed{3}\ \boxed{)}\ \boxed{=}$

Remark: The brackets "(" and ")" need to be included appropriately if there are more than one parameters in the evaluated trigonometric function.

e.g. Evaluate $\sin\left(\frac{\pi}{4}\right)+\frac{2\pi}{3}$.

$\boxed{\sin}\ \boxed{(}\ \boxed{\text{SHIFT}}\ \boxed{\pi}\ \boxed{\text{a b/c}}\ \boxed{4}\ \boxed{)}\ \boxed{+}\ \boxed{2}\ \boxed{\text{SHIFT}}\ \boxed{\pi}\ \boxed{\text{a b/c}}\ \boxed{3}\ \boxed{=}$

Remark: $\sin\left(\frac{\pi}{4}+\frac{2\pi}{3}\right) \neq \sin\left(\frac{\pi}{4}\right)+\frac{2\pi}{3}$.

iv) ***To evaluate trigonometric values involving powers:***

e.g. Evaluate $\cos^3\left(\frac{\pi}{4}\right)$.

$\boxed{(}\ \boxed{\cos}\ \boxed{\text{SHIFT}}\ \boxed{\pi}\ \boxed{\text{a b/c}}\ \boxed{4}\ \boxed{)}\ \boxed{\wedge}\ \boxed{3}\ \boxed{=}$

e.g. Evaluate $\cos\left(\frac{\pi}{4}\right)^3$.

cos	(	SHIFT	π	a b/c	4	)	^	3	=

Remark: $\cos^3\left(\frac{\pi}{4}\right) \neq \cos\left(\frac{\pi}{4}\right)^3$.

(c) Other Transcendental Functions

i) *To evaluate exponential values:*

e.g. Evaluate $e^2 + e$.

SHIFT	e^x	2	+	SHIFT	e^x	1	=

e.g. Evaluate $e^{\left(5/6 + \pi\right)}$.

SHIFT	e^x	(	5	a b/c	6	+	SHIFT	π	)	=

e.g. Evaluate $e^{\tan\left(\pi/6\right)}$.

SHIFT	e^x	(	tan	SHIFT	π	a b/c	6	)	=

ii) *To evaluate natural logarithms:*

e.g. Evaluate $2\ \ln\left(\frac{\pi}{4}\right)$.

2	ln	(	SHIFT	π	a b/c	4	)	=

e.g. Evaluate $\ln^2\left(\frac{\pi}{4}\right)$.

(	ln	SHIFT	π	a b/c	4	)	^	2	=

e.g. Evaluate $\ln\left(\frac{\pi}{4}+1\right)^2$.

ln	(	SHIFT	π	a b/c	4	+	1	)	^	2	=

(d) Saving and Recalling Values

i) *To save a value to a letter:*

e.g. Evaluate $\sqrt[4]{7^6}$ and store it to a letter A.

4	SHIFT	$\sqrt[x]{\ }$	7	^	6	=

SHIFT	STO	A

ii) *To recall a value from a letter:*

e.g. Evaluate $\sqrt[4]{7^6}-5$ by recalling the saved value of the letter A.

ALPHA	A	–	5	=

Conclusion

Using a scientific calculator is not as difficult as we imagine. Among possible reasons for having difficulties in using a scientific calculator are a lack of students' self-exploration towards the features of the calculator and the failure of relating and applying the PEMDAS rule. PEMDAS is an acronym for the order of operations that stands for Parenthesis, Exponents, Multiplication, Division, Addition, and Subtraction. Other acronyms used for the order of operations are BODMAS (Brackets, Order, Division, Multiplication, Addition, Subtraction) and BIDMAS (Brackets, Indices, Division, Multiplication, Addition, Subtraction) (Rahman et al. 2017). These acronyms have been the common teaching method used to help students in memorisation (Headlam and Graham 2009). If the students know how to key in certain mathematical expressions such as indices, transcendental functions, and other basic operations on the calculator, they just need to apply the rule of PEMDAS appropriately in order to get the correct outputs.

There are many ways can be done to get the correct answers using a scientific calculator. If a mathematical expression looks complicated and lengthy, it is recommended to solve the expression term by term and use “the storing and recalling” function to make the calculations easier. The students can also try to identify, extract, arrange, and write the mathematical expressions by following the PEMDAS rule. The students are then required to key in the relevant inputs on the calculator according to the extraction.

In order to avoid careless mistakes when using a scientific calculator, the students can also apply the relevant basic properties of mathematics to check their solutions. For instance, the answer for $\ln\left(\frac{\pi}{4}\right)^2$ can be checked or verified by evaluating the output for $2\ln\left(\frac{\pi}{4}\right)$.

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An Introduction to Car Loan Interest Charges

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Introduction

Many people love cars, but the price of a car is usually not cheap, so asking a bank loan is the easiest way to solve this financial problem. Do you know that money is not free to borrow? There is a cost to pay when one borrow money! Interest is the name for the cost of borrowing money. In this paper, we would like to share how the interest is being calculate for a car loan, how to determine the monthly payment for a car loan, as well as the total amount paid over a period of car loan term for the car. This would help the reader to make a smart decision when taking a car loan in future.

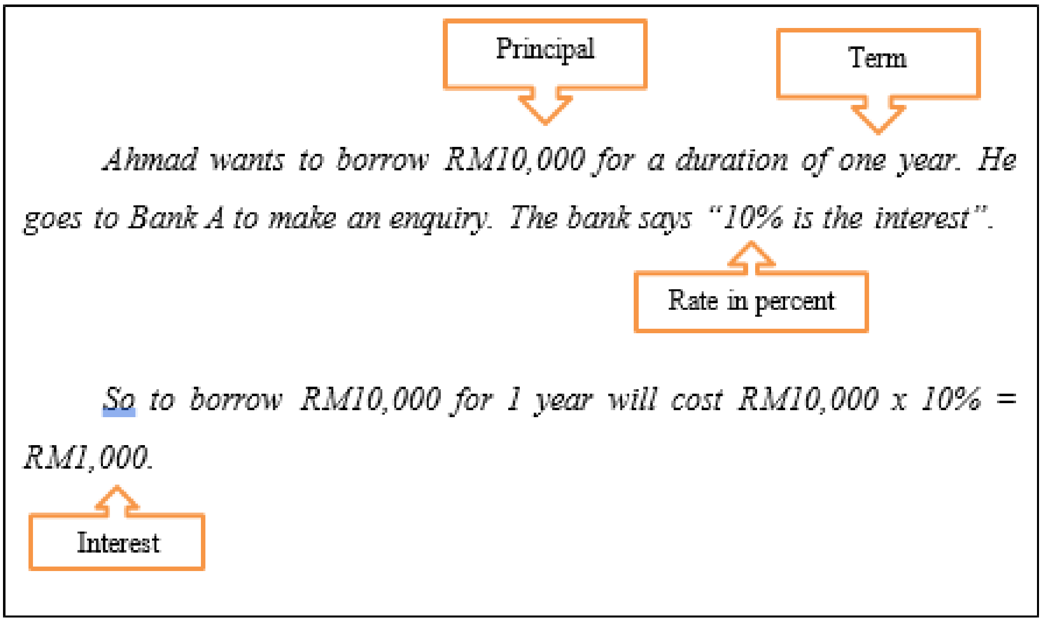
Definition of terms

In this section, we would like to introduce the reader the special terms used when borrowing money. Let's consider the following case (a simple full year loan):

Ahmad wants to borrow RM10,000 for a duration of one year. He goes to Bank A to make an enquiry. The bank says "10% is the interest". So to borrow RM10,000 for 1 year will cost RM10,000 x 10% = RM1,000.

If Ahmad agrees to the condition offered by the bank and he will brings back RM10,000 now. One year later, of course he has to pay back the original RM10,000 plus the interest RM1,000 and the total to be paid up to the bank is RM11,000.

Ahmad is the **Borrower**, the Bank A is the **Lender**. The amount of money borrowed is the **Principal** of the loan. The duration of the loan in years is called **Term**. The percent (per year) of the amount borrowed is stated in **Rate per annum**. The cost to pay when borrowed money is the **Interest** charged.



Simple Interest

We can use the following formula to calculate the interest charged on loan:

Interest = Principal x Rate x Term.

Let's say Ahmad wanted to borrow the money (RM10,000) for 2 years. If the bank charges "Simple interest", then Ahmad just pays another 10% for the extra year. Ahmad pays the interest of (RM10,000 x 10%) x 2 years. Then he just has to pay the same amount of interest every year.

Car Loans Interest

If you plan to buy a car by taking a car loan, then it is better to fully understand how interest rate charges work. Besides that, most Malaysian banks require car buyer makes a minimum down payment of at least 10% of the total car value for a new car or 20% for a used car (Surendra, 2015).

The interest calculation for car loans usually applies a flat interest rate (CompareHero.my, October 12, 2018), such that the amount of interest charged is fixed upon the principal.For example:

Ahmad wants to buy a new car, the price of the car is RM77,000. He decides to make a down payment 10% of the price of the car, and the rest he will apply a car loan. Bank A offers him 3.4% interest rate. Ahmad is given a choice on the duration of the loan (5-year, 7-year, or 9-year).

Now, Ahmad wishes to find out the total interest charged for a-9 year term loan, a-7 year term loan and a-5 year term loan. Do you know how much is the total interest charged for each loan term?

Here, the price of the car is RM77,000. The down payment is RM77,000 x 10% = RM7,000. Therefore, the loan amount for Ahmad is RM70,000 (RM77,000 – RM7000).

The following is the comparison of the interest calculations based on the respective terms.

A 9-year term

Based on the simple interest formula, the calculation for the total interest paid over 9 years will be as follows:

Interest = Principal x Rate x Term

= 70,000 x 3.4% x 9 years

= RM21,420

Total amount need to repay is RM70,000 + RM21,420 = RM91,420

Monthly payment for Ahmad is total amount need to repay divide over a period of 108 months = RM91,420 ÷ 108 = RM846.48

Total amount paid for the car by Ahmad after 9 years is RM 7,000 + RM 70,000 + RM 21,420 = RM98,420.

A 7-year term

Based on the simple interest formula, the calculation for the total interest paid over 7 years will be as follows:

Interest = Principal x Rate x Term

= 70,000 x 3.4% x 7 years

= RM16,660

Total amount need to repay is RM70,000 + RM16,660 = RM86,660.

Monthly payment for Ahmad is total amount need to repay divide over a period of 84 months = RM86,660 ÷ 84 = RM1031.66

Total amount paid for the car by Ahmad after 7 years is RM 7,000 + RM 70,000 + RM 16,660 = RM93,660.

A 5-year term

Based on the simple interest formula, the calculation for the total interest paid over 5 years will be as follows:

Interest = Principal x Rate x Term

= 70,000 x 3.4% x 5 years

= RM11,900

Total amounts need to repay is RM70,000 + RM11,900 = RM81,900.

Monthly payment for Ahmad is total amount need to repay divide over a period of 60 months = RM81,900 ÷ 60 = RM1365.

Total amount paid for the car by Ahmad after 5 years is RM 7,000 + RM 70,000 + RM 11,900 = RM88,900.

Table 1 depicts a summary of a comparison of the monthly payment and the total amount paid for three different term loan, we want to ask the reader, "*if you are Ahmad, which loan term are you going to choose?*" The decision is yours.

Table 1: A comparison of the monthly payment and the total amount paid for three different term loan.

Term	**Monthly Payment**	**Total amount paid for a car with selling price RM77,000**
9-year	RM846.48	RM98,420
7-year	RM1031.66	RM93,660
5-year	RM1365	RM88,900

Final Words

Some borrowers just consider the monthly payment amount when making a choice on which term loan to take, but it is advisable to look at the total amount paid for a car also. In this paper, it is clearly showing that the shorter the loan term the less amount the borrower is actually paying back for the same car!

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Conversion of Coordinate System (Circular Area)

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Introduction

The Cartesian coordinate system provides a straightforward way to describe the location of points in space. Some surfaces, however, can be difficult to model with equations based on the Cartesian system for example, cases in two-dimensional Polar Coordinates often offers as a useful alternative system for describing the location of a point in the plane, particularly in cases involving circles. Alternatively, for three-dimensional cases, extensions of polar coordinates are used, namely by the Cylindrical Coordinates and Spherical Coordinates.

Cylindrical Coordinates

When we expanded the traditional Cartesian coordinate system from two dimensions to three, we simply added a new axis to model the third dimension. Starting with polar coordinates, we can follow this same process to create a new three-dimensional coordinate system, called the cylindrical coordinate system. In this way, cylindrical coordinates provide a natural extension of polar coordinates to three dimensions.

Definition: The Cylindrical Coordinate System In the cylindrical coordinate system, a point in space (Figure 1) is represented by the ordered triple (r, θ, z) are the polar coordinates of the point's projection in the *xy*-plane

- z is the usual z-coordinate in the Cartesian coordinate system

Figure 1: The right triangle lies in the xy-plane. The length of the hypotenuse is r and θ is the measure of the angle formed by the positive *x*-axis and the hypotenuse. The z-coordinate describes the location of the point above or below the *xy*-plane. In the *xy*-plane, the right triangle shown in Figure 1 provides the key to transformation between cylindrical and Cartesian, or rectangular, coordinates.

Conversion between Polar / Cylindrical and Cartesian Coordinates: The rectangular coordinates (x, y, z) and the cylindrical coordinates (r, θ, z) were given by Isaac Newton in year 1670 (Vladimir Rovenski, 1999) of a point are related as follows:

These equations are used to convert from polar/cylindrical coordinates to rectangular coordinates.

- $x = rcos\theta$
- $y = rsin\theta$
- $z = z$

These equations are used to convert from rectangular coordinates to cylindrical coordinates

1. $r^2 = x^2 + y^2$
2. $\tan\theta = \frac{y}{x}$
3. $z = z$

As when we discussed conversion from rectangular coordinates to polar coordinates in two dimensions, it should be noted that the equation $tan\theta = \frac{y}{x}$ has an infinite number of solutions. However, if we restrict θ to values between 0 and 2π, then we can find a unique solution based on the quadrant of the *xy*-plane in which original point (x, y, z) is located. Note that if $x = 0$, then the value of θ is either $\frac{\pi}{2}, \frac{3\pi}{2}$, or 0 depending on the value of *y*.

Notice that these equations are derived from properties of right triangles. To make this easy to see, consider point *P* in the *xy*-plane with rectangular coordinates $(x, y, 0)$ and with cylindrical coordinates $(r, \theta, 0)$, as shown in Figure 1

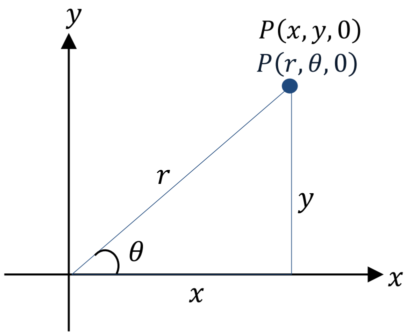


Figure 1: The Pythagorean theorem provides equation $r^2 = x^2 + y^2$.
Right-triangle relationships tell us that $x = rcos\theta$, $y = rsin\theta$, and $\tan\theta = \frac{y}{x}$.

Let's consider the differences between rectangular and cylindrical coordinates by looking at the surfaces generated when each of the coordinates is held constant. If c is a constant, then in rectangular coordinates, surfaces of the form $x=c$,$y=c$, or $z=c$ are all planes. Planes of these forms are parallel to the *yz*-plane, the *xz*-plane, and the *xy*-plane, respectively. When we convert to cylindrical coordinates, the *z*-coordinate does not change.

Therefore, in cylindrical coordinates, surfaces of the form $z=c$ are planes parallel to the *xy*-plane. Now, let's think about surfaces of the form $r=c$. The points on these surfaces are at a fixed distance from the *z*-axis. In other words, these surfaces are vertical circular cylinders. Last, what about $\theta=c$? The points on a surface of the form $\theta=c$ are at a fixed angle from the *x*-axis, which gives us a half-plane that starts at the *z*-axis (Figures 3 and 4).

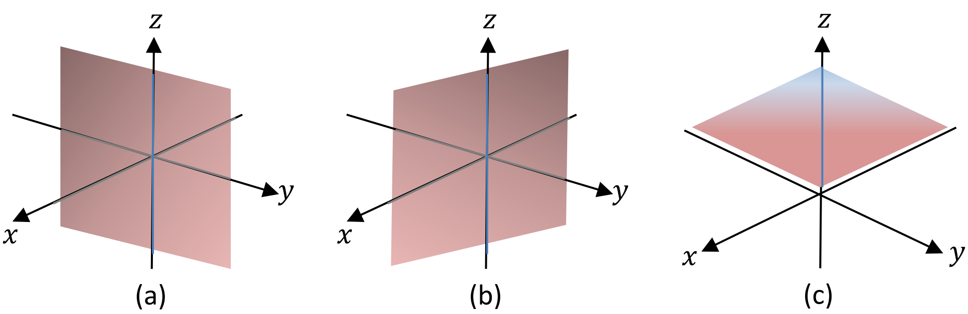


Figure 3: In rectangular coordinates, (a) surfaces of the form $x=c$ are planes parallel to the *yz*-plane, (b) surfaces of the form $y=c$ are planes parallel to the *xz*-plane, and (c) surfaces of the form $z=c$ are planes parallel to the *xy*-plane.

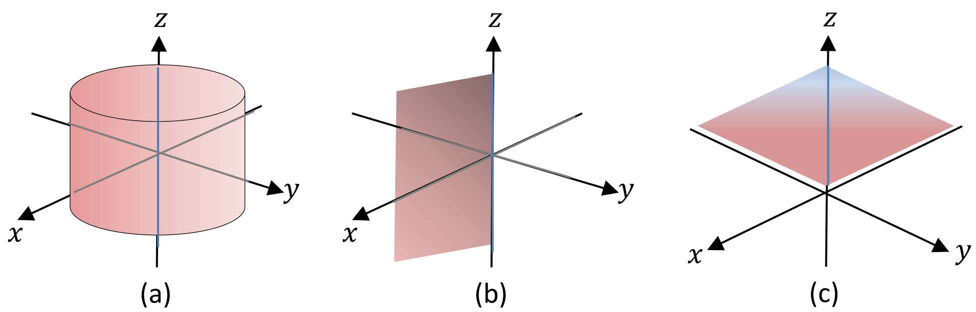


Figure 4: In cylindrical coordinates, (a) surfaces of the form $r=c$ are vertical cylinders of radius r, (b) surfaces of the form θ=c are half-planes at angle θ from the x-axis, and (c) surfaces of the form z=c are planes parallel to the xy-plane.

Spherical Coordinates

In the Cartesian coordinate system, the location of a point in space is described using an ordered triple in which each coordinate represents a distance. In the cylindrical coordinate system, location of a point in space is described using two distances (r and z) and an angle measure (θ). In the spherical coordinate system, we again use an ordered triple to describe the location of a point in space. In this case, the triple describes one distance and two angles. Spherical coordinates make it simple to describe a sphere, just as cylindrical coordinates make it easy to describe a cylinder. Grid lines for spherical coordinates are based on angle measures, like those for polar coordinates.

Definition: Spherical Coordinate System In the spherical coordinate system, a point P in space (Figure 5) is represented by the ordered triple (ρ, θ, φ) where

- ρ (the Greek letter rho) is the distance between P and the origin $(\rho \neq 0)$;
- θ is the same angle used to describe the location in cylindrical coordinates;
- φ (the Greek letter phi) is the angle formed by the positive z-axis and line segment $\overrightarrow{OP}$, where O is the origin and $0 \leq \varphi \leq \pi$.

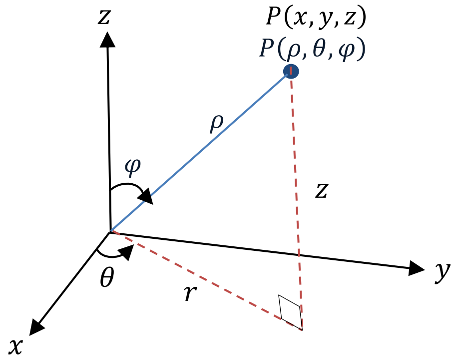


Figure 5: The relationship among spherical, rectangular, and cylindrical coordinates. By convention, the origin is represented as $(0,0,0)$ in spherical coordinates.

