

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 $(-3)^2$.

([-] 3 [)] [^] 2 [=]

Remark: [-] 3 [^] 2 means $-3^2 = -(3 \times 3) = -9$

ii) To evaluate numbers involving fractions:

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

[2] [a b/c] [(] [-] 5 [a b/c] 4 [)] [=]

or [2] [÷] [(] [-] 5 [÷] 4 [)] [=]

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

(2 a b/c 5) a b/c 4 =

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

(2 a b/c 3) ^ 4 =

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

(5 ^ (3 a b/c 2) - 4 a b/c 5) ^ 7 =

(b) The Trigonometric Functions

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

MODE MODE MODE MODE

Choose for degree mode or for radian mode.

ii) *To evaluate a trigonometric value:*

If there is no degree symbol, i.e. ($^{\circ}$), we assume that the value is measured in radian mode.

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

sin 3 =

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

5 cos (2 SHIFT π ÷ 3) =

or 5 cos 2 SHIFT π a b/c 3 =

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

sin (SHIFT π a b/c 4 + 2 SHIFT π a b/c 3) =

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

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

sin (SHIFT π a b/c 4) + 2 SHIFT π a b/c 3 =

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

(cos SHIFT π a b/c 4) ^ 3 =

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 $e^{(5/6 + \pi)}$.

SHIFT e^x (5 a b/c 6 + SHIFT π) =

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

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

References:

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