



Family name: _____

Given name(s): _____

Student ID number: _____

August Main 2020 Mathematics 1

COVER PAGE

Assignment 1 (8%)

Due Date and Time: Monday 19th October, 5:30pm AEDT

Assignment Overview

This assignment contains three questions from the topic of **Logarithms**. You are required to answer each question in the assignment. You will be marked on the correctness of your responses, your working and the quality of your mathematical communication (as described in the Mathematics 1 Assignment Guide for Students available on the TCOLE page).

Assignment Instructions

Format: Your assignment must be submitted as a single portable document format (.pdf) file of no more than 10 pages in length and 10MB in size. Pictures, graphs, etc. must be included in the same file as your assignment responses. Your responses may be typed or handwritten in either pen or pencil. Check that your file opens properly on your device; if you cannot open your .pdf file on your device your marker will also be unable to open it.

Submission: Include this cover page in your submission (it does not count towards the page limit). You must submit your assignment via Gradescope. Please write your name and student number on each page of your submission. You must only submit responses to the assignment version you have been allocated on TCOLE. Submitting the wrong version will incur a marks penalty of 10%.

Late Submission: Late submissions will receive a marks penalty of 10% per day past the due date. Assignments will not be accepted more than four days past the due date.

Academic integrity: This assignment must be completed in accordance with the TCFS Academic Integrity Policy.

Examiners Only		
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Assignment 1

LOGARITHMS

Version 2

1. Show full working for the following questions.

(a) Solve the following equation for $x \in \mathbb{R}$

$$\log_7(x - 3) + \log_7(x + 3) = 1$$

(b) Rewrite the following equation as an expression of y in terms of x

$$\log_2 y - 3 \log_2(2x + 3) = 3$$

(c) Simplify the following equation so that z is expressed as a single integer

$$z = \log_3(9) + \frac{1}{2} \log_3(36) - \log_3(2)$$

[3 + 3 + 2 = 8 marks]

Solutions to Question 2 parts (a), (c) and (d) must be displayed on the same Desmos graph. A screen shot of the graph (including the sidebar with the formulas) should be submitted as part of your answer. Label the axes and any intercepts. The viewing window required is $-0.2 \leq x \leq 1.25$ and $-2 \leq y \leq 18$.

2. Consider the following table of values for a log-log graph.

$\log_{10}(x)$	0	0.30103	0.4771213	0.60206	0.69897	0.7781513	0.845098
$\log_{10}(y)$	2	2.903090	3.431364	3.806180	4.096910	4.334454	4.535294

(a) Using Desmos create a table with the $(\log_{10}(x), \log_{10}(y))$ coordinates and plot these points.

(b) Assuming an equation of the form $y = 10^b x^m$, where m and b are real constants, prove that

$$\log_{10}(y) = m \log_{10}(x) + b.$$

(c) From the table, calculate the values of m and b and then plot the line $\log_{10}(y) = m \log_{10}(x) + b$ using Desmos. Show your working and label the y -intercept.

- (d) Write down the equation $y = 10^b x^m$ with the values you found in part (c) and plot the graph using Desmos.
- (e) Briefly comment (in one or two sentences) on why a log–log graph might be preferable to a graph of the form $y = 10^b x^m$.

[2 + 1 + 3 + 2 + 1 = 9 marks]

Solutions to Question 3 parts (a), (b) and (d) must be displayed on the same Desmos graph. A screen shot of the graph (including the sidebar with the formulas) should be submitted as part of your answer. Label the axes and any intercepts. The viewing window required is $-2 \leq x \leq 57$ and $-4 \leq y \leq 102$.

3. Some analysts have suggested that the number of active users of Facebook has grown exponentially since its initial launch from a Harvard dorm room in February 2004. We want to investigate the validity of this claim by using an exponential model of the form $y = ae^{kx}$. However, we only have limited data. We will use a linear function of the form $\ln(y) = mx + c$ to help us find the values of a and k . In this question a , k , m and c are real constants.

The table below has the approximate numbers of active users A , in millions, x months after the launch. For example, the first entry means there were 2 million active users in December 2004.

Month x	Active Users in Millions A
10	2
22	5.6
34	13
38	23
44	48
54	99

- (a) Use Desmos to create a table with 3 columns and enter the values for x , A and $\ln(A)$ using the data from the table above. Plot the (x, A) and $(x, \ln(A))$ coordinates on the same Desmos graph.
- (b) Use Desmos to find and a line of best fit¹ for the $(x, \ln(A))$ coordinates and plot using Desmos for $x \geq 0$.

¹A linear equation of the form $y = mx + c$ that best represents the data points.

- (c) Write down the values of m and c found in part (b) to 6 decimal places.
- (d) Use the values of m and c to find the approximate values of a and k for the exponential model $y = ae^{kx}$ to 6 decimal places. Show your working and plot this equation using Desmos for $x \geq 0$.
- (e) Using the exponential model found in part (d), predict the number of active facebook users 10 years after the initial launch of Facebook.
- (f) Comment (in one or two sentences) on whether this is a reliable model to use to predict the number of Facebook users in the year 2019.

[2 + 2 + 2 + 3 + 2 + 2 = 13 marks]

END OF ASSIGNMENT.