Conversions among Rectangular, Cylindrical / Polar and Spherical Coordinates: Rectangular coordinates (x, y, z), cylindrical or polar coordinates (r, θ, z) or $(r, \theta, 0)$ and spherical coordinates (ρ, θ, φ) of a point are related as follows:

Convert from spherical coordinates to rectangular coordinates

These equations are used to convert from spherical coordinates to rectangular coordinates.

- $x = \rho sin\varphi cos\theta$
- $y = \rho sin\varphi sin\theta$
- $z = \rho cos\varphi$

Convert from rectangular coordinates to spherical coordinates

These equations are used to convert from rectangular coordinates to spherical coordinates.

- $\rho^2 = x^2 + y^2 + z^2$
- $\tan\theta = \frac{y}{x}$
- $\varphi = cos^{-1}\left(\frac{z}{\sqrt{x^2+y^2+z^2}}\right)$.

Convert from spherical coordinates to cylindrical coordinates

These equations are used to convert from spherical coordinates to cylindrical coordinates.

- $r = \rho sin\varphi$
- $\theta = \theta$
- $z = \rho cos\varphi$

Convert from cylindrical coordinates to spherical coordinates

These equations are used to convert from cylindrical coordinates to spherical coordinates.

- $\rho = \sqrt{r^2 + z^2}$
- $\theta = \theta$
- $\varphi = cos^{-1}\left(\frac{z}{\sqrt{r^2+z^2}}\right)$

The formulas to convert from spherical coordinates to rectangular coordinates may seem complex, but they are straightforward applications of trigonometry. Looking at Figure, it is easy to see that $r = \rho sin\varphi$. Then, looking at the triangle in the *xy*-plane with r as its hypotenuse, we have $x = rcos\theta = \rho sin\varphi cos\theta$. The derivation of the formula for *y* is similar. Figure 6 also shows that $\rho^2 = r^2 + z^2 = x^2 + y^2 + z^2$ and $z = \rho cos\varphi$. Solving this last equation for φ and then substituting $\rho = \sqrt{r^2 + z^2}$ (from the first equation) yields $\varphi = cos^{-1}\left(\frac{z}{\sqrt{r^2+z^2}}\right)$. Also, note that, as before, we must be careful when using the formula $\tan\theta = \frac{y}{x}$ to choose the correct value of θ.

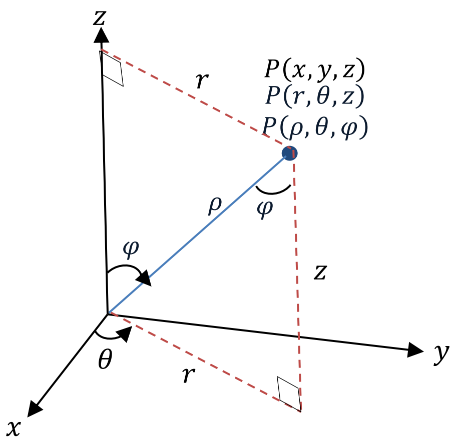


Figure 6: The equations that convert from one system to another are derived from right-triangle relationships.

As we did with cylindrical coordinates, let's consider the surfaces that are generated when each of the coordinates is held constant. Let c be a constant, and consider surfaces of the form $\rho=c$. Points on these surfaces are at a fixed distance from the origin and form a sphere. The coordinate θ in the spherical coordinate system is the same as in the cylindrical coordinate system, so surfaces of the form $\theta=c$ are half-planes, as before. Last, consider surfaces of the form $\varphi=0$. The points on these surfaces are at a fixed angle from the z-axis and form a half-cone (Figure 7).

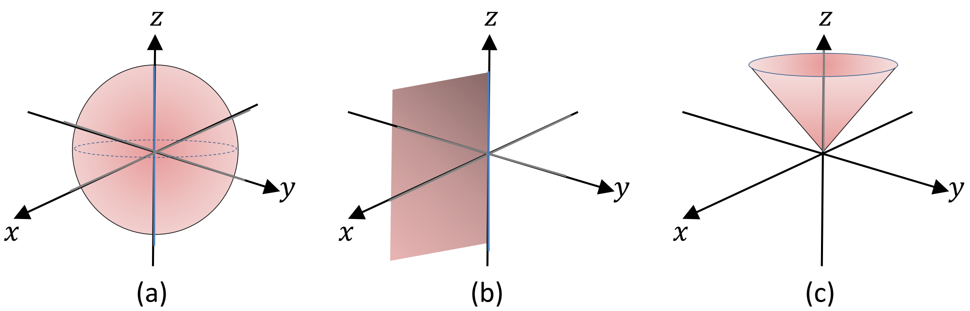
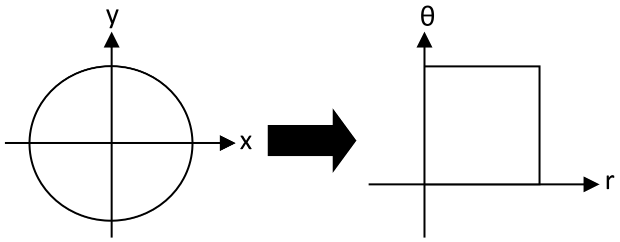
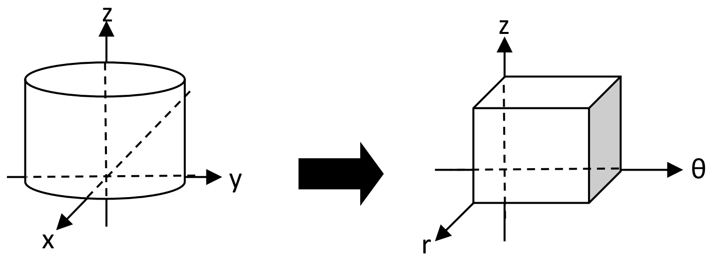
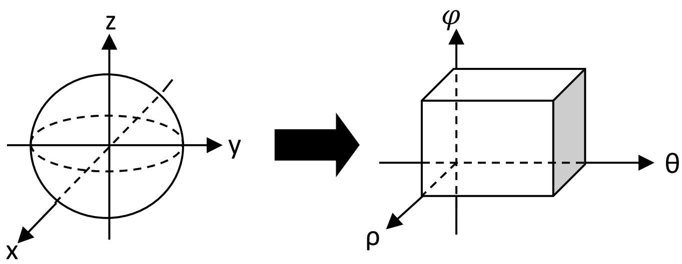


Figure 7: In spherical coordinates, surfaces of the form $\rho=c$ are spheres of radius ρ (a), surfaces of the form $\theta=c$ are half-planes at an angle θ from the x-axis (b), and surfaces of the form $\phi=c$ are half-cones at an angle ϕ from the z-axis (c).

Table 1 graphically describes the conversion of rectangular or Cartesian coordinate system to polar, cylindrical and spherical coordinate for the circular area.

Table 1. Conversion of Coordinate System.

Polar Coordinate (2-D) $x = rcos\theta$ $y = rsin\theta$	
Cylindrical Coordinate (3-D) $x = rcos\theta$ $y = rsin\theta$ $z = z$	
Spherical Coordinate (3-D) $x = \rho sin\varphi cos\theta$ $y = \rho sin\varphi sin\theta$ $z = \rho cos\varphi$	

Cylindrical coordinates are convenient for representing cylindrical surface and surface of revolution, which the z-axis is the axis of symmetry. Spherical coordinates are desirable when representing spheres, cones, or certain planes (Bradley & Smith, 1999). Figure 8 shows the relations between Cartesian, Cylindrical, and Spherical coordinates.

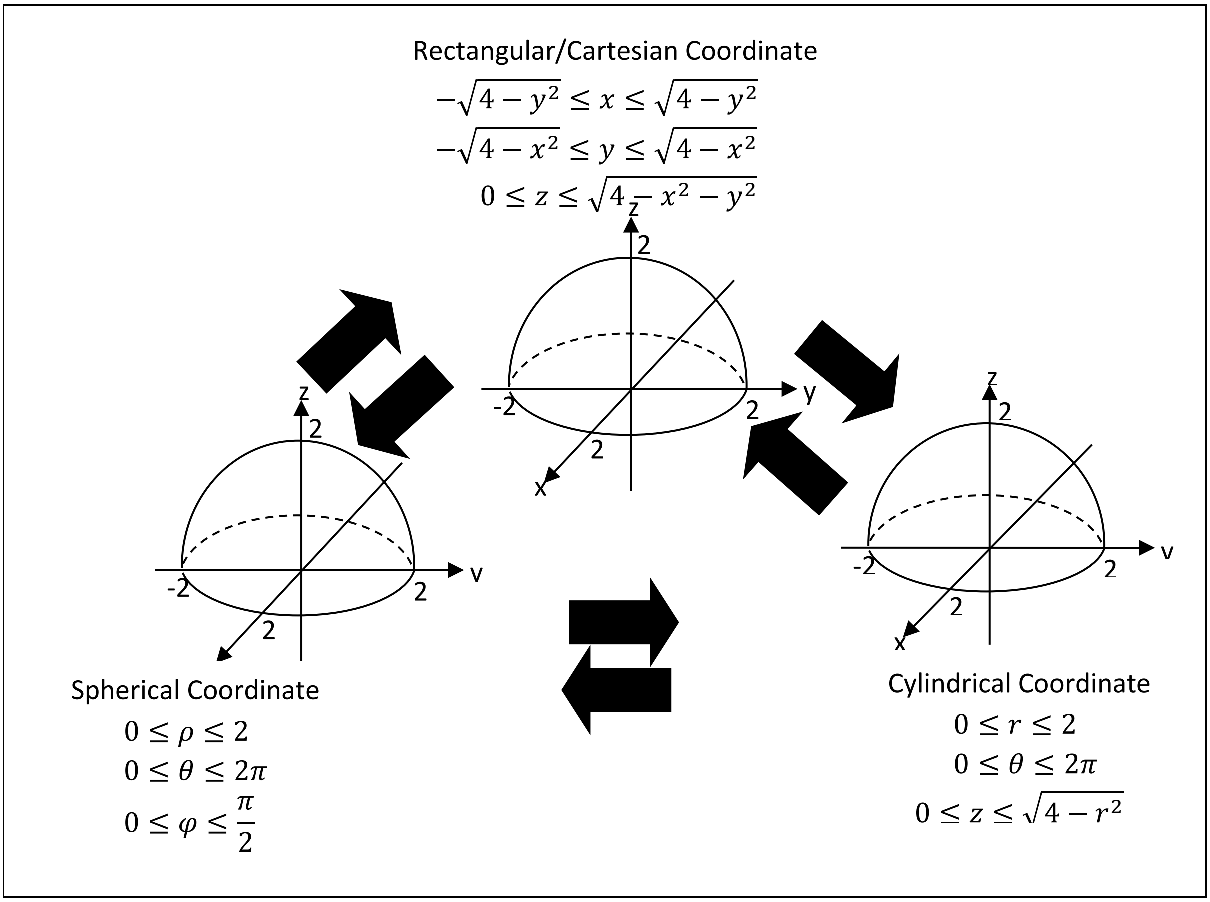


Figure 8: Relations between Cartesian, Cylindrical, and Spherical Coordinates.

Acknowledgements:

These notes have been adapted, remixed and transformed from Gilbert Strang (MIT) and Edwin "Jed" Herman (Harvey Mudd) with many contributing authors for sharing the content under OpenStax is licensed with a CC-BY-SA-NC 4.0 license. For further details of this topic, download free at http://cnx.org.

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Basic TT (Truth Table) Function for Non-Computer Science Students

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Function is one of the most difficult chapter in programming subject. The difficulty is not only for students but also for academician to deliver the content since it requires of full understanding of the concept of function.

Function is where we can break up programs into segments (Mohamad & Mydin , 2019), and according to Ian (2006) is a way of breaking problems down into smaller sub-problems and Prinz et. al, (2002) defines function will helps to divide problem into smaller units. Function can be divided into two parts; 1) predefined functions; and 2) user defined functions. Predefined function is the function that already built in and user only need to call the function, but user defined function is the function need to be created by user. The user defined functions is the topic that harder to explain because it has many variable such as function type `void` or `non-void`, passing values either using; 1) parameters passing `byValue` or `byRef;` 2) global variable. Hence, the student always confuses where to type the input and output statement either in main function `main()` or user defined function `udf()`. Therefore, a basic truth table of function has been developed to helps student to identify where to type the input and output as shown in Table 1.

Table 1: Basic TT Function

Function Type		Passing Values			Result	
Void	Non-void	ByValue	ByRef	Global Variable	Input	Output
True	False	No	No	No	`udf()`	`udf()`
False	True	No	No	No	`udf()`	`main()`
True	False	Yes	No	No	`main()`	`udf()`
False	True	Yes	No	No	`main()`	`main()`
True	False	No	Yes	No	`main()`	`main()`
False	True	No	Yes	No	`main()`	`main()`
True	False	No	No	Yes	`udf()` `main()`	`udf()` `main()`
False	True	No	No	Yes	`udf()` `main()`	`udf()` `main()`

From the table, student can inference the function type and passing values that directly can identify where to type the inputs and outputs statements. For example, if the function type is void() and no passing parameter so the student can refer to the table and straight away know the input and output statement will be written in user defined function not in main function. Hopefully, this table can enhance the student understanding about function.

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Common Mistakes in Writing Basic Elements of C++ Programming for Dummies

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Introduction to writing a program

"Understanding that in the future there is no profession is untouched by machines means admitting that coding is part of the liberal arts" according to Wall Street Journal (2015). Therefore, giving basic education on programming language to primary and secondary school is one of strategic planning in Education 5.0. Not every child learn writing will become a novelist, nor everyone who learn algebra a mathematician, yet we treat both as foundation skills for all children. Coding is the same since the future consist of emerging industries of cryptocurrency and Artificial Intelligence space. Coding is uniquely suited to training children not just how to solve problems, but also how to express themselves (Resnick, 2019).

Introduction to programming language has been taught to several programmes in university level. In Universiti Teknologi MARA Cawangan Pulau Pinang, Malaysia, engineering students for both diploma and degree levels are compulsory to enrol the course. The necessity of taking this course lies on practising problem solving skills, expose students to writing programming language and simulate creative thinking in solving problems. All of the students are categories as novice programmers due to has no official learning both in programming and computer essential. Hence, learning computer language is not only new but difficult to understand the rules and structures. The next sections will discuss about common mistakes in basic elements of programming and input and output statements respectively.

Common mistakes on basic elements of C++

Mistakes or errors in writing C++ program could happen in three ways, the most common one is syntax errors, followed by run-time errors and lastly, logical errors. This section will discuss thoroughly some common errors happens when the basic concept of programming is concerned.

Declaration is most basic elements, yet crucial statement in writing a program. In general, students easily understand the concept of declaring variables and the four rules of naming variables. Understand the concept of data in a program, memory allocations and how CPU and computer memory run the source code are some of important piece of information that have to be clarified to the novice programmers. The explanation would help them understand the foundation of why declarations is important in a program and visualise how the processor and memory works in order to execute the declaration instructions. In the next subsections, several common errors of the basic concept in C++ will be discussed.

Confusion of data representation of variables

In C++, students are well known about variations of data types such as `int`, `float`, `double`, `long`, `char`, `string` and `bool`. Apparently, when a case study is given most of novice programmers will become confused with the data store in the variables and the variable itself.

Example 1.0

*Write a program to mimic a simple calculator. Prompt user to enter two number and an operation of +, -, /, *. The program will display the result of the selected operation.*

Given the Example 1.0, this type of question required programmer to do selection in the program based on operation selected by user. Three data are required in order to calculate and get the output. Students have to analyse these three data in order to declare variables with appropriate data types. Two of the data are numeric data, meanwhile the confusing part is to represent the third data which is operator. The most occurred error is declaring all the operators as variables such as char +, -, /, *; without considering the valid variable's name guided by the naming rules of identifiers. The right way is students have to understand that +,-,/ and * are data that user has to key in and select only one of them. Therefore, a valid variable with character data types is required to store the selected operator such as, `char option;`.

Example 2.0

The Entrepreneur Club would like to offer canopies to be rented on Entrepreneur Week celebration. As programmer you have been appointed to write a program to calculate the total charge of rental for the whole week. The charges are based on category of traders entered by user whereas; student (T) is charge RM 95.99; Staff(S) is charge RM150.99; and Outsider(O) is charge RM200.99 all in a day.

Another Example 2.0 is considering to select code of T, S or O in order to calculate the rental charge of the canopy. The most common error done by students is declaring variable as `char T, S, O;` which shows the inability to differentiate between data and appropriate variable. Students suppose understand that user will select the data of T or S or O when they key in and store it into the allocation of memory based on the proper variable declaration. Example of valid declaration is char `tradecode`; this indicate a variable name `tradecode` is declared as character data type. The `tradecode` is supposed to store any valid data of T or S or O entered by user using appropriate input statement.

Choosing suitable data types

In a program, apparently data is the most important element, where data will be manipulated and transformed into information for output display. Students has to write instructions to allocate memory location for the data when the program is running. The instruction is called declaration statements which consist of variables and appropriate data types. The data types are reserved word in C++ or any programming languages. Students has to know the suitable data types for that particular data used in the program.

When the data is numeric that come with unit of measurements such as kg, cm, litre, or currency symbol such as RM, students intend to initialised the data together with the units. Here are example of invalid declaration and initialisations, `int price_sugar= RM10; float volume= 25kg;double length=34.7cm;` all the unit mistakenly considered as part of the data. The data should only consider the raw values that required for further manipulation. The units of measurement or currency are treated as label and not the raw data. Program can output or display the labels anytime using output statements. Thus, the declaration and initialisation only consist of raw data with appropriate data types such as, `int price_sugar= 10; float volume= 25;double length=34.7;`

Mismatch declarations with input statement

In general, data entered into a program either with initialisation or prompt input from user. The concept of request data from user is the most flexible way to get fresh data. In solving real life problems, most of the data is collected directly from users. The second method is retrieved data from database, anyhow this method is not covered for fundamental study in C++ course syllabus.

The instruction for getting the data from user into a program is constructed as input statements. The input statement has to work closely with the declaration statements since the process of entering data require memory allocation in order to store the data for further manipulation. C++ input statement usually begin with cin and followed by stream extraction operator >> and next followed by dedicated variable of the data. The syntax is `cin>> variable1>>variable2;`. This input statement only valid for numeric and single character data. When user has to enter alphabet data, there are two input statements has to be considered and depends to the declaration statements of the dedicated variables. There are two data types involves which are char and string, examples of declaration are char `patients_n[30];` and `string address1;`. The first declaration, `char patients_n[30]` means a variable name of `patients_n` is declared, whereas memory location is set and labelled as the variable's name with the maximum size of characters are 30. The second declaration, `string address1;` means a variable address1 is declared to store alphabet data types. Appropriate input statements for both data are `cin.getline(patients_no,30);` and `getline(cin,address1);` subsequently.

Students tends to forget the input statement for `string` and `char` data type. They usually continue repeat the errors until the end of semester. Table 1.0 is summarized the basic concept of implementing declarations, input statements and closely related with difference categories of data types adapted from Mohamad & Mydin (2019).

Table 1. Association of basic elements of C++.

Categories of data	Data Types	Description of data	Size Byte	Declaration statement	Initialisation	Input Statement
Numeric	`float`	Decimal numbers	4	`float no1, no2;`	`no1=2.8; no2=10.7;`	`cin>>no1; cin>>no2;`
	`double`		8	`double _a;`	`_a=2.8973;`	`cin>>_a;`
	`int`	Whole numbers	4	`int a,b,c;`	`a= 100, b= 5, c=`	`cin>>a>>b >>c;`
	`long`	Both decimal and whole numbers	8	`long int x;`	`x=452122;`	`cin>>x;`
Character	`char`	One character	1	`char code;`	`code='T';`	`cin>>code ;`
		Limited characters with max size	>1	`char name[30];`	`name= 'a','b', 'c'; name="abc" ;`	`cin.getli ne(name,3 0);`
Alphabet	`string`	Small, capital letters, symbols, numerics	>8	`string status;`	`status=" available" ;`	`getline(c in, status);`
Boolean	`bool`	True/1 (as long as the value is NOT 0), False/0	2	`bool delicious;`	`delicious= true;` or `delicious= 1;`	`cin>>deli cious;`

Common mistakes on input/output statements

Syntax for input statement is very straight forward, students have to understand the solely purpose of input statement is to prompt data from user. Therefore, the syntax of input statement is based on the `cin>>` and followed by variables such as explained in previous section. Meanwhile output statements are used to display various variables' values, arithmetic expression and any "message in between double quote". The examples of various purposes output statements are shown in Table 2.0.

Table 2. Variation of output statements

Purpose	Example of output statements

Display variable's value	`int num=2;//appropriate variable declaration`
	`cout<<num;`

Display arithmetic expression	`float a=3.2; //appropriate variable declaration`
	`cout<<a*5;`

Display messages on output screen	`cout<< "\n welcome to C++";` `cout<< "3 +9 = ";`

When writing a program, input and output statements are usually written together in order to create user friendly instruction. As an example, to prompt user to enter weight and height, the basic instruction is using `cin>>` statement as Example 3.0 below:

Example 3.0:
```
float weight, height;
cin>>weight>>height;
```

Anyhow, as for user friendly instructions we may add messages before user entered data. This will help user to give accurate data for the program purpose. The appropriate instruction is in Example 4.0 as follows:

Example 4.0:
```
float weight, height;
cout<< "Enter weight in KG:";
cin>>weight;
cout<< "Enter height in feet:";
cin>>height;
```

Here, when the commands `cin>>` and `cout<<` are used together, most of students tends to get confuse with the usage and the purpose of both commands. The wrong instructions are shown in Example 5.0 and Example 6.0 as follows:

Example 5.0:
```
float weight, height;
cout<< "Enter weight in KG:"<<weight;
cout<< "Enter height in feet:"<<height;
```
or

Example 6.0:
```
float weight, height;
cin>>"Enter weight in KG:">>weight;
cin>>"Enter height in feet:">>height;
```

Example 5.0, shows no syntax errors in both `cout<<` statements. Misunderstood of message "Enter weight in KG:" and variable weight displayed after the message as input statement is almost happen for those ignorance students to the concept of input and output. It is already clear the roles of `cin>>` statement to enter data and `cout<<` statement to display data. Therefore, Example 5.0 will display the messages and the value of variables weight and height if any.

Example 6.0 will cause syntax errors when compiling the statements. Students have to remember the purpose of each statements. The purpose to write messages `"Enter weight in KG:"` and `"Enter height in feet"` are to display the messages on output screen, therefore the right command in C++ is `cout<<` statement. Meanwhile variable weight and height are used to retrieve data right after user key in into computer. Undoubtedly, the `cin>>` statement is required here.

Conclusion

Basic elements of programming cover the essential of commands for declaring, initialisation, input and output the data. The information is fundamental every time the new program is developed. If students unable to master the concept, they won't able to write a free error program and facing more difficulties in writing complicated program in future chapters.

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Suggested Questions for Non-Computer Science Students' Assessments Using Bloom's Taxonomy in Programming Context.

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Introduction

Introduction to programming language is a course that offered to several programmes in UiTM. This course will emphasize on the introduction of computer problem solving with the use of C++ programming language to illustrate the solution. The aim is to develop students' problem-solving strategies, techniques and analytical skills that can be applied to computer field or in other areas as well as to use in their subsequent course work and professional development. Students are learned to identify a problem, design appropriate solution and solve the problem in computerized way.

At the beginning, students are introduced to the basic elements in programming. At this stage, students able to declare variables, applying mathematical operation and able to construct a simple programming statement. Then, student will be exposed to the used of selection control structure and repetition control structure. The implementation of functions and array are also discussing in this course. At the end of semester, students are able to write a complete programming by applying all the elements that are discussed in the course.

Construction of Questions based on Bloom's Taxonomy

One way to measure students' skills in mastery of programming is through assessments. This article proposes the role of Bloom's Taxonomy in the preparation of student assessments. Bloom's Taxonomy was created by Benjamin Bloom (1956) which proposed the six different levels of understanding which are: remember, understand, apply, analyse, evaluate, and create. This section discusses the six level of understanding proposed by Benjamin Bloom and the summary of Bloom's Taxonomy that explores by Thompson et al. (2008) is discussed below:

a) Remember

- Retrieving relevant knowledge from long-term memory
- Includes recognising and recalling.

Example of assessment terms:

- *Identifying a particular construct in a piece of code.*
- *Recognising the implementation of a subject area concept.*
- *Recognising the appropriate description for a subject area concept or terms.*
- *Recalling any material explicitly covered in the teaching programme. eg. conceptual definition.*

b) Understand

- Constructing meaning from instructional messages, including oral, written, and graphical communications.
- Includes interpreting, exemplifying, classifying, summarising, inferring, comparing, and explaining.

Example of assessment terms:

- *Translating an algorithm from one form of*
- *representation to another form.*
- *Explaining a concept or an algorithm.*
- *Presenting an example of concept or an algorithm.*

c) Apply

- Carrying out or using a procedure in a given situation.
- includes executing and implementing.

Example of assessment terms:

- *The process and algorithm are known to the learner and both are applied to a problem that is familiar, but that has not been solved previously in the same context.*
- *The process and algorithm are known to the learner, and both are applied to an unfamiliar problem.*

d) Analyse

- breaking material into its constituent parts and determining how the parts relate to one another and to an overall structure or purpose.
- Includes differentiating, organising, and attributing.

Example of assessment terms:

- *Breaking a programming task into its component*
- *parts (classes, components, etc.).*
- *Organising component parts to achieve an overall objective.*
- *Identifying critical components of a development.*
- *Identifying unimportant components or requirements.*

e) Evaluate

- Making judgements based on criteria and standards.
- Includes checking and critiquing.

Example of assessment terms:

- *Determining whether a piece of code satisfies the requirements through defining an appropriate testing strategy.*
- *Critiquing the quality of a piece of code based on coding standards or performance criteria.*

f) Create

- Putting elements together to form a coherent or functional whole; reorganising elements into a new pattern or structure.
- Includes generating, planning, and producing.

Example of assessment terms:

- *Coming up with a new alternative algorithm or hypothesising that a new combination of algorithms will solve a problem.*
- *Devising an alternative process or strategy for solving a problem; or complex programming tasks, this might include dividing the task into smaller chunks to which they can apply known algorithms and processes.*
- *Constructing a code segment or program either from an invented algorithm or through the application of known algorithms in a combination that is new to the students.*

Suggested Questions based on Bloom's Taxonomy

As non-computer science students, there are some important things that they need to learn in programming. This section proposes the features of programming language that the students need to be expert while learning programming which are divided into sections: introduction to programming; basic elements of programming; selection and repetition control structures; function; as well as array. From these sections, this article proposed the questions that should be assessed on students. Bloom's Taxonomy is used as a guideline in preparing the questions. The suggested questions are listed below:

a) Introduction to Programming

- Define/explain the terms: program/programming, source code/ source file, integer, floating point, object code, assembler, compiler, interpreter, types of programming design approach, types of error, algorithm.
- Briefly explain the importance/advantages of programming.
- Identify the difference/distinguish between machine language and high-level language; assembler, compiler and interpreter.

- Write/insert comments in a program, how the compiler responds to the comments.
- Identify/briefly explain the steps in Program Development Life Cycle (PDLC).
- Illustrate/Write a pseudocode or draw a flowchart based on a problem situation and vice versa.
- Write/Insert indentation in a given program segment.

b) Basic Element of Programming

- Identify the rules of naming identifier and determine the validity of identifier, how an identifier is related to reserve word.
- Write a declaration statements and assignment statements for variables and constants to accomplish the given sentences.
- Evaluate/trace the mathematical expression based on certain input – basic operations (+.-./.*.%), function pow(), sqrt(), etc.
- Postfix increment and prefix decrement - a++, a--, ++a, --a., unary and binary operators, compound assignment.
- Given a problem situation and transform to C++ program segment.
- Given a program and find/label syntax errors.
- Convert algebraic equation into C++ statement.
- Construct/evaluate Boolean expression using relational & logical operator.
- Write a formatting statement to display decimal number.

c) Control Structure: Selection and Repetition

i. Selection Control Structure

- Discuss the types of selection control structure
- Transform/convert into IF..ELSE/SWITCH..CASE statement based on the given problem situation.
- Trace program segment and show the output based on the given input.
- Write a complete program that include the combination of selection & repetition control structure.

ii. *Repetition Control Structure*

- Discuss the types of repetition control structure
- Identify Loop Control Variable (LCV), starting value, loop condition, updating condition.
- The difference/distinguish between while and do..while
- Trace a program segment and show the output based on the given input.
- Write program segment base on the given problem situation.
- Rewrite using another loop structure based on the given loop.
- Find the number of loops.
- How to avoid infinite loop from the given program segment.
- Write a complete program that include the combination of selection and repetition control structure.

d) Function

- Discuss the types of function and its elements: function prototype, function call, function definition.
- User-defined function-strcpy(), strlen(), etc.
- Identify the types of parameter: actual and formal
- Identify the types of variable: local and global
- Identify the types of parameter passing: by values and by references
- Write a function definition based on the given problem situation including receives and return values.
- Trace a program segment including receives and return value and show the output.
- Write a complete program by constructing functions including the combination of selection and repetition control structure.

e) Array

- Write a declaration and assignment statement to an array.
- Write a program segment to input and display data in array.
- Find the last index number or value in array.
- Trace program segment and show the output based on the given input.

- Write a complete program by constructing arrays including the combination of function, selection and repetition control structure.

Conclusion

This article has discussed the role of Bloom's Taxonomy as a guideline in the preparation of assessments in the context of programming. It is a very important to look thoroughly on the cognitive processes while preparing the assessments and needs to be taken seriously so that students' ability to master the programming knowledge can be measured more efficiently. With this study, it is hoped that educators will benefit from it by generating more discussion and more an important is the quality of assessments can meet current needs.

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An Overview on Common Mistakes by Students for Introduction, Basic Elements and Selection Control Structure in Fundamentals of Computer Problem Solving (CSC128) Course

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Introduction

Computer programming is an abstract subject that requires correct understanding, suitable teaching approaches and tools as well as proper learning materials to support the teaching and learning process of novice learners. According to Robins et. al (2003), they stated that du Boulay (1989) describe five domains that a novice programmers must mastered in learning programming are the general orientation of a program, the notational machine model, the notation of a programming language, programming structures and pragmatics. A brief explanation of each domain is stated in the Table 1.

Table 1: Five Computer Programming Domains (du Boulay, 1989)

Domain	**Description**
General Orientation	What programs are for and what can be done with them.
Notational Machine	A model of the computer as it relates to executing programs.
Notation	The syntax and semantics of a particular programming language.
Structures	Schemas or plans.
Pragmatics	The skills of planning, developing, testing, debugging and others.

In view of the above research on the key aspects of learning to program, the following section will discuss on the background of computer problem solving course that is offered in our university to a non-major of computer course learners, what are the common mistakes that these novice programmers done according to the first three chapters in our syllabus and a summarisation of suggestion for the learners to ponder.

Background of Computer Problem Solving Course (CSC128) for Novice Programmer

Fundamentals of Computer Problem Solving (CSC128) are an introductory course that highlights on various aspects of problem solving to using computer software. It primarily comprising of the problem domain, phases of problem solving via structured programming using Program Development Life Cycle (PDLC) and basic techniques in designing a solution using chosen programming language which is C++.

In Universiti Teknologi MARA Cawangan Pulau Pinang, Malaysia, CSC128 is a compulsory subject taken by students' from Diploma in Mechanical Engineering and Diploma in Civil Engineering. This subject is taught for 14 weeks during each semester and it consists of a two hours lecture session with another two hours of practical session which is conducted at computer laboratory. CSC128 covers five main topics which are the introduction to computer programs, component of a programming language, selection control structure, repetition control structure and function.

At the end of each semester, we hope that students will achieve three learning outcomes which are able to identify the steps and requirements of given problems using systematic problem solving approach, manage to write complete programs using structural and modular approach and finally demonstrating basic program to solve daily problem using designated programming control structures: selection, repetition and function.

Common Mistakes made by Students in CSC128 Course by Chapters

Fundamentals of Computer Problem Solving (CSC128) is an introductory programming course that entail five basic chapters which are the introduction to computer programs, component of a programming language, selection control structure, repetition control structure and function. As this subject is taken by students from non-computer major courses, our paper would like to highlight on some typical errors done by these programming beginners'. In this article, we will explain the common mistakes done by students based on CSC128 chapters which are from Chapter 1 until Chapter 3.

Introduction to computer programs

Among the usual misconception of students in the first chapter on introduction to computer programs are from the sub-section on Program Development Life Cycle (PDLC) as stated in Table 2.

Table 2: Common Mistakes in Introduction to Computer Programs

Chapter 1	**Common Mistakes**
Brief history of C++	None (Definition, Concept and Theory)
Preparation for programming: a) What is a computer program and importance of computer programming? b) Importance of good programs. Relationship between compilers, interpreters, assemblers	None (Definition, Concept and Theory)
Program Development Life Cycle: a) Problem solving phases: problem definition, algorithm design and implementation b) Analysis, design, coding, maintenance	✖ In the analysis phase, students are unable to understand the problem, thus, incapable of listing out the correct input, output and processes involve in a question given. ✖ In the design phase, learners are supposed to write out the pseudocode and flowchart for a stated problem. Unfortunately, some of the learners are incapable to use appropriate symbol when drawing the flowchart. ✖ In the implementation (coding) phase, students are able to write codes in C++. However, some of them are incompetent to correct their own errors (syntax, logic or runtime) without the assistance of their lecturer or friends. ✖ Most students do not experience problem in the testing phase as well as the maintenance phase.

To overcome this misunderstanding, we suggest the learners to follow the phases in the PDLC every time they want to write a code to solve a problem given. Novice programmers normally have the tendency of writing a complete coding (third step in PDLC) by skipping the first and second steps of PDLC, which are analysing a problem and designing the pseudocode or flowchart of a program. This practice contributes to the learners’ incompetency to refine their understanding on problem-solving procedures (PDLC), whereby each problem can be solved by decomposing into steps that will be translated into lines of code. Thus, the lecturers can remind the students on importance of following the sequence of Problem Development Life Cycle phases at the beginning of each practical or tutorial session.

Component of a programming language

The second chapter on component of a programming language sees students' common mistakes on the sub-topics of variable naming and declaration, identification of data type, input statements, and C++ block structure as well as assignment concept that is specified by Table 3.

Table 3: Common Mistakes in Component of a Programming Language

Chapter 2		**Common Mistakes**
Identifier, variable, constant, statement	✖	Some students make careless mistakes by not following the rules in naming variables/identifiers. For example, they declared a variable name that consists of spaces in between the name.
Standard data type (int, float, double, char)	✖	A few students are still confused on the data type of a variable. If the variable is supposed to be a floating point number, for instance, they declared as integer. Some are still mixed up on the concept of non-number data type (char or string).
Input/output statement	✖	Students are easily overlooked on the input statements of non-number data which string character and string data type.
C++ block structure	✖	In the early stages of learning to code, some student writes the C++ block structure not in proper sequences. However, these errors are resolved later with a lot of exercises and practical sessions.
Arithmetic expressions	✖	Some of the students are confused with the % symbols as this symbols means modulus which the remainder of a division instead of percentage. Since most of the students usually use calculators to solve mathematical equation, they tend to make mistakes especially when they solve equations which involve division (/). The students must understand that an integer divide with another integer number, the answer will also be an integer. To make the answer a decimal number, one of the number must be a decimal number.
Operators - Unary operator ++, --,	✖	Some students might get confused between postfix and prefix whereby in some situation, the results for postfix and prefix will show no differences. However, in certain situation, prefix and postfix will show a different in the answer.
Assignment concepts	✖	There are students who are uncertain to assign value of non-numbers data (char or string).

These typical errors can be avoided through hands-on exercises done during the practical sessions. The more programming tutorial questions the novice learners' practice in class with the guidance of the lecturer, the more basic concepts that can be learned and easily remembered through mistakes made.

Selection control structure

Selection control structure exposes students' common errors on the relational and logical operators, the **if** statement as well as the **switch** statements as indicated by Table 4.

Table 4: Common Mistakes in Selection Control Structure

Chapter 3		**Common Mistakes**
Concept of condition - Boolean statements	✖	Most of the mistakes come from the relational and logical operators' application in writing a condition statement. In using logical operators, students usually mixed up between the usage of **AND (&&)** and **OR (||)** in writing condition statement. Thus, the final output of the program produced logic error. Moreover, students also exchange symbols in the use of relational operators, for instance instead of using >=, the students mistakenly wrote =>.
Selection : One- way, two –way, multi-way , nested selection	✖	Among the mistake done in coding an **if** statement is writing a condition after an else statement. Another typical error by students will be missing curly brackets **{}** within an **if** statement that consist of multiple lines of code.
Selection : Switch statement	✖	Students usually make mistakes by overlooking the inverted comma **‘’** when using single character data type and putting **‘’** to data that is declared as integer. Another common error by students will be using the else term/keyword for default cases.

Programming tutorials and past years' examination question can be used as exercises during practical lessons to enhance understanding and exposed students to a variety of questions on selection control structures concept.

Conclusion

Learning programming needs a lot of understanding on abstract concepts. It requires continuously practical experiences and a lot of programming tutorials so that students will be able to understand the basic concepts and solve whatever problem given to them. With the knowledge that they have learnt in this course and the typical mistakes that we have acknowledged in this paper, we hope that it can assist the students in learning this course more efficiently and avoid them from making the same errors.

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The uses of Wolfram Alpha in Mathematics

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Introduction

Wolfram|Alpha is a special engine to generate answers and provide more information about the answers given. By using its vast store of expert-level knowledge and algorithms it can automatically answer questions, do analysis and generate reports. Other search engine gives you information, but Wolfram|Alpha gives you the answer. Wolfram|Alpha is ideal for the sort of math that Google's calculator and most other calculator websites couldn't solve the questions given. It even provides graphs that help students understand the mathematical concept itself. According to Flanagan (2008), many educators use a variety of technologies to enhance student interest and achievements. To access Wolfram|Alpha, simply go to the link https://www.wolframalpha.com/, then its interface is shown in figure 1.

The mathematical expressions used in Wolfram|Alpha are slightly different from the calculator. Table 1 shows the commands used in Wolfram|Alpha for mathematical expression.

Table 1. Wolfram alpha's command

Mathematical expression	Command
$\dfrac{x^2-36}{5(x-6)}$	((x^2)-36)/(5(x-6))
$\dfrac{x^2}{\sqrt{x^4-5}}$	(x^2)/sqrt((x^4)-5)

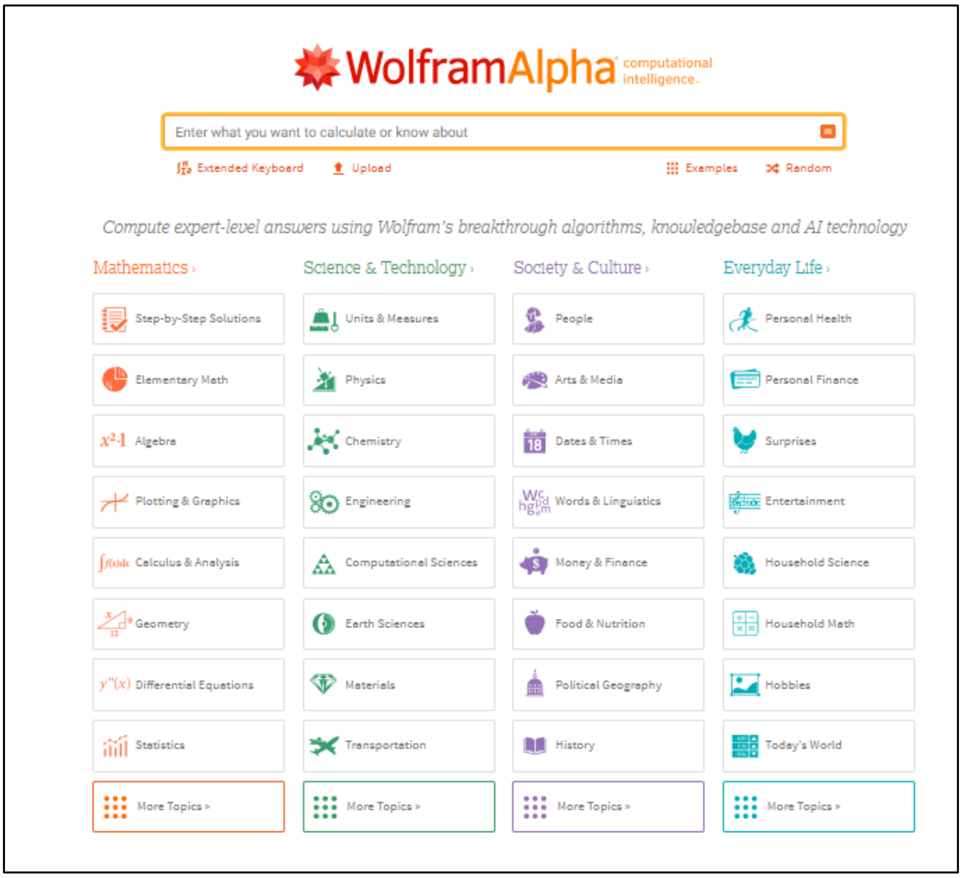


Figure 1. Wolfram|Alpha's interface

Limit of a function

Limit is one of the most useful branches of mathematics (McGregor et. al 2010). Therefore, knowledge of limits is very important. In Wolfram|Alpha, just type the word 'limit' in the dialogue box. Then enter the function and value to approach. Figure 2 shows the interface that appears when you want to solve the limit question.

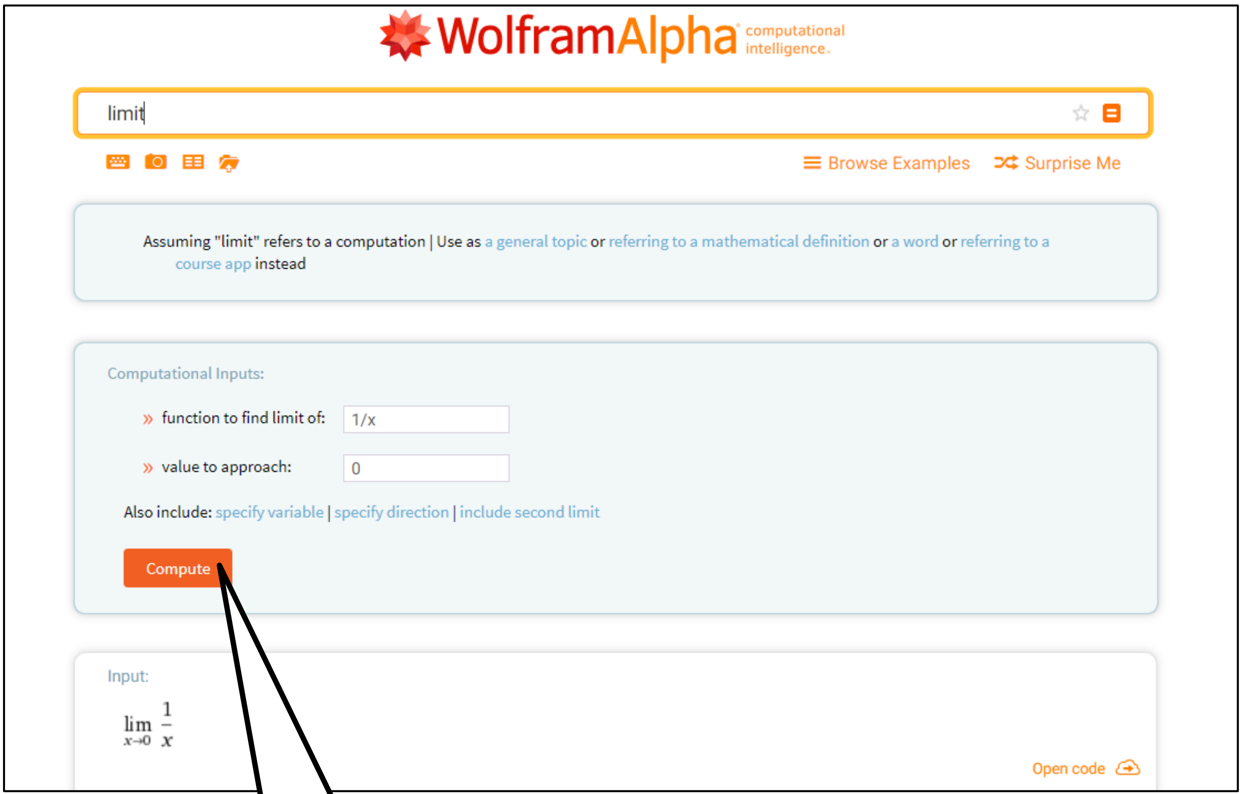
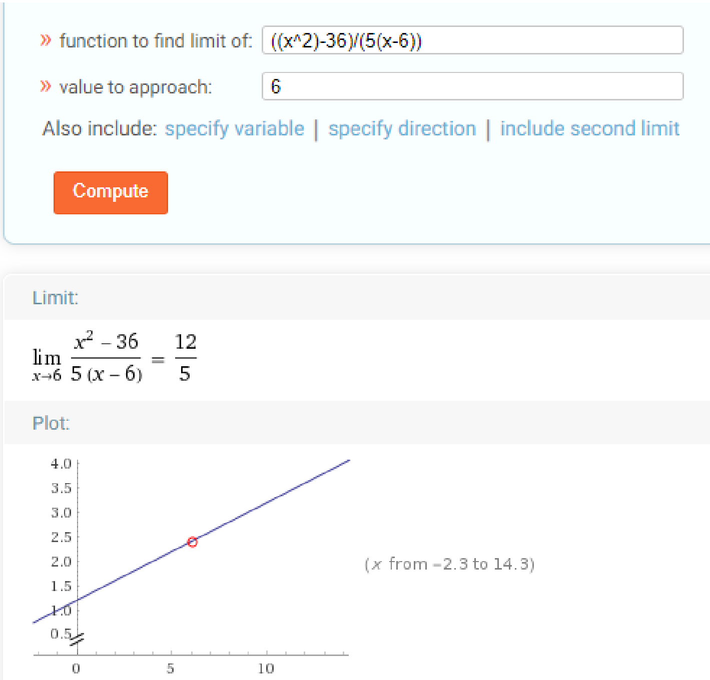
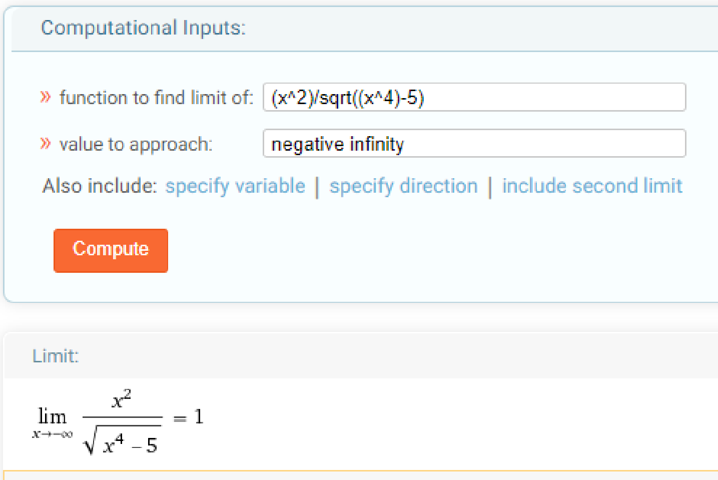


Figure 2. Limit's interface

Table 2 shows the limit questions that were solved using Wolfram|Alpha and manually.

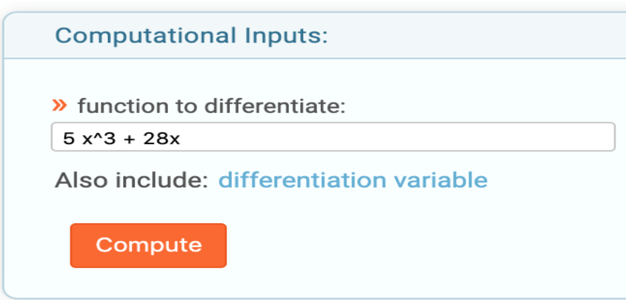
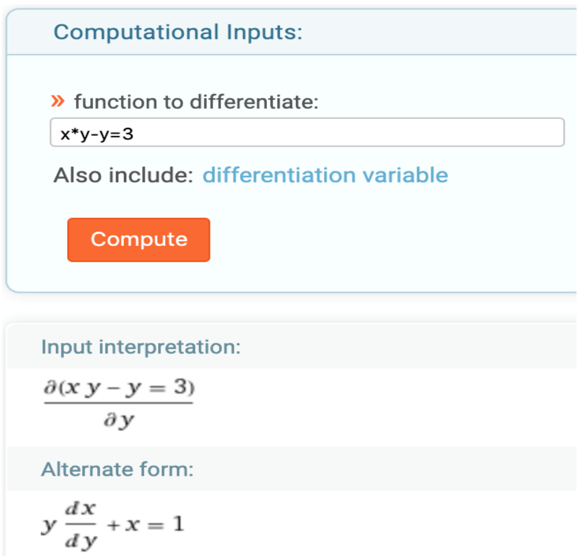
Table 2. Limit's questions

Wolfram|Alpha	Manually
 	$\lim_{x\to6}\frac{1}{x-6}\left(\frac{x^2-36}{5}\right)$ $=\lim_{x\to6}\frac{(x-6)(x+6)}{5(x-6)}$ $=l\,im_{x\to6}\frac{x+6}{5}=\frac{12}{5}$
 	$\lim_{x\to-\infty}\left(\frac{x^2}{\sqrt{x^4-5}}\right)$ $\lim_{x\to-\infty}\left(\frac{\frac{x^2}{x^2}}{\sqrt{\frac{x^4-5}{x^4}}}\right)$ $=\lim_{x\to-\infty}\left(\frac{1}{\sqrt{1-\frac{5}{x^4}}}\right)=1$

Differentiation

Differentiation is the measures of computing a derivative. The derivative of a function y = f(x) of a variable x is a steps of the rate at which the value y of the function changes with respect to the change of the variable x. It is called the derivative of f with respect to x. Differentiation allows us to find rates of change. For example, it allows us to find the rate of change of velocity with respect to time (which is acceleration). It also allows us to find the rate of change of x with respect to y, which on a graph of y against x is the gradient of the curve. There are a number of simple rules which can be used to allow us to differentiate many functions easily. Table 3 shows the differentiation questions that were solved using Wolfram|Alpha and manually.

Table 3. Differentiation's questions

<table>
<tr><th>Wolfram|Alpha</th><th>Manually</th></tr>
<tr><td>
</td><td>$$\frac{d}{dx}\left(5x^3 + 28x\right)$$
$$= 15x^2 + 28$$</td></tr>
<tr><td>
</td><td>$$xy - y = 3$$
$$x\frac{dy}{dx} + y(1) - \frac{dy}{dx} = 0$$
$$x\frac{dy}{dx} + y - \frac{dy}{dx} = 0$$
$$x\frac{dy}{dx} - \frac{dy}{dx} = -y$$
$$\frac{dy}{dx}(x - 1) = -y$$
$$\frac{dy}{dx} = \frac{-y}{x - 1}$$</td></tr>
</table>

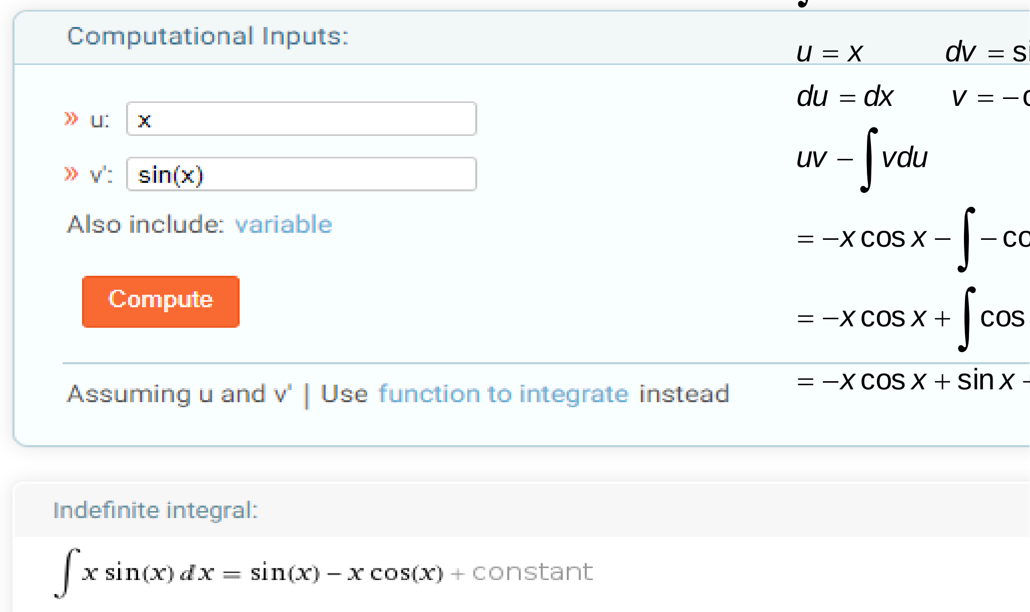
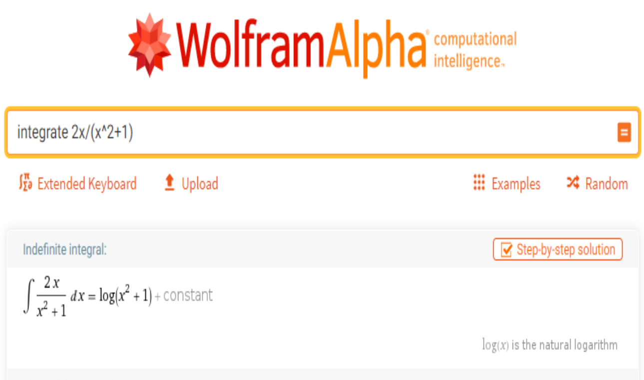
Integration

Integration is one of the two major calculus in Mathematics, apart from differentiation. Integration is the reversed of differentiation which used to find areas, volumes, central points and many useful things. There are several techniques of integration such as integration by substitution, integrations by parts, integration by partial fractions, and integration using trigonometric identities. In this paper, we just focused on how to solve the integration by substitution and integration by parts by using Wolfram|Alpha. To solve question that use integration by parts using Wolfram|Alpha, just type the word 'integration by parts' in the dialogue box. Then enter the function of 'u' and 'v'' or 'dv'. Meanwhile, to solve question that use integration by substitution in Wolfram|Alpha, just type the function that we want to evaluate in the dialogue box. Then just press the 'enter'. Table 4 shows the integration questions that were solved using Wolfram|Alpha and manually.

Conclusion

In general, the development of our country is strongly connected with the growth of the development in technology. According to Harris (2016), Technology also had makes humans life easier and more comfortable in some aspects including in educations. Nowadays, there are so many software has been developed to make it easier for student to complete their studies. However, some of them that is used in the classroom for student learning cannot simply be a replacement of best practices in teaching and learning for students. Teachers must continue to be learners themselves to produce the best teaching methods and introduce technology that works for their classroom and the specific needs of their students. The process of learning also should be creative and captivating. Thus, the programs, materials, and projects done should be meaningful to the students. When this is done correctly, we will see the higher engagement and achievement levels of students and the desire of student to learn.

Table 4. Integration's questions

Wolfram|Alpha	**Manually**
i)Integration by Parts  	$\int x \sin x dx$ $u = x \quad dv = \sin x$ $du = dx \quad v = -\cos x$ $uv - \int v du$ $= -x\cos x - \int -\cos x dx$ $= -x\cos x + \int \cos x dx$ $= -x\cos x + \sin x + C$
ii)Integration by Substitutions  	$\int \frac{2x}{x^2+1} dx$ Let $u = x^2+1$ $\frac{du}{dx} = 2x; \quad du = 2xdx$ $\int \frac{du}{u}$ $= \int \frac{1}{u} du$ $= \log u + C$ $= \log(x^2+1) + C$

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Understanding the Common Mistakes made by Fundamentals of Computer Problem Solving (CSC128) Students of Universiti Teknologi MARA Cawangan Pulau Pinang, Malaysia on Repetition and Functions Topic

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Introduction

Computer programming is the process of writing and designing a computer programs while a computer program is a set of instructions to solve problems (Anisha et. al., 2019). Learning computer programs need to start from the basic level before anyone can go to a higher level. Thus, it is very important for non-programmers to understand the basic concepts of programming before they are able to solve a complicated one.

Rogalski and Samurcay (1990) summarise in their study that the process of acquiring and developing computer programming knowledge includes numerous cognitive activities and mental representations associated with program design, program comprehension, program debugging, program modifying and lastly program documentation. They added that programmers should be able to construct the theoretical understanding into schemas and plans using basic control structures such as conditional statements, loops, functions and others.

Other than that, a study by Saeli et. al. (2011) mentioned that Govender (2006) indicated three main parts of learning to program are the data, instruction and syntax. Data refers to the variables and data types of a computer language while instruction is the control structures (conditional statements, loops and others) and subroutines in the programming. Syntax represents the rules and vocabulary of a programming language.

Fundamental of Computer Problem Solving (CSC128) for Novice Programmer

As mentioned in our previous paper, Fundamentals of Computer Problem Solving (CSC128) is a course specifically for beginners or those who are new to programming. This course only covers few chapters which involved the basic concept of computer problem solving.

Since this course is being taken by the non-IT students or the novice programmers, they will only learn the fundamental part of programming using the C++ programming language. The topics involve the introduction to programming where students will learn few terms on programming and understand the process in developing a program which is by using the Program Development Life Cycle. Before moving to the control structures, students must also understand the basic elements in programming such as how to declare variables and constant, data types, input, and output as well as operation statement. The control structures will enable the students to write programs using sequential, selection and repetition. Finally, functions are being introduced to the students so that they will be able to construct the program into smaller pieces.

Common Mistakes made by Students in CSC128 Course by Chapters

CSC128 is the fundamental course on programming taken by the engineering students. Since the students do not have any programming background, it is very crucial for the lecturers to make sure that the students understand what they will be learning to make the learning process more interesting in order to gather the students' attention.

Learning is a process of understanding or acquiring knowledge. However, it is normal if the students make some mistakes during the learning process. Below are the common mistakes that have been identified during the learning process of this course. In this part, we will show the common mistakes done by most of the student on the repetition control structure and functions topic.

Repetition control structure

In repetition control structure, it allows a program to be repeated based on certain condition. Thus, students must be able to understand the Loop Control Variables or LCV and how the loop works. Table 1 shows the common mistakes done in Repetition Control Structure.

Table 1: Common Mistakes in Repetition Control Structure

Chapter 4		**Common Mistakes**
Flow Chart on Repetition	✖	Most of the students do not have problem in writing programs on repetition. However, when it comes to drawing flowchart which involves repetition, students tend to make mistakes whereby they do not show how the repetition happens in the flowchart. In the flowchart, repetition is being shown by using the flow line symbol that goes back to check the condition. Once the condition is TRUE, the program will be repeated but once the program is FALSE, the program will skipped all the statements.
Writing Initial Value	✖	Before any condition in a repetition is being checked especially for a WHILE loop, an initial value should be entered or initialized first. Some of the students do not give input or initialize values to the variables and this will unable the condition to be read as the value is not given yet. One important thing that student must understand here is the Loop Control Variable which is the starting value that must be given to a variable.
Infinite Loop	✖	Infinite loop happens when there is no counter which controls the loop condition. This is another important concept that the student must understand in Loop Control Variable which is the function of the counter is to control the number of time the loop is being repeated.
Wrong syntax	✖	Student should understand the syntax on writing the three types of loop which is the while loop, do...while loop and for loop. Because lack of practices, some of the students is confused by the different syntax for these three types of control structure and will make mistakes when using it.
Tracing	✖	Tracing a loop needs a lot of patience. As long as the condition is TRUE, a loop will continue looping and when it is FALSE, a loop will stop. When tracing, students must identify the types of loop used and be able to trace the loop especially when it involves nested loop where in nested loop, the outer loop takes control of the inner loop. The outer loop will run once, follow with the inner loop which will run until the condition is FALSE. The program will then go back to the outer loop and will repeat back the steps as long as the outer loop is TRUE. Program will only stop until the outer loop is FALSE.

All the mistakes discussed above can be avoided if the students do a lot of practices. In any programing lesson, doing a lot of exercise will help the students to understand much better.

Function

In real world situation where programs are written by team of programmers, function is being done as each of the programmers only does their part. The advantage of functions is that it will separate the programs into smaller one. However, since student are used to write programs in only one main function from chapter 1 to chapter 4, they are not used to function and it is quite hard for them to understand the concept of function. Since there are many ways to do function, Table 2 below are the common mistakes done in Functions.

Table 2: Common Mistakes in Functions

Chapter 5	**Common Mistakes**
Understanding the concept of function	✘ Before starting to do a function, students must be able to understand the concept of function and why it needs to be done. In function, what is important is to understand the three function elements which are function prototype, function definition and function call.
Function prototype	✘ In function prototype, what student must know is function prototype is only written if the function definition is done below the main function. If a function definition is done above the main function, a function prototype is not needed.
Function definition	✘ In English, definition is also known as meanings. Students are confused with this term so they tried to give the definition of function instead of writing the correct function definition.
Function call	✘ A function needs to be called in order for it to be useful. However, there are many ways to call a function. Some of the students did not call the function while some of them do not understand the few ways of calling a function.
Function with/without return statement	✘ Sometimes, students are not sure to start a function definition with either void or other function types. They also must understand that a function which starts with void does not have to return a value while a function that starts with other function types MUST return a value.
Global and local variables	✘ In functions, variables are declared either globally or locally. Some students make mistakes especially when it comes to declaring a local variable as they do not know that when using local variables, parameter passing is needed. The students must also understand the concept and ways of passing a parameter to a function.
Passing parameter -by value and by reference	✘ This is very important when students used local variables in their functions. Student must know that a function must only return one value at one time. The concept of passing parameter is very crucial that if a function needs to return more the one value, passed by reference is needed in a program.

To understand this topic, lecturers should expose the students with real world situation so that they can understand the topic better. Students must also try to solve many problems which involve functions so that they can be used to it.

Conclusion

Learning programming is fun if the students know how to solve problems given to them. However, to make them understand more, students need to do a lot practices instead of just reading the books. To make programming more interesting, lecturers should play an important role so that students will love programming. It is also hoped that this paper will help the students to avoid all the common mistakes that they did when learning programming especially in their assessment.

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Fundamental of Computer Problem Solving (CSC 128) – Final Exam Format and Frequent Questions

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Introduction

Fundamental of Computer Problem Solving (CSC 128) is one of the servicing papers offered in UiTM for diploma students. The subject is taken by student from mechanical engineering, civil engineering, actuarial science and statistic. This course contains three (3) credit hours with two (2) hours for lecturing and another two (2) hours for lab session. The main purpose of this paper is to introduce problem solving using computers. It also emphasizes various aspects of problem solving, phases of problem solving and basic techniques in designing a solution using C++ language. CSC128 also emphasis on solving problems using computer rather than the syntactical aspects of the chosen programming language which is C+ +.

There are five (5) main topics covers in CSC128, the first topic are the introduction to computer programs, the second topic are component of a programming language, then continue with selection control structure, followed by repetition control structure and the last topic will be function topic. The assessment format for this CSC128 is 50 % from ongoing assessment and another 50% from final exam. The ongoing assessments include tests, quizzes, individual assignment, and group project.

In Universiti Teknologi MARA Cawangan Pulau Pinang, Malaysia, CSC128 are taken by diploma students from civil and mechanical engineering programme. For civil engineering students they are planned to take in semester two (2) while for mechanical engineering students, it is being offered in semester four (4). This course has been offered here since 2009.

Final Exam Format

As mentioned earlier, CSC128 have final exam that contribute 50 % of the overall result. Examination duration for the final exams takes three (3) hours. The total marks for this final paper are 100 marks. The final paper has three (3) parts. Part A for objective question consists of ten (10) questions which contribute 20 marks. Part B contribute 50 marks contains five (5) short questions and part C consists of two (2) discussion question that contribute 30 marks. Figure 1 below illustrates the format structure for the CSC128 final exam paper.

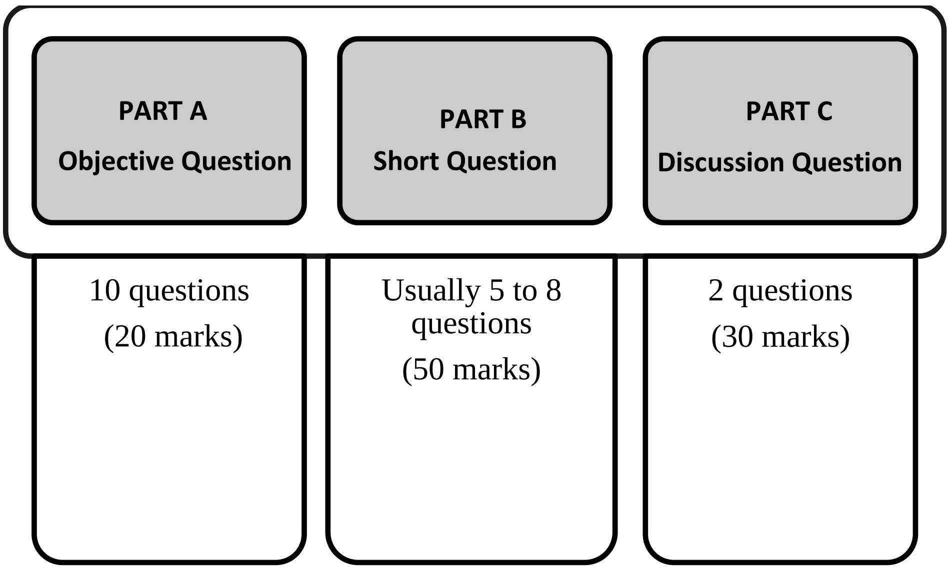

Figure 1. Examination Paper Format Structure

The objective questions usually will cover all the chapters. The frequent question type asked in objective will be basic definition, understanding of a process and examples. Besides that, tracing simple output for program is also often being asked here. Minimum one question will be asked from each chapter.

The part B questions also will cover all the chapters. In this part, the questions are arranged by chapter sequence. The difficulties of the question also will increase as its goes. There will be sub questions given here. Usually, the marks in this part will be from 1 to 10 marks by question and sub questions. The question types in this part are listed below:

i. Explanations and definition question
ii. Simple calculation questions
iii. Write the program statement
iv. Tracing output
v. Rewrite the program given
vi. Draw flowchart based on problem statement

Part C is known as discussion questions. Here the full marks given are 30 marks. The questions here are to write a full program based on the problem statement given. There will be two (2) questions in this part and the marks are evenly distributed. There are also sub questions in part C.

Frequent Question by Chapters

In the early part, final examination structure has been discussed. Now, the discussion will be detailed up by chapters. Every chapter have few topics that should be focused. Table 1 below shows the chapters and the topics that are frequently being asked in final examination by parts.

Table1: Chapter and Topics in Final Examination by Parts.

Chapters/Topics	Part A	Part B	Part C
Introduction to computer programs			
i. Introduction to Programming Program	√	√	
ii. Development Life Cycle	√	√	
Chapter 2:			
Component of a programming language			
i. Identifier, variable, constant, reserved word	√		
ii. Basic data types	√		
iii. Arithmetic operators, precedence and expression	√	√	
iv. Assignment Statement			
v. Input/output statement		√	
vi. Debugging and error handling Types of control structures	√	√	
Chapter 3:			
Selection control structure			
i. Boolean values and expression	√		
ii. Relational and logical operators			
iii. Types of selection control structures (one-way: if, two-way:if-else and multiple-way:switch-case)	√	√	***1 Question***
iv. Nested selection control structure (nested if)	√		
Chapter 4:			
Repetition control structure			
i. Requirements and operation in repetition control structure	√	√	
ii. Types of repetition control structures (for, while and do...while)	√	√	
iii. Nested loop	√		
Chapter 5:			
Function			
i. Introduction to functions	√		
ii. Function call	√	√	
iii. Library functions	√		***1 Question***
iv. User-defined	√	√	
v. functions Parameter passing (pass-by-value and pass-by-reference)	√	√	

From the table above, there are frequent topics which are being asked in final examination in every chapter. Actually, the frequent questions are based on the basic understanding of programming. Besides that, the aims of this paper to test their understanding and their capabilities to apply the concept in any kind of problem statement.

For topics in chapter one (1), questions based on definition and explanation of computer type, computer functions and program will be frequently asked. Besides that, the explanations of steps in PDLC are also very famous in final examination.

For chapter two (2), topics on arithmetic operators will always be asked in the final examination paper. Here, the examiner wants to identify whether the student really understands the operator and the calculation concepts in programming. Data type and variable topic is the basic concept of writing a program, so it will be tested too usually in part A and part C. Writing simple program and a part of program segment using sequential control structure also will be evaluated usually in part B. Topic on error handling is also very important because as a programmer, the student has to understand where or how the mistakes is being done during the program implementation and coding.

For chapter three (3) and four (4), the overall concept of selection and repetition method will be tested. Usually, problem statements are given and are applied to all type of selection and repetition method. Sometimes, tracing output question are also applied in this topics to test the understanding of these control structure.

For chapter function, usually the understanding about the function element and parameter passing process will be tested in part A and part B. Writing a full program which involved function will also be asked in part C.

Conclusion

CSC128 is a servicing subject for certain courses and the students are novice students. The syllabus for this subject is being designed appropriately according to the curriculum and programme needs. The assessments for CSC128 are also convenient and allow the student to score well in this subject. As the student preparation, they have to make sure they understand and are able to apply the concept of programming in the correct situation. They have to really identify the program structure in order to help them solve the problem.

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Strengthening the core in Calculus: Differentiation and Integration

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Introduction

Calculus plays a vital role in mathematics and is the important branch in Applied Mathematics. Calculus covers from limit, functions, derivatives, and integral till infinite series. Understanding key concepts in Algebra and Trigonometry is needed to have a better comprehension in Calculus.

As Calculus is widely applied in the field of engineering, sciences and economics, it is essential for students to learn this subject in schools and higher education institutes. Nevertheless, students struggle and perceive Calculus as a hard and difficult subject where they often misunderstood the concept of calculus (Tarmizi 2010).

Students generally have difficulties in solving problems with limits, derivative and integral (Siti Fatimah, 2019). Therefore, this article serves as a tool for students to grasp the heart of calculus which consists of differentiation and integration. It also tackles on basic algebra and trigonometry, definitions as well as techniques of differentiation and integration.

Tips in Learning Calculus

Remember the Basics Mathematics

It is important to memorize the basics in mathematics to avoid silly mistakes in the solutions. There is no shortcut as these basic properties are being used in all of Calculus's branches. Figure 1 below shows a right triangle where the adjacent side is labelled by a, the opposite side is labelled by b and side c is the hypotenuse of the triangle.

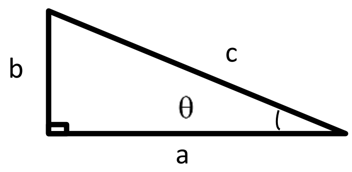

Figure 1

The angle θ in Figure 1, can be calculated based on the trigonometric rules as follows,

$$\sin\theta = \frac{b}{c},\ \cos\theta = \frac{a}{c},\ \tan\theta = \frac{b}{a},\ \csc\theta = \frac{c}{b},\ \sec\theta = \frac{c}{a},\ \cot\theta = \frac{a}{b}$$

Table 1 and Table 2 below show the law of indices and the laws of limits respectively that are widely used in calculus.

Table 1: Laws of Indices

(1) $a^m a^n = a^{m+n}$	(5) $\left(\frac{a}{b}\right)^n = \left(\frac{a^n}{b^n}\right), b \neq 0$	(8) $a^{-m} = \frac{1}{a^m}$
(2) $\frac{a^m}{a^n} = a^{m-n},\ a \neq 0$	(6) $a^0 = 1$	(9) $a^{\frac{1}{m}} = \sqrt[m]{a}$
(3) $\left(a^m\right)^n = a^{mn}$	(7) $a^1 = a$	(10) $a^{\frac{n}{m}} = \sqrt[m]{a^n} = \left(\sqrt[m]{a}\right)^n$
(4) $(ab)^n = a^n b^n$		

Table 2: Laws of Limits

Let k and a be any real number,		
(1) $\lim\limits_{x\to a} k = k$	(4) $\lim\limits_{x\to 0^+} \frac{1}{x} = \infty$	(7) $\lim\limits_{x\to +\infty} x = +\infty$
(2) $\lim\limits_{x\to a} x = a$	(5) $\lim\limits_{x\to \pm\infty} k = k$	(8) $\lim\limits_{x\to \pm\infty} kf(x) = k \lim\limits_{x\to \pm\infty} f(x)$
(3) $\lim\limits_{x\to 0^-} \frac{1}{x} = -\infty$	(6) $\lim\limits_{x\to -\infty} x = -\infty$	

Understand the Definition

It is vital to understand the definitions in limits, derivatives and integrals. All of them are the foundations and core in Calculus. When students fully understand the definitions and concepts, no matter how the questions are being rephrased, they will surely know how to solve the questions in their hands.

Rules in Mathematics

There are always rules in all fields of study including Calculus. In differentiation, there are product rule, quotient rule as well as chain rule. Integration has a lot more rules such as integration by substitution and integration by parts.

Understand the Problem

The problems given may be a direct or indirect where critical thinking is often needed to solve ones. By doing lots of exercises, it can help students to quickly understand the problem in hand and hence manage to solve them correctly.

Differentiation

Definition 1

The derivative of the function f is the function f' given by $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$. The process of computing a derivative is called differentiation. If $y = f(x)$, then $y' = \frac{dy}{dx} = \frac{d}{dx} f(x)$. The expression $\frac{d}{dx}$ is called a differential operator. Table 3 below shows a basic rules to compute derivatives:

Table 3: The Derivatives of a Function

(1) Constant Rule: $\frac{d}{dx}(k) = 0$	(5) Trigonometric Rules: $\frac{d}{dx}\sin[f(x)] = f'(x)\cdot\cos[f(x)]$
(2) Power Rule: $\frac{d}{dx}(x^n) = nx^{n-1}$	$\frac{d}{dx}\cos[f(x)] = f'(x)\cdot(-\sin[f(x)])$
(3) Logarithmic Rule: $\frac{d}{dx}\ln[f(x)] = \frac{f'(x)}{f(x)}$	$\frac{d}{dx}\tan[f(x)] = f'(x)\cdot\sec^2[f(x)]$
(4) Exponential Rule: $\frac{d}{dx}e^{f(x)} = f'(x)\,e^{f(x)}$	$\frac{d}{dx}\mathrm{cosec}[f(x)] = f'(x)\cdot(-\mathrm{cosec}[f(x)]\cot[f(x)])$
	$\frac{d}{dx}\sec[f(x)] = f'(x)\cdot(\sec[f(x)]\tan[f(x)])$
	$\frac{d}{dx}\cot[f(x)] = f'(x)\cdot(-\mathrm{cosec}^2[f(x)])$

If given two functions such as $f(x)$ and $g(x)$, the derivatives can be computed as below.

Product Rule

Suppose that f and g are differentiable. Then, $\frac{d}{dx}[f(x)\,g(x)] = f'(x)\,g(x) + f(x)\,g'(x)$

or let $u = f(x)$ and $v = g(x)$, then $\frac{dy}{dx} = uv' + vu'$.

Quotient Rule

Suppose that f and g are differentiable. Then, $\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$

or let $u = f(x)$ and $v = g(x)$, then $\frac{dy}{dx} = \frac{vu' - uv'}{v^2}$.

Integration

Definition 2

The process of finding anti-derivatives is called anti-differentiation or integration. If $\frac{d}{dx}[F(x)] = f(x)$, then, integrating $f(x)$ produces the anti-derivatives $F(x)+C$ where *C* is a constant. It also can be denoted as $\int f(x)\,dx = F(x)+C$. Table 4 shows the list of the basic integration formula.

Table 4: List of the Basic Integration formula

(1) Constant Rule: $\int k\,dx = kx + C$	(5) Trigonometric Rules: $\int \sin x\,dx = -\cos x + C$
(2) Power Rule: $\int x^n dx = \frac{x^{n+1}}{n+1} + C,\quad \int \frac{1}{x}dx = \ln\lvert x\rvert + C$	$\int \cos x\,dx = \sin x + C$
(3) Logarithmic Rule: $\int \ln\lvert x\rvert\,du = x\ln\lvert x\rvert - x + C$	$\int \tan x\,dx = -\ln\lvert\cos x\rvert + C$
(4) Exponential Rule: $\int e^x\,dx = e^x + C$	$\int \cot x\,dx = \ln\lvert\sin x\rvert + C$
	$\int \sec x\,dx = \ln\lvert\sec x + \tan x\rvert + C$
	$\int \sec^2 x\,dx = \tan x + C$
	$\int \mathrm{cosec}^2 x\,dx = -\cot x + C$

There are several methods of integration that can be used to solve more complicated integral.

Integration by substitution

The integration by substitution method also called as u-substitution is used when an integral contains some function and its derivative. In this case, u will be set as equal to the function and rewrite the integral in terms of the new variable u. This makes the integral easier to solve. Then, the final answer will be expressed in terms of the original variable x.

Integration by parts

This method is applied when integrating the product of two different functions of the same variable. The formula is $\int u\,dv = uv - \int v\,du$. In order to solve the integral using integration by parts, the integral is split into two parts, *u* and *dv*, where *u* will be differentiated and *dv* will be integrated. There is a guideline to select *u* and *dv* that is by using acronym L-I-A-T-E where L stands for logarithmic function, I stands for inverse trigonometric function, A stands for algebraic function, T stands for trigonometric function, and E stands for exponential function. According to this guideline, *u* should be the function that comes first in this list and dv will be the rest of the function.

Integration by trigonometric substitution

Integration by trigonometric substitution method is used to solve the integrals containing the expression of the form $\sqrt{a^2 - x^2}$, $\sqrt{x^2 - a^2}$ and $\sqrt{a^2 + x^2}$.This method uses substitution to rewrite these integrals as trigonometric integrals where the variable x changed to θ by the substitution, then the identity allows to solve of the root sign. Table 5 shows the list of trigonometric substitutions for the given radical expressions.

Table 5: List of Trigonometric Substitution

Expression	**Substitution**	**Identity**
$\sqrt{a^2 - x^2}$	$x = a \sin\theta$	$1 - \sin^2\theta = \cos^2\theta$
$\sqrt{x^2 - a^2}$	$x = a \sec\theta$	$\sec^2\theta - 1 = \tan^2\theta$
$\sqrt{a^2 + x^2}$	$x = a \tan\theta$	$1 + \tan^2\theta = \sec^2\theta$

Integration by partial fractions

Partial fraction is a technique of integration that can be used to integrate a proper rational function. A ratio of two polynomials $\frac{P(x)}{Q(x)}$ is called as a rational function where it is said to be proper when the degree of $P(x)$ is lesser than degree of $Q(x)$. This method focuses on denominators that can be factorized into linear and quadratic equations where the integral can be written as a sum of simpler rational functions so that the integral can be solved easily. Table 6 shows some simple partial fractions.

Table 6: Form of Partial Fraction

	Form of the rational function	**Form of the partial fraction**
1	$\frac{px+q}{(x-a)(x-b)}, a \neq b$	$\frac{A}{x-a}+\frac{B}{x-b}$
2	$\frac{px+q}{(x-a)^2}$	$\frac{A}{x-a}+\frac{B}{(x-a)^2}$
3	$\frac{px^2+qx+r}{(x-a)(x^2+bx+c)}$	$\frac{A}{x-a}+\frac{Bx+C}{x^2+bx+c}$
4	$\frac{px^2+qx+r}{(x^2+bx+c)^2}$	$\frac{Ax+B}{x^2+bx+c}+\frac{Cx+D}{(x^2+bx+c)^2}$
	where x^2+bx+c cannot be factorized further	

Conclusion

In conclusion, the main problem that needs to tackle in Calculus is students' comprehension in differentiation and integration and more importantly in algebra and trigonometry. Teaching problem-solving strategies in Calculus is necessary so that students know the steps toward solution formulation. Memorizing the basic Mathematics, grasping the definition and concept will then help students to identify which rules or methods needed to solve problems given to them. Students also need to do more practice to improve their ability in solving application problems (Klymchuk,2010).

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How to Solve an Interpolation Using Calculator

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Linear Interpolation

Let us say that we have two known points x_1, y_1 and x_2, y_2 . Now we want to estimate what y value we would get for some x value that is between x1 and x2. Call this y value estimate as an interpolated value. A simple traditional method to find the y value is by drawing a straight line between x_1, y_1 and x_2, y_2 . We look to see y value on the line for our chosen x. This is called linear interpolation (Figure 1).

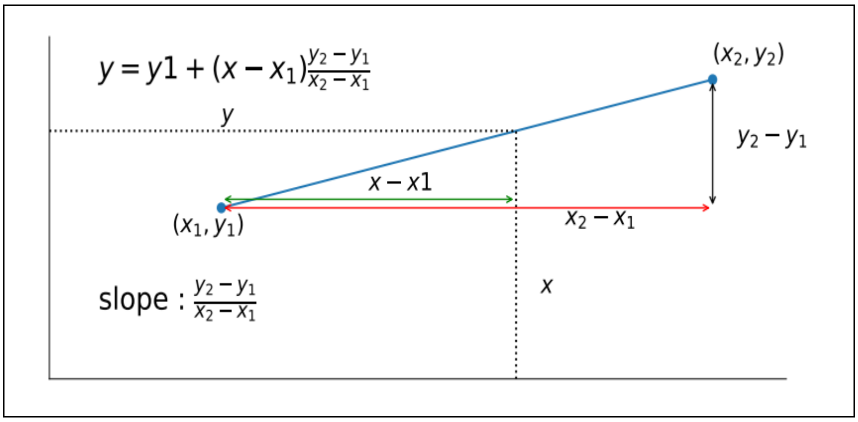


Figure 1: Linear Interpolation. Figure adapted from https://matthew-brett.github.io/teaching/linear_interpolation - Retrieved 5/3/2020

As time goes by, the scientific calculator is another tool to solve the interpolation. One of the advantages of using this tool is it can make potentially lengthy calculations much shorter and time wisely. Nowadays, there are so many scientific calculators you can find out there.

According to the article written by LaToya Irby (2020), there are 8 best scientific calculators were selected in the year 2020. These scientific calculators have their own strength for solving maths, science, and engineering problem. Table 1 shows this type of scientific calculators.

Table 1: Type of Scientific Calculator.

Scientific Calculator Model	**Description**
Texas Instruments TI-36X Pro	The TI-36X can be used in high school and college for algebra, geometry, trigonometry, statistics, calculus, and biology
Casio FX-115ES Plus	Calculator is great for high school and college students in general math, algebra, statistics, trigonometry, calculus, engineering, and physics.
Texas Instruments TI-30X IIS 2-Line	The calculator is ideal for general math, pre-algebra, algebra 1 and 2, geometry, statistics, and general science.
Casio FX-300MS	Allows you to enter fractions, figure out standard deviations, calculate sine, cosine, tangent, and inverse, and many more mathematical functions.
Casio FX-260	Suitable for middle school and early high school math.
HP 35s	Great option for engineers, surveyors, scientists, medical professionals, and college students.
Texas Instruments TI-30XS MultiView	Enter and view expressions using common math notation — exactly the way expressions appear in the textbook — for easier understanding.
Sharp Calculators EL-W516TBSL	The calculator can handle 640 different functions including trig functions, logarithms, reciprocals, powers, and more.
Casio fx-570EX (CLASSWIZ)	ClassWiz contains calculation functions that support mathematical operations, including spreadsheet calculations, 4 × 4 matrix calculations, simultaneous equations with four unknowns. It also generates QR codes of equations input into the calculator by a simple operation. Graphs and other graphics can be displayed on smartphone or tablet screens.

https://www.thoughtco.com/best-scientific-calculators-4178005

Casio FX991, Casio FX991ES & Casio fx-570EX (CLASSWIZ)

In this article, we use the scientific calculator model Casio FX991 , Casio FX991ES and Casio fx-570EX (CLASSWIZ) to show the steps on how to solve the interpolation problem. The first two models are commonly used by the students in UiTM Penang and recently the third model has been widely introduced to them.

The guidance about the calculator

Problem: For z of 1.64 the probability is 0.9495 and for z of 1.65, the probability is 0.9505. This implies the probability of the z of 1.645 lies somewhere between 0.9495 and 0.9505. Refer Figure 2. The ratio of the short line to the long line is the same for the z-value and the corresponding probabilities. The x represents the unknown probability we would like to determine.

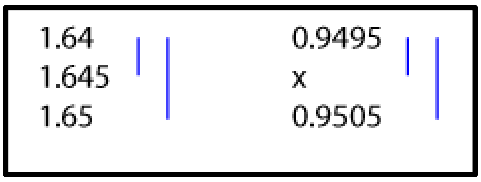
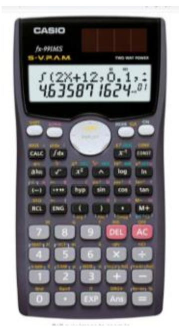
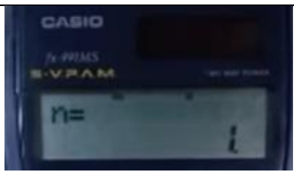
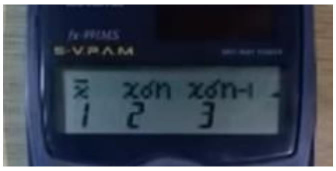


Figure 2: Interpolation Process. Figure adapted from https://accendoreliability.com/interpolation-within-distribution-tables/ - Retrieved 10/3/2020

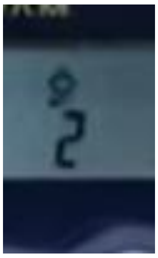
Model	Steps
 Casio FX991	1. Calculator must be in mode Regression. Press **MODE** and choose **REG** by pressing the button number **2.** 2. Then choose **LIN** by pressing the button **1.** 3. Enter the first two values: **1.64 , 0.9495** . Then press the button **M+**. You can see **n=1** on the screen. It shows that this is the first two values in the interpolation being store in the calculator.

<table>
<tr>
<td></td>
<td>


4. Next, enter another two values: **1.65 , 0.9505** . Then press the button **M+**. You can see **n=2** on the screen. It shows that this is another two values in the interpolation that are in the calculator.
5. To find **x**, enter **1.645**, then press the button **SHIFT** and **2**. The screen will show as below:



Then, **move to the right** until you can find the this symbol



Hence, press button **2** and press the button **=** . Finally you got the answer.
</td>
</tr>
<tr>
<td>


Casio

FX991ES
</td>
<td>

1. Press **MODE** and choose **STAT** by pressing the button number 3**.**

2. Then choose A+BX by pressing the button number **2**
</td>
</tr>
</table>

3. The screen will appear like this

.

4. Key-in all the values.

	X	Y
1	1.64	0.9495
2	1.65	0.9505

Then, press the button **AC**

5. Enter the value **1.645,** and then press **SHIFT** followed by pressing the button **1.** The screen will appear like this

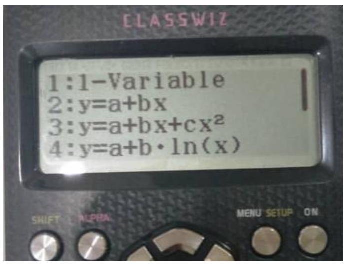
.

Choose **REG**

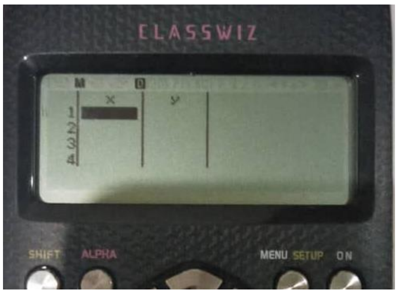
<table>
<tr>
<td></td>
<td>


6. Hence, choose the symbol number 5 by pressing the button number 5.
7. Finally, press the button = and you got the answer.
</td>
</tr>
<tr>
<td>


Casio fx-570EX (CLASSWIZ)
</td>
<td>
1. Press MENU and choose Statistics by pressing button number 6.


2. Then choose y-a+bx by pressing the button number 2


3. The screen will appear like this.
</td>
</tr>
</table>

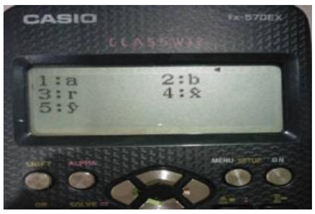


4. Key-in all the values.

	X	**Y**
1	1.64	0.9495
2	1.65	0.9505

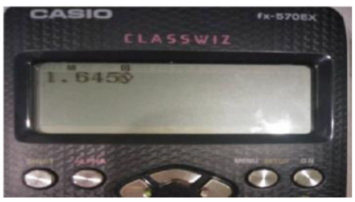
Then, press the button **AC**

5. Press **OPTN,** scroll down and choose number 4 for **regression**



then choose number 5 for $\hat{y}$ **.**

6. Enter the value **1.645** right before $\hat{y}$ **,** and then press **=.**



The answer will appear on the screen .

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https://accendoreliability.com/interpolation-within-distribution-tables/ - Retrieved 9/3/2020

Miskonsepsi Pelajar Dalam Topik Trigonometri

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Pengenalan Miskonsepsi dalam Matematik

Miskonsepsi didefinisikan sebagai kesalahan pemahaman yang mungkin terjadi selama atau sebagai hasil pengajaran yang baru saja diberikan, berlawanan dengan konsepsi-konsepsi ilmiah yang dibawa atau berkembang dalam waktu lama (Mosik, P. Maulana 2010). Miskonsepsi ialah satu daripada masalah yang sering dihadapi oleh pelajar dalam pembelajaran matematik dan sering menjadi penghalang kepada mereka untuk memahami konsep-konsep matematik yang berkaitan dengan konsep yang mereka salah ertikan. Terdapat tiga sumber yang menjadi penyumbang kepada miskonsepsi iaitu idea daif yang berpunca daripada pengalaman pelajar itu sendiri, kesalahan semasa aktiviti pengajaran yang berpunca daripada kefahaman yang tidak kuat terhadap sesuatu konsep yang dijelaskan oleh guru dan pengajaran guru atau pensyarah yang tidak tepat atau salah. (Effandi 2007)

Antara jenis miskonsepsi yang sering berlaku di kalangan pelajar ialah terlalu menggeneralisasikan (overgeneralization), terlalu memudahkan (oversimplification), pandangan/idea pengetahuan sedia ada (pre-conceive notion), salah mengenalpasti (misidentifying), salah faham (misunderstanding), salah maklumat (misinformation), kepercayaan bukan saintifik (nonscientific beliefs), salah faham konsep (conceptual misunderstands), kepercayaan kepada yang lebih terkenal (popular beliefs) dan penerangan yang salah mengenai definisi dan kaedah (definition and method incorrectly explained).

Miskonsepsi dalam topik trigonometri

Trigonometri adalah satu cabang matematik yang berhadapan dengan sudut, segi tiga dan fungsi trigonometri seperti sinus, kosinus, dan tangen. Secara generalnya terdapat tiga jenis hubungan miskonsepsi dalam topik trigonometri iaitu pertama salah faham yang berkaitan dengan suatu konsep yang menggunakan objek dan simbol matematik. Contohnya Sinus atau Sin ialah simbol dan juga merupakan notasi dalam trigonometri. Kedua ialah salah faham yang berkaitan dengan proses iaitu keupayaan untuk menggunakan operasi. Contoh pengiraan $Sin30^o$ dan nilaikan $Sin30^o$. Ketiga salah faham yang melibatkan "Procept" iaitu keupayaan untuk memikirkan matematik operasi dan objek. Procept merangkumi kedua-duanya konsep dan proses. Contoh Sin adalah fungsi dan nilai. (Hulya Gur 2009)

Di antara soalan-soalan lazim yang berkaitan topik trigonometri ialah

(1) Soalan berdasarkan mencari nilai-nilai nisbah trigonometri jika diberi sudut atau salah satu daripada enam nisbah trigonometri.

(2) Soalan-soalan pada sudut pelengkap hubungan

(3) Soalan mengenai pembuktian trigonometri identiti menggunakan identiti asas.

(4) Soalan berdasarkan ketinggian dan jarak

(5) Soalan penyelesaian persamaan trigonometri

Contoh-contoh miskonsepsi dalam topik Trigonometri

Jadual 1 adalah diantara contoh-contoh kesalahan umum yang dilakukan oleh pelajar kerana miskonsepsi mereka dalam topik trigonometri. Disertakan keterangan pada setiap contoh soalan akan kesalahan pelajar dan pembetulan yang perlu dibuat supaya kesilapan dikalangan pelajar tidak berulang.

Jadual 1. Keterangan Contoh Miskonsepsi dalam Topik Trigonometri

Keterangan	**Soalan**	
Miskonsepsi berlaku dalam penggunaan simbol apabila setiap fungsi trigonometri tidak diletakan ‘argument’ atau ‘input’.	Contoh: Simplify the following $\csc(x)\tan(x)$	
	Kesalahan, x	Pembetulan,√
	$\csc(x)\tan(x) = \frac{1}{\sin}\frac{\sin}{\cos}$ $= \frac{1}{\cos}$ $= \sec$	$\csc(x)\tan(x) = \frac{1}{\sin(x)}\frac{\sin(x)}{\cos(x)}$ $= \frac{1}{\cos(x)}$ $= \sec(x)$

(a)

Keterangan	**Soalan**	
Miskonsepsi berlaku apabila konsep operasi dalam algebra diaplikasikan didalam trigonometri.	Contoh: Given $x = \pi$, find $\cos^2 x$	
	Kesalahan, x	Pembetulan,√
	$\cos^2 x = \cos(x^2)$ for $x = \pi$ $\cos^2 \pi = \cos(\pi^2)$ $= -0.902685$	$\cos^2 x = (\cos x)(\cos x)$ $= (\cos x)^2$ for $x = \pi$ $\cos^2 \pi = (\cos \pi)^2$ $= (-1)^2$ $= 1$

(b)

Keterangan	**Soalan**	
Miskonsepsi berlaku apabila pelajar memudahkan fungsi trigonometri yang mengandungi sudut gandaan 'double angle formula'.	Contoh: Given that $\tan A = \frac{3}{4}$ and A is an acute angle, find without the use of tables or a calculator the value of $\tan 2A$	
	Kesalahan, x	Pembetulan,√
	$\tan 2A = 2\tan A$ $= 2\left(\frac{3}{4}\right)$ $= \frac{3}{2}$	$\tan 2A = \frac{2\tan A}{1-\tan^2 A}$ $= \frac{2\left(\frac{3}{4}\right)}{1-\left(\frac{3}{4}\right)^2}$ $= \frac{24}{7}$

(c)

Keterangan	**Soalan**	
Miskonsepsi berlaku apabila pelajar tidak memahami konsep notasi bagi sonsangan fungsi trigonometri	Contoh: Find $y = \cos^{-1}(x)$ where $x = 0$	
	Kesalahan, x	Pembetulan,√
	$y = \cos^{-1}(x)$ $= \frac{1}{\cos(x)}$ $= \frac{1}{\cos(0)}$ $= 1$	$y = \cos^{-1}(x)$ $= \cos^{-1}(0)$ $= \frac{\pi}{2}$

(d)

Keterangan	**Soalan**	
Miskonsepsi terhadap penggunaan formula yang melibatkan penambahan dua sudut 'compound angle formula'	Contoh: Given $A=\frac{\pi}{6}$ and $B=\frac{\pi}{3}$, find $\sin(A+B)$	
	Kesalahan, x	Pembetulan,√
	$\sin(A+B)=\sin(A)+\sin(B)$ $=\sin\left(\frac{\pi}{6}\right)+\sin\left(\frac{\pi}{3}\right)$ $=\frac{1}{2}+\frac{\sqrt{3}}{2}$ $=1.366$	$\sin(A+B)$ $=\sin(A)\cos(B)+\cos(A)\sin(B)$ $=\sin\left(\frac{\pi}{6}\right)\cos\left(\frac{\pi}{3}\right)+\cos\left(\frac{\pi}{6}\right)\sin\left(\frac{\pi}{3}\right)$ $=\frac{1}{2}\left(\frac{1}{2}\right)+\frac{\sqrt{3}}{2}\left(\frac{1}{2}\right)$ $=0.683$

(e)

Keterangan	**Soalan**	
Miskonsepsi dalam 'cancelation/slashing' iaitu menggunapakai konsep algebra dalam penyelesaian trigonometri.	Contoh: Simplify the following $\frac{\cos(2x)}{\cos(x)}$	
	Kesalahan, x	Pembetulan,√
	$\frac{\cos(2x)}{\cos(x)}=\frac{\cos(x)}{1}$ $=\cos(x)$	$\frac{\cos(2x)}{\cos(x)}=\frac{\cos^2(x)-\sin^2(x)}{\cos(x)}$ $=\frac{\cos^2(x)}{\cos(x)}-\sin(x)\frac{\sin(x)}{\cos(x)}$ $=\cos(x)-\sin(x)\tan(x)$

(f)

-

Keterangan	**Soalan**	
Miskonsepsi berlaku apabila 'argument' atau 'input' pada fungsi trigonometri diabaikan.	Contoh: Simplify $\csc(x)\tan(x)$	
	Kesalahan, x	Pembetulan,√
	$\csc(x)\tan(x)$ $=\frac{1}{\sin}\frac{\sin}{\cos}$ $=\frac{1}{\cos}$ $=\sec$	$\csc(x)\tan(x)$ $=\frac{1}{\sin(x)}\frac{\sin(x)}{\cos(x)}$ $=\frac{1}{\cos(x)}$ $=\sec(x)$

(g)

Keterangan	**Soalan**	
Miskonsepsi dalam menentukan nilai fungsi trigometri dalam radian atau darjah.	Contoh: Evaluate $\sin 210^{o}$	
	Kesalahan, x	Pembetulan,√
	$\sin 210^{o} = -\sin(210^{o} - 180^{o})$ $= -\sin(30^{o})$ $= 0.98803$	$\sin 210^{o} = -\sin(210^{o} - 180^{o})$ $= -\sin(30^{o})$ $= -\frac{1}{2}$

(h)

<table>
<tr><th>Keterangan</th><th colspan="2">Soalan</th></tr>
<tr><td rowspan="3">Miskonsepsi dalam perwakilan simbol dalam fungsi trigonometri bagi penyelesaian persamaan trigonometri.</td><td colspan="2">Contoh:

Solve the following equation for t:
$\sin\left(\frac{\pi}{6}t\right)=0$ with $0 \le t \le 24$</td></tr>
<tr><td>Kesalahan, x</td><td>Pembetulan,√</td></tr>
<tr><td>$\sin\left(\frac{\pi}{6}\right)\sin t = 0$
$\frac{1}{2}\sin(t)=0$
$\sin(t)=0$, $t = k\pi$

for k an interger

$\therefore t = 0, \pi, 2\pi, 3\pi, 4\pi$</td><td>$\sin\left(\frac{\pi}{6}t\right)=0$
$\frac{\pi}{6}t = k\pi$
$t = 6k$, for k an interger

$\therefore t = 0,6,12,18,24$</td></tr>
</table>

(i)

Konsep matematik perlu diperkenalkan dengan pelbagai bentuk, kaedah dan pendekatan. Pelajar perlu diperkenalkan dengan pelbagai jenis contoh yang konkrit. Rober Gagne, menyatakan bahawa, pembelajaran konsep matematik yang berkesan memerlukan beberapa teknik penyampaian iaitu memberi pelbagai contoh konkrit untuk membuat generalisasi, memberi contoh yang berbeza tetapi berkaitan supaya dapat membuat perbezaan, memberi contoh-contoh yang tiada kaitan dengan konsep yang diajar untuk membuat perbezaan dan generalisasi dan memberi pelbagai jenis contoh matematik untuk memperoleh konsep matematik yang tepat. (Mohammad Redzuan 2014).

Berikut merupakan tip dalam memudahkan pembelajaran trigonometri

(1) Fahami konsep trigonometri itu sendiri. Kukuhkan pemahaman melalui pembuktian dan menerbitkan semula formula jika perlu. Hal ini memudahkan pelajar lebih mengingati bagaimana formula itu dihasilkan.

(2) Fahami formula yang dihafal. Formula yang dihafal pelajar perlu difahami konsepnya dan pembuktian wujudnya formula yang dihafal. Pelajar tahu mengapalikan penggunaan formula dalam soalan yang diberi.

(3) Wujudkan mnemonik sendiri yang mudah dihafal. Dalam mewujudkan mnemonik ini, pelajar masih perlu berpegang pada formula asal tanpa menukar apa-apa. Bagi mereka yang lebih suka menghafal, kaedah ini mungkin dapat membantu sedikit sebanyak dalam menghafal rumus.

(4) Banyakkan latihan dan latih tubi. Dengan memperbanyakkan latihan perkara itu sudah menjadi kebiasaan bagi memori dan otak kita supaya ianya menjadi ingatan jangka panjang. Hal ini juga dapat membiasakan pelajar dengan apa jua bentuk soalan yang diberi.

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Special Section (MAT435/MAT235): Common Errors in Mathematics

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This special section covers the errors that the students often make in doing algebra, and not just errors typically made in an algebra class. These mistakes, in fact, make by students at all level of studies. The earlier examples are the errors commonly done in a math class not limited to the calculus class.

Algebra Errors

Case 1. Division by Zero

☑ $\frac{0}{2} = 0$ ☒ $\frac{2}{0} = 0$ or $\frac{2}{0} = 2$

Division by zero is undefined! You simply cannot divide by zero so don't do it!

Case 2. Bad/lost/Assumed Parenthesis

Example 1. Square $3x$

☑ $(3x)^2 = (3)^2(x)^2 = 9x^2$ ☒ $3x^2$

Parenthesis are required in this case to make sure we square the whole thing, not just the x, so don't forget them!

Example 2. Square -4

☑ $(-4)^2 = (-4)(-4) = 16$ ☒ $-4^2 = -(4)(4) = -16$

Parenthesis are required in this case especially when you use the calculator.

<u>*Example 3*</u>. Subtract from $3x-5$ from x^2+2x-5

☑ $x^2+2x-5-(3x-5)=x^2-x$ ☒ $x^2+2x-5-3x-5=x^2-x-10$

<u>*Example 4.*</u> Convert $\sqrt{6x}$ to fractional exponents.

☑ $\sqrt{6x}=(6x)^{1/2}$ ☒ $\sqrt{6x}=6x^{1/2}$

<u>*Example 5*</u>. Evaluate $-3\int 6x-2dx$

☑ $-3\int 6x-2dx=-3(3x^2-2x)+c$
$=-9x^2+6x+c$

☒ $-3\int 6x-2dx=-3.3x^2-2x+c$
$=-9x^2-2x+c$

Case 3. Improper Distribution

<u>*Example 1*</u>. Multiply $3(3x^2-9)$

☑ $3(3x^2-9)=9x^2-27$ ☒ $3(3x^2-9)=9x^2-9$

Make sure that you distribute the 3 all the way through the parenthesis! Too often people just multiply the first term by the 3 and ignore the second term.

<u>*Example 2*</u>. Multiply $3(2x-5)^2$

☑ $3(2x-5)^2=3(4x^2-20x+25)$
$=12x^2-60x+125$

☒ $3(2x-5)^2=(6x-15)^2$
$=36x^2-180x+225$

Remember that exponentiation must be performed **BEFORE** you distribute any coefficients through the parenthesis!

Case 4. Additive Assumption

- $(x+y)^2 \neq x^2 + y^2$
- $\dfrac{1}{(x+y)} \neq \dfrac{1}{x} + \dfrac{1}{y}$
- $3(2x-5)^2$
- $(x+y)^2 \neq x^n + y^n$ for any integer $n \geq 2$
- $\sqrt{x^2 + y^2} \neq x + y$
- $\sqrt[n]{x+y} \neq \sqrt[n]{x} + \sqrt[n]{y}$ for any integer $n \geq 2$
- $\log \sqrt{x} \neq \sqrt{\log x}$

Case 5. Cancelling Errors

<u>*Example 1*</u>. Simplify $\dfrac{2x^4 - x}{x}$.

☑ $\dfrac{2x^4 - x}{x} = \dfrac{x(2x^3 - 1)}{x} = 2x^3 - 1$ ☒ $\dfrac{2x^4 - x}{x} = 2x^3 - x$ or $2x^4 - 1$

<u>*Example 2*</u>. Solve $4x^2 - x$.

☑
$$4x^2 - x = 0$$
$$x(4x-1) = 0$$
$$x = 0, \frac{1}{4}$$

☒
$$4x = 1$$
$$x = \frac{1}{4}$$

Often, many students get used to just cancelling (i.e. simplifying) things to make life easier. So, the biggest mistake in solving this kind of equation is to cancel an *x* from both sides to get $x = \frac{1}{4}$, while, there is another solution that we've missed, i.e. $x = 0$.

Case 6. Proper Use of Square Root

☑ $\sqrt{16} = 4$ ☒ $\sqrt{16} = \pm 4$

This misconception arises because they are also asked to solve things like $x^2 = 16$. Clearly the answer to this is $x = \pm 4$ and often they will solve by "taking the square root" of both sides. There is a missing step however. Here is the proper solution technique for this problem.

$$x^2 = 16$$
$$x = \pm\sqrt{16} \to x = \pm 4$$

Case 7. Ambiguous Fractions

<u>*Example 1*</u>. Writing 2/3*x* in a proper way.

When writing "/" to denote a fraction, it should be made clear, which fraction that this 2/3*x* represent? This can be either of the two following fractions :

$$\frac{2}{3}x \text{ or } \frac{2}{3x}$$

If you intend for the *x* to be in the denominator then write it as such that way, $\frac{2}{3x}$, *i.e.* make sure that you draw the fraction bar over the WHOLE denominator. If you don't intend for it to be in the denominator then don't leave any doubt! Write it as $\frac{2}{3}x$.

<u>*Example 2*</u>. Writing a + b/c + d in a proper way.

This fraction can be either of the two following fractions : $a + \frac{b}{c} + d$ or $\frac{a+b}{c+d}$

This is definitely NOT the original fraction. So, if you MUST use "/" to denote fractions use parenthesis to make it clear what is the numerator and what is the denominator. So, you should write it as $(a+b)/(c+d)$.

Trigonometric Errors

Case 1. Degree vs Radian

$$\sin(10) = 0.173648178 \quad \text{(in degree)}$$
$$\sin(10) = -0.54421111 \quad \text{(in radian)}$$

So, be careful and make sure that you always use radians when dealing with trigonometric functions. Make sure your calculator is set to calculations in radians.

Case 2. cos(x) is NOT multiplication

$$\cos(x + y) \neq \cos x + \cos y$$
$$\cos(3x) \neq 3\cos x$$

In general, this example uses cosine, but it also applies to any of the six trigonometric functions, so be careful!

Case 3. Power of trigonometric functions

Remember that if *n* is a positive integer then

☑ $\sin^n x = (\sin x)^n$ ☒ $\sin^n x \neq \sin x^n$

The same holds for all the other trig functions as well of course. Also remember to keep the following straight.

$$\sin^2 x \ \text{ vs } \ \sin x^2$$

In the first case, we are taking the sine then squaring the result and in the second we are squaring the *x* then taking the sine.

Case 4. Inverse trigonometry notation

$$\cos^{-1} x \neq \frac{1}{\cos x}$$

In trigonometry, the -1 in $\cos^{-1} x$ is NOT an exponent, it is to denote the fact that we are dealing with an inverse trigonometric function. There is another notation for inverse trig functions, however, not commonly used.

$$\cos^{-1} x = \arccos x$$

Calculus Errors

Case 1. Derivatives and Integrals of Products/Quotients

Recall that

$$(f \pm g)'(x) = f'(x) \pm g'(x) \text{ and } \int f(x) \pm g(x)\,dx = \int f(x)\,dx + \int g(x)\,dx$$

	Derivatives	**Integrals**
Product	$(fg)'(x) \neq f'(x).g'(x)$	$\int f(x)g(x)\,dx \neq \int f(x)\,dx \int g(x)\,dx$
Quotient	$\left(\frac{f}{g}\right)'(x) \neq \frac{f'(x)}{g'(x)}$	$\int \frac{f(x)}{g(x)}\,dx \neq \frac{\int f(x)}{\int g(x)}$

Case 2. Proper use of the formula for $\int x^n\,dx$

Many students forget that there is a restriction on this integration formula, so for the record here is the formula along with the restriction.

$$\int x^n\,dx = \frac{x^{n+1}}{n+1} + c \text{ provided } n \neq -1.$$

Case 3. Dropping the absolute value when integrating $\int \frac{1}{x} dx$ **.**

The formula for $\int \frac{1}{x} dx = \ln|x| + c$, the absolute value bars on the argument are required! It is certainly true that on occasion they can be dropped after the integration is done, but they are required in most cases. For instance, contrast the two integrals,

$$\int \frac{2x}{x^2+10} dx = \ln|x^2+10| + c = \ln(x^2+10) + c$$

$$\int \frac{2x}{x^2-10} dx = \ln|x^2-10| + c$$

In the first case the x^2 is positive and adding 10 will not change the positive value since $x^2+10>0$, so, we can drop the absolute value bars. In the second case however, since we don't know what the value of *x* is, there is no way to know the sign of x^2-10 and so the absolute value bars are required.

Case 4. Improper use of the formula $\int \frac{1}{x} dx = \ln|x| + c$

In this case, students seem to make the mistake of assuming that if $\frac{1}{x}$ integrates to $\ln|x|$ then so must one over anything! The following table gives some examples of incorrect uses of this formula.

Integral	☒	☑
$\int \frac{1}{x^2+1} dx$	$\ln(x^2+1)+c$	$\tan^{-1} x + c$
$\int \frac{1}{x^2} dx$	$\ln(x^2)+c$	$-x^{-1}+c = -\frac{1}{x}+c$
$\int \frac{1}{\cos x} dx$	$\ln\|\cos x\|+c$	$\ln\|\sec x + \tan x\|+c$

So, be careful when attempting to use this formula. This formula can only be used when the integral is of the form $\int \frac{1}{x} dx$.

Case 5. Improper use of Integration formulas in general

This one is really the same issue as the previous one, but so many students have trouble with logarithms. For example, the general formula is:

$$\int \sqrt{u}\, du = \frac{2}{3} u^{3/2} + c \text{ or } \int u^2\, du = \frac{u^3}{3} + c$$

The mistake here is to assume that if these are true then the following must also be true.

$$\int \sqrt{\text{anything}}\, du = \frac{2}{3}\left(\sqrt{\text{anything}}\right)^{3/2} + c \;\text{ or }\; \int (\text{anything})^2\, du = \frac{1}{3}(\text{anything})^3 + c$$

This just isn't true! The first set of formulas work because it is the square root of a single variable or a single variable squared. Here's another table with a couple of examples of these formulas not being used correctly.

Integral	☒	☑
$\int \sqrt{x^2+1}\, dx$	$\frac{2}{3}\left(x^2+1\right)^{3/2} + c$	$\frac{1}{2}\left(x\sqrt{x^2+1} + \ln\left\lvert x + \sqrt{x^2+1} \right\rvert \right) + c$
$\int \cos^2 x\, dx$	$\frac{1}{3}\cos^3 x + c$	$\frac{x}{2} + \frac{1}{4}\sin(2x) + c$

Case 6. Dropping limit notation

Students tend to get lazy and start dropping limit notation after the first step. For example, an incorrectly worked problem is

☒	☑
$\lim\limits_{x \to 3} \frac{x^2-9}{x-3} = \frac{(x-3)(x+3)}{x-3} = x+3 = 6$	$\lim\limits_{x \to 3} \frac{x^2-9}{x-3} = \lim\limits_{x \to 3} \frac{(x-3)(x+3)}{x-3} = \lim\limits_{x \to 3} (x+3) = 6$

In the wrong (☒) section, the following mistake is listed :

Mistakes #1: $\lim\limits_{x\to 3}\frac{x^2-9}{x-3}=\frac{(x-3)(x+3)}{x-3}$.

You're saying that the value of the limit is $\frac{(x-3)(x+3)}{x-3}$ and this is clearly not the case.

Mistakes #2: $x+3=6$

You are making the claim that each side is the same, but this is only true provided $x = 3$ and what you really are trying to say is $\lim\limits_{x\to 3} x+3=6$.

Case 7. Improper derivative notation

Often time, the differentiation of $f(x)=x(x^3-2)$ is written as

$$f(x)=x(x^3-2)=x^4-2x=4x^3-2$$

The proper notation should be written as $f'(x)=...$

$$f(x)=x(x^3-2)=x^4-2x$$
$$f'(x)=4x^3-2$$

Case 8. Loss of integration notation

<u>*Example 1*</u>.

There are many dropped notation errors that occur with integrals. One of the examples is: $\int x(3x-2)\,dx=3x^2-2x=x^3-x^2+c$

The proper notation should be written as $\int x(3x-2)\,dx=\int\left(3x^2-2x\right)dx=x^3-x^2+c$

<u>*Example 2*</u>.

Another big problem in dropped notation is students dropping the *dx* at the end of the integrals. For instance, $\int x(3x-2)\,dx$.

<u>*Example 3*</u>.

Another dropped notation error that is also common is with the definite integrals. Students tend to drop the limits of integration after the first step and do the rest of the problem with implied limits of integration as follows :

☒ $\int_1^2 x(3x-2)\,dx = \int (3x^2-2x)\,dx = x^3 - x^2 = 8-4-(1-1) = 4$

☑ $\int_1^2 x(3x-2)\,dx = \int_1^2 (3x^2-2x)\,dx = \left(x^3 - x^2\right)\Big|_1^2 = 8-4-(1-1) = 4$

Case 9. Dropped constant of integration

Dropping the constant of integration on indefinite integrals (the + *c* part) is one of the biggest errors that students make in integration. There are actually two errors here that students make. Some students just don't put it in at all, and others drop it from intermediate steps and then just tack it onto the final answer.

Case 10. Misconceptions about $\frac{1}{0}$ and $\frac{1}{\infty}$.

This is not so much about an actual error that students make, but instead a misconception that can, on occasion, lead to errors. This is also a misconception that is often encouraged by laziness on the part of the instructor.

Often, we will write $\frac{1}{0} = \infty$ and $\frac{1}{\infty} = 0$. The problem is that neither of these are technically correct and in fact the second, depending on the situation, can actually be $\frac{1}{0} = -\infty$. All three of these are really limits and we just short hand them. What we really should write are $\lim_{x\to\infty} \frac{1}{x} = 0$; $\lim_{x\to 0^+} \frac{1}{x} = \infty$ and $\lim_{x\to 0^-} \frac{1}{x} = -\infty$.

In the first case 1 over something increasingly large is increasingly small and so in the limit we get zero. In the last two cases note that we've got to use one-sided limits as $\lim_{x\to 0}\frac{1}{x}$ doesn't even exist! In these two cases, 1 over something increasingly small is increasingly large and will have the sign of the denominator and so in the limit it goes to either ∞ or $-\infty$.

Case 11. Indeterminate forms

This is actually a generalization of the previous topic. The two operations above, $\infty-\infty$ and $\lim_{x\to 0^-}\frac{1}{x}=-\infty$ are called indeterminate forms because there is no one single value for them. Depending on the situation they have a very wide range of possible answers. There are many more indeterminate forms that you need to look out for. As with the previous discussion there is no way to determine their value without taking the situation into consideration. Here are a few of the more common indeterminate forms.

$$\infty-\infty \qquad \frac{\infty}{\infty} \quad \frac{0}{0} \quad 0.\infty \quad 0^0 \quad 1^\infty \quad \infty^0$$

Let's just take a brief look at 0^0 to see the potential problems. Here we really have two separate rules that are at odds with each other. Typically, we have $0^n=0$ (provided n is positive) and $a^0=1$. Each of these rules implies that we could get different answers. Depending on the situation we could get either 0 or 1 as an answer here. In fact, it's also possible to get something totally different from 0 or 1 as an answer here as well. All the others listed here have similar problems. So, when dealing with indeterminate forms you need to be careful and not jump to conclusions about the value.

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The Use of Statistics in Engineering and Food Industry

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Introduction

Statistics is an important tool for robustness analysis, measurement system error analysis, test data analysis and it is extremely important in our daily life. In this article we will discuss some examples of the importance of statistics in engineering and food industry as these are the two main programs available in UiTM Permatang Pauh.

Statistics in Engineering

An engineer is someone who solves problems of interest in society by either refining an existing product or design a new product that meets customers' needs. The steps to accomplish this are as shown in figure 1.

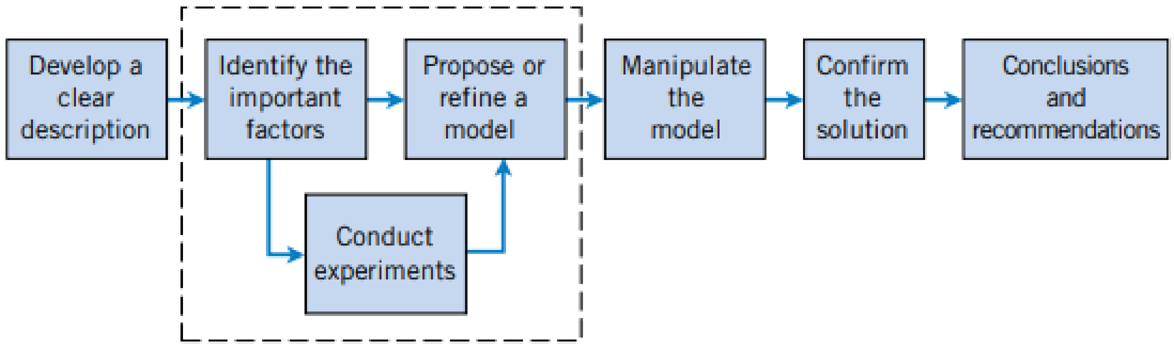

Figure 1: The engineering method

Knowledge of statistics is important to engineers because some statistical techniques can be a powerful aid in designing new products and systems, improving existing designs, developing new design and improving production processes. Some of the most important statistics applications in the field of engineering are Probability Application, Experimental Design, Hypothesis Testing, Quality Control and Regression Analysis

Probability Application

The study of probability is very important to engineers as it can helps them to examine how likely events could happen so the risk could be determined and solve professionally. Another significant application of probability theory in everyday life is reliability. Many consumer products such as automobiles and consumer electronics use reliability theory to reduce the probability of failure in product design.

Experimental Design

The design of experiments (DoE) methodology is a tool that has been applied for years in industry for process performance and product quality improvement such as for solar technologies. In this example DOE such as two-way analysis of variance is applied on injection-molding process with the aim of improving product quality such as excessive flash. Factors considered as affecting for flash formation are: pack pressure , pack time , injection speed, and screw RPM,while clamping pressure, injection pressure and melting temperature were under control. Each factor affecting flash formation is considered at low and high levels.

Table1: Factors contributing to flash formation

Factors	**Low**	**High**
pack pressure	10	30
pack time	1	5
injection speed	12	50
screw RPM	100	200

(Source: Benjamin Durakovic,2017)

Hypothesis Testing

The decision an engineer takes regarding which factor to change or what are the variables that need to experimented are made using statistical hypothesis testing. Both parametric test (t-test and z-test) and nonparametric test (sign test and Wilcoxon rank-sum test) are appropriate for use in a manufacturing environment. The parametric is used when the sample is taken from a population with a Normal distribution whereas the nonparametric test does not require the population to conform to a normal distribution. For example, a voltage measurement will always measure as 5 volts under ideal conditions. A hypothesis testing can be used to help an engineer decide whether the same measurement in a high humidity environment will significantly affect the measurement average.

Quality Control

In modern manufacturing plants, engineering quality control is use to ensure that a product's quality meets a specified standard and that rejection rates are minimised. For instance in producing a resistor to a specified value, the process will invariably produce a range of values and those that are closer to the nominal specification will have a higher sale price. The Shewhart's statistical process control model can be used in distinguishing assignable cause variation from common cause variation. In the case of monitoring vibration levels in steam turbines, statistical models are used to set alarms which detect changes in vibration above normal values. The alarms highlight that something is changing and allow action to be taken before a major failure takes place, or the machine has to be taken out of service for investigation, thus avoiding major loss of revenue.

Regression Analysis

Regression analysis is a statistical process for estimating the relationships among variables. It includes many techniques for modelling and analyzing several variables and the focus is on the relationship between a dependent variable and one or more independent variables. For example, an engineer in aquaculture development might be interested to see the relation between the dissolve oxygen and the depth of water in a pool. Dissolved oxygen is necessary to many forms of life including fish, invertebrates, bacteria and plants. Therefore the result will help the engineer in planning the size and location of the pool and the suitable aquatic life for the pool.

Statistics in Food Industry

Basic statistical concepts such as population size, sample size, sample space, variance, distribution, standard deviation, T-tests, hypothesis and so on are much needed in food technology to provide safe and quality food for consumers and people. There are many applications of statistics in the field of food technology and some are as mentioned in table 1.

Table 1. Application of statistics in the food technology.

Method	Year
Summaries of results	Tables, graphs and descriptive statistics and instrumental, sensory and consumer measures of food characteristics
Analysis of difference and relationships	Research and applications on differences in food properties due to processing and storage, correlation studies of instrumental and sensory properties
Monitoring of results	Statistical control of food quality and parameters such as net filled weight
Measurement system integrity	Uncertainty of estimates for pesticides and additives levels in food
Experimental design	Development and applications of balanced order designs in sensory research

(Ellendersen et al,2012)

The process of producing new product have many stages which are developing innovation strategy, understanding consumers, formulation development, instrument measurement, sensory test and food product processing. It is essential to identify a formula that will optimized the levels of ingredients for sensory acceptability with minimum cost

Food sensory is the analysis that used human senses to analyse foods in term of taste, flavour and texture. Some important statistical analysis in food sensory are such as hypothesis testing and Analysis of variance. Using an efficient experiment design can save a lot of time and helps in achieving the best results.

Analysis of Variance

Analysis of variance is the most common statistical test performed in descriptive analysis and other sensory tests where more than two products are compared using scaled responses. It provides a very sensitive tool for seeing whether treatment variables such as changes in ingredients, processes, or packaging had an effect on the sensory properties of products. As in the story above, it is a method for finding variation that can be attributed to some specific cause, against the background of existing variation due to other causes. Depending on the number of factors to be analysed. We can have:

- *A one-way ANOVA* in which only one factor is assessed. For example, five samples of apple are analyzed for its' catechin content. Other example is the investigation on the rheological behaviour of honeys from Spain under different temperatures (25 °C, 30 °C, 35 °C, 40 °C, 45 °C, and 50 °C)
- *The 2-way ANOVA* determines the differences and possible interactions when response variables are from two or more can be employed in sensory evaluation when both panelists and samples are sources of variation(Granato, Ribeiro, & Masson, 2012) or when the consistency of the panelists needs to be assessed.
- *A factorial ANOVA* for n factors, that analyzes the main and the interaction effects is the most usual approach for many experiments, such as in a descriptive sensory or microbiological evaluation of foods and beverages (Ellendersen, Granato, Guergoletto, & Wosiacki, 2012; Jarvis, 2008; Mon & Li-Chan, 2007). For example, two sweeteners, sucrose and high-fructose corn syrup (HFCS), being blended in a food (say, a breakfast cereal), and we would like to understand the impact of each on the sweetness of the product. Each sweetener is added to the product in 3 levels (2%, 4%, and 6% of each) and four individuals panel are selected to rate the product for its sweetness. Using the factorial design we will be able to know whether these levels of sucrose had any effect, whether the levels of HCFS had any effect and whether there is an interaction between the two sweeteners.

- *A repeated-measures (RM) ANOVA* has been used to examine results from assessments of different instrumental color attributes for a mixture of juices from yacón (Peruvian ground apple) tubers and yellow passion conditions

Regression and Correlation

Sensory scientists are frequently faced with the situation where they need to know whether there is a significant association between two sets of data. For example, the sensory specialist wants to know if the perceived brown-color intensity (dependent variable) of a series of cocoa powder-icing sugar mixtures increased as the amount of cocoa (independent variable) in the mixture increased. In another example, the sensory scientist wants to know if the perceived sweetness of grape juice (dependent variable) is related to the total concentration of fructose and glucose (independent variable) in the juice, as determined by high-pressure liquid chromatography.

Conclusion

Statistics are an important part of our lives. The role of statistics in engineering and food industry is indispensable. Starting from designing a product, making a finished one and making it work, at every step an engineer and food practitioner needs help of statistics in some form or other to get the best solution.

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Sepuluh Langkah Mudah Menghasilkan Carta Alir Dengan Aplikasi Draw.io

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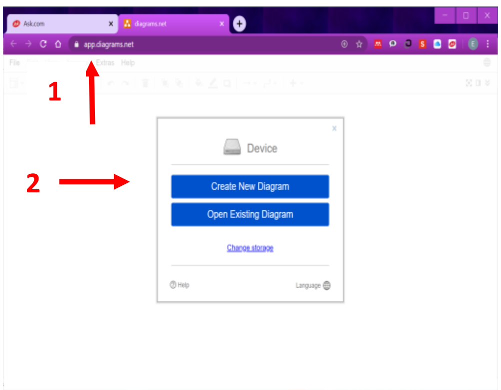
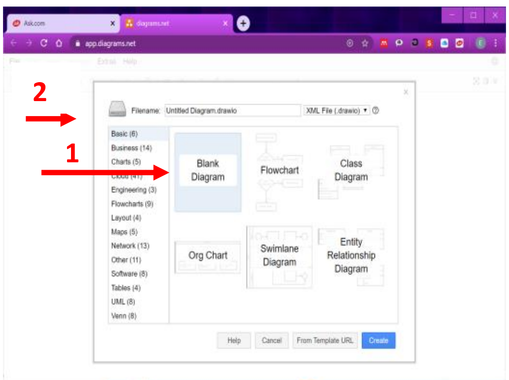
Carta alir adalah sejenis rajah yang mewakili suatu algoritma atau proses di mana ia ditunjukkan dalam pelbagai jenis kotak dan susunannya dihubungkan dengan anak panah.(wikipedia, 2020.). Gambaran rajah dapat membantu dalam menyelesaikan masalah yang timbul secara langkah demi langkah. Operasi proses diwakili dalam bentuk kotak dan anak panah yang menghubungkannya pula mewakili aliran kawalan data. Carta aliran telah digunakan dalam menganalisis, merekabentuk, mendokumentasi atau menguruskan proses atau program dalam pelbagai bidang (SEVOCAB, 2020). Berikut adalah sepuluh langkah mudah untuk menghasilkan carta alir mengunnakan aplikasi *drawio* yang berasaskan web.

Langkah Pertama



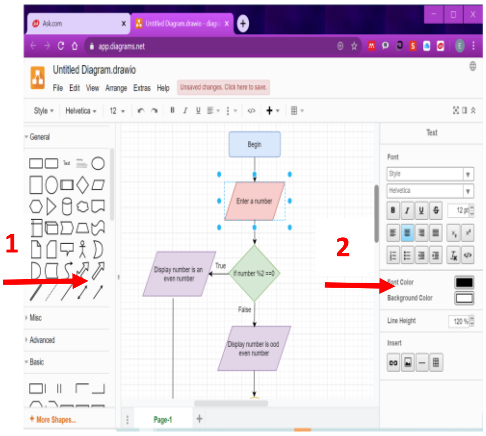
1. Pergi ke halaman https://app.diagrams.net/
2. Klik *Create New Diagram.*

Langkah Kedua



1. Pilih *Blank Diagram.*
2. Namakan fail dengan nama yang bersesuaian.

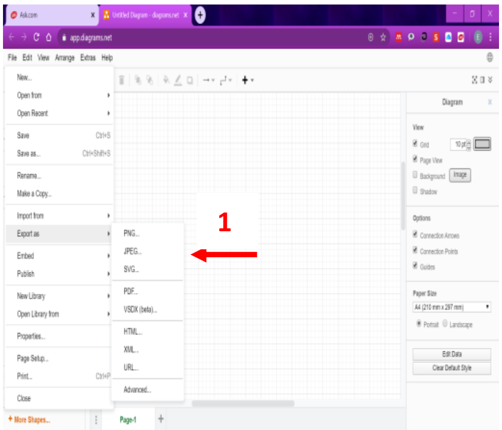
Langkah Ketiga



1. Mula menghasilkan carta alir dengan memilih panel simbol yang disediakan dengan kaedah *drag and drop.*

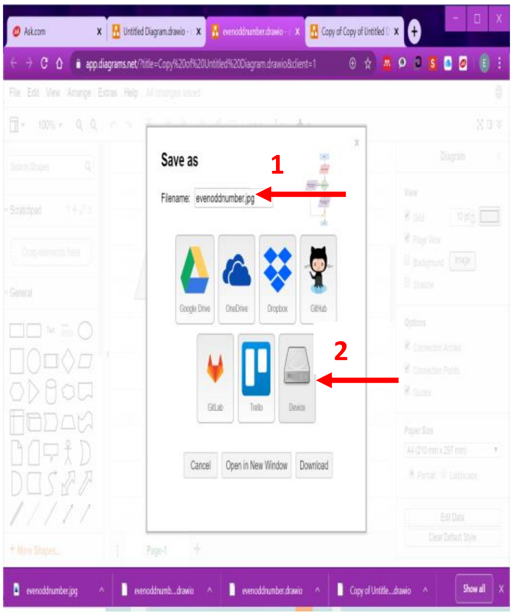
2. Pilihan tulisan dan warna yang dikehendaki pada panel sebelah kanan.

Langkah Keempat



1. Pilih menu *File->Export as->JPEG* atau format imej yang lain untuk menyimpan carta alir yang telah dihasilkan.

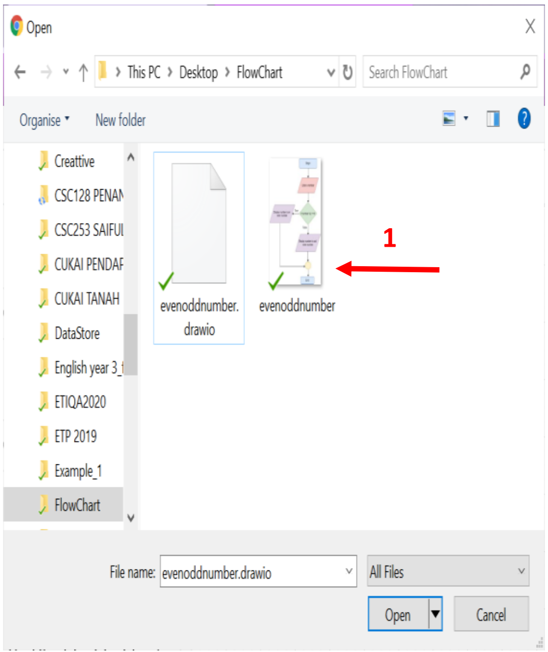
Langkah Kelima



1. Beri nama fail yang bersesuaian.

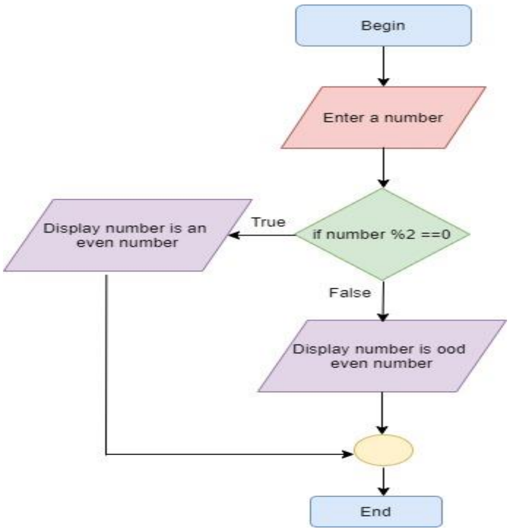
2. Pilih *Device* sebagai platfom untuk storan carta alir.

Langkah Keenam



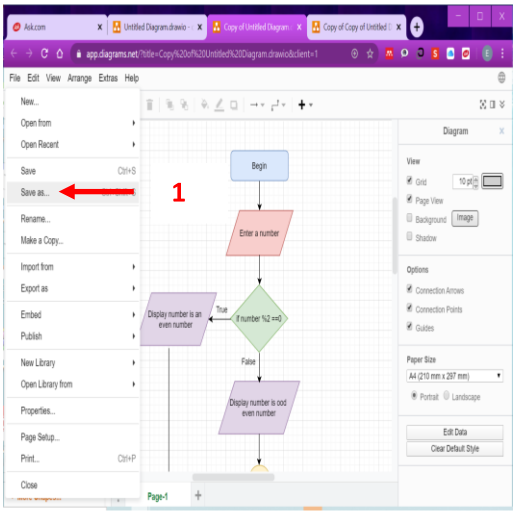
1. Pilih carta alir yang telah disimpan dalam format JPEG, *copy* dan *paste* pada aplikasi yang mengandungi laporan yang hendak dibuat seperti Word.

Langkah Ketujuh



1. Carta alir yang terhasil.

Langkah Kelapan



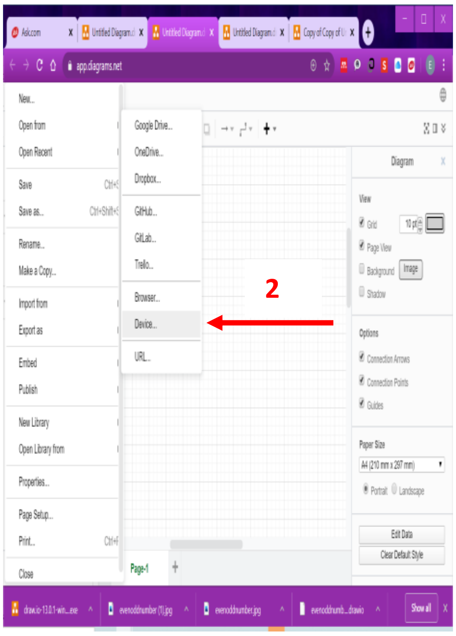
1. Pilih menu *File->Save as* untuk menyimpan carta alir yang dihasikan.

Langkah Kesembilan

1. Beri nama fail yang bersesuaian. dan akan disimpan dalam format *.drawio*

2. Pilih *Device* sebagai platfom untuk storan carta alir.

Langkah Kesepuluh



1. Jika hendak mengemas kini carta alir yang dihasilkan pilih *File-> Open from -> Device* dan pilih fail yang dikehendaki dalam format *.drawio*

2. Sila ulang Langkah Ketiga sehingga carta alir terhasil seperti yang anda kehendaki.

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drawio Application.2020. Atas talian. https://app.diagrams.net/

What if Mathematics is Learned using ODL in Hogwarts?

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1.0 Introduction

Mathematics is always great and fun as pictured in Hidden Figure movie, with excellent understanding the applications are enormous. It even gave impacts on space travel and its role crafted in modern history. However, when the theories and concepts are misunderstood, it changed to Nightmare on the Elm Street. Leading the students to take it or leave it.

In learning mathematics, teacher plays an important role to deliver the content in the most understandable and creative ways of teaching to gasp the students' attention (Preciado-Babb, Metz, Sabbaghan, & Davis, 2018). Many methods of teaching have been implemented that suited the teachers' and students' preferences (Sankar & Karri, 2016; Khoshaim & Subhi-Aiad, 2018). Even in the current situation of Covid-19 pandemic that lead to Movement Control Order (MCO) by the government, the learning must continue. Students stay safe at home, and teachers continue to deliver the courses.

One of the methods used is Online and Distance Learning (ODL) using learning management system (LMS). From the views of us as mathematics teachers, here are some tips for the teachers and the students in learning mathematics through ODL. In order to make it interesting, we used *Harry Potter* movie as the narrative of the situation and tips in commencing ODL with the students.

2.0 Tips for ODL: The story begins

Can you imagine teaching mathematics in Hogwarts using ODL? For some reason, the students in Hogwarts need to stay home because of the rage of the Death Eaters. Albus Dumbledore urge all the professors (teachers) to continue teaching despite the situation. Due to that, we started to google the internet to find the best methods that going to suit our teaching preference. We also asked the students which platform do they comfortable with.

2.1 The wand.

Every sorceress must have their own wand and the wand will always choose their owner. It is a magical object and its role is to channel the magical powers. But with ODL, our *wands* have changed. We need gadgets as smart phones, computers, laptops, tablets, digital writing pad or pen tablets with variety of brands to choose from as our magical object.

Smart phone is good enough for students, if it can play videos and can download required apps needed. But with additional gadget such as laptop or computer, it could be an advantage as they don’t have to rely on only one gadget. However, make sure your *wands* have enough space and data to view all the videos. Learning mathematics through video usually require you to watch the video repeatedly in order to understand the solutions.

Mathematics is a subject that require long list of solution and it is important to ensure students understand each step. Therefore, most teachers will seek gadgets that can enable them to scribble while teaching online. The different is, we are the one who gets to choose our *wands* because each of us do have different preference and depends on owns financial budget. Well, we are not necessarily having to buy expensive and branded gadgets, even a smartphone and a pen can still be good enough to develop our teaching videos. It’s not that we can wave our *wands* with *Wingardium Leviosa!* and suddenly our teaching materials are completed. All we need are good planning and some creativities in preparing materials in ODL (Hussin, 2018). If the students can view our video and understand the contents, at least half of the learning is achieved. At the end of the day, that is the use of our *wands*, to deliver magics!

Students’ tips: Be clear with your teachers’ chosen LMS and learn to use it. Download any apps that required to be used during ODL. Different teacher, may use different platform, so please make a list for all courses and their teaching platforms.

Teachers' tips: List out your preferable gadgets based on your own budget. Make sure it fits with your type of LMS chosen and get comfortable in using it. Clearly inform the student of our teaching method to avoid confusion, besides they also have other courses too.

2.2 The class.

Handling the class is challenging in ODL as the way of learning is without being face-to-face with the students. Teachers have many options in communication technology that can replaced conventional way of teaching (Stosic, 2015). Most common platform of online meeting are Google Meet or Zoom where teachers are allowed to make video conferencing with their students from wherever they are (Platin J-C, 2018**)**. We don't have to throw *Floo Powder in a fire connected to the Floo Network* anymore to meet the students, just share the link with our *wands* and there you are, a virtual class full of our students.

However, teachers must organize and inform the students the date and time of your future meeting earlier (Wang & Chen, 2011). Always discuss with the students the most convenient time to do the meeting. Plan the content of your meeting so it won't take longer time in your meeting.

Either the students are from *Slytherin*, *Gryffindor*, *Ravenclaw* or *Hufflepuff*, they all need to attend ODL class. And students please, don't wear your *invisible cloak* during the class. We need to make sure that we don't talk alone like talking to a brick wall. At least show your face and nod when asked. Sometime teachers just missed their students.

Students' tips: Make schedule of all your course classes. Please inform your teachers if there is any clash of time. Be prepare for your class and give responses if asked by the teachers. Do not stay anonymous as this will make the teachers anguish.

Teachers' tips: Plan and organise the time and content wisely. Students' time and internet data are also valuable.

2.3 Quidditch game.

Mathematical exercises are like playing *Quidditch game*. Students need to work hard, practice and make efforts in doing all the questions in the tutorials. Like in the game, you only scored when you throw the *quaffle* into the hoops, as like you only get marks when your answers are correct. Teachers can guide the students through videos and supplementary materials given to them (Barlow & Lane, 2007). Open the opportunities for them to asked questions. We as teachers need to understand that this is also a new norm for the students. Like us, they may also struggle to the new study habits, just like balancing and flying on the *magic broom*. Consistently guide the students and give motivation to them. This may lighten their spirit in the *game*.

However, players need to be aware not to be hit by the opposing *bludger*, means, do not get caught in misconception in mathematics if not you will lose the marks. Always refer to your teacher and friends on your solutions. The most important thing is practice, practice and practice! The game only ends when the *golden snitch* has been caught, just like final exam. Maybe you are the lucky one who can catch the *snitch*.

Students' tips: Practice make perfects. Do your tutorials and cross check with your friends. Ask questions whenever you have problem in the solutions. Do not give up the questions. Perhaps the similar question will appear in the final exam. Remember, there is no magic in success.

Teachers' tips: Continuously encourage students to do mathematics questions in tutorials. Always ready to answer their queries and give adequate number of examples to improve their understanding.

3.0 Conclusion

During this COVID-19 pandemic, teachers play a crucial role to make sure the learning process continues without disruption. Teachers try to explore various tools in preparation for the lesson materials and various platforms to deliver the lessons in the most effective ways. For teaching mathematics via online class, teachers should choose teaching methods that suit best their teaching, what with to keep students able to grasp the mathematical concepts and able to solve the related mathematical problems. Students should also play an important role in adopting this new learning process so that in the end the lesson outcomes can be achieved.

There is neither special potion nor spell for you to success in mathematics especially during this semester. Always think positive. Dumbledore once said in Harry Potter & the

Prisoner of Azkaban, "*Happiness can be found even in the darkest of times, if one only remembers to turn on the light*." Therefore, don't stay in the dark.

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