TRINITY COLLEGE

Year 12 Methods Units 3/4
Test 4 2018

Section 1 Calculator Free

Logarithmic Functions

STUDENT'S NAME _____

DATE: Thursday 19th July **TIME:** 30 minutes **MARKS**: 29

INSTRUCTIONS:
Standard Items: Pens, pencils, drawing templates, eraser, Formula sheet.

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

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1. (8 marks)

Differentiate the following with respect to x

(a) $\ln(2+4x+x^3)$ [2]

(b) $\ln\left(\frac{1}{(e^x+2x)^3}\right)$ [3]

(c) $\log_3(x^2-2x^3)$ [3]

2. (4 marks)

Determine the exact value of the gradient of the function $f(x) = \ln \dfrac{1+e^x}{1-e^x}$ when $x = \ln 2$.

3. (5 marks)

Determine

(a) $\displaystyle\int \frac{-4x^2}{2x^3-5}\,dx$ [2]

(b) $\displaystyle\int \tan(1-2x)\,dx$ [3]

4. (5 marks)

Determine the exact area enclosed between $f(x) = x^2$ and $g(x) = 6 - \frac{6}{x+1}$ in the first quadrant.

5. (4 marks)

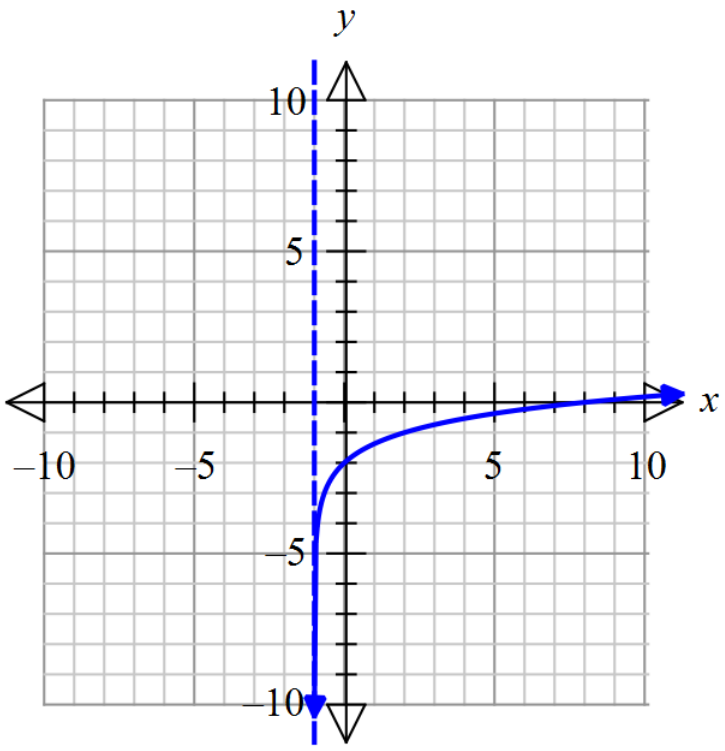
Given $\log_2 3 = a$ and $\log_2 5 = b$, determine in terms of a and b

(a) $\log_2 75$ [2]

(b) $\log_2 2.5$ [2]

6. (2 marks)

Determine the equation of the function shown below.



TRINITY COLLEGE

Year 12 Methods Units 3/4
Test 4 2018

Section 2 Calculator Assumed

Logarithmic Functions

STUDENT'S NAME _____

DATE: Thursday 19th July **TIME:** 15 minutes **MARKS**: 14

INSTRUCTIONS:

Standard Items: Pens, pencils, drawing templates, eraser.
Special Items: Up to three (3) approved calculators. One side A4 page of notes.

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

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7. (3 marks)

A scale used to measure the intensity of earthquakes is known as the Richter Scale. The Richter scale is defined by the formula $R = \log\left(\frac{A}{A_0}\right)$ where A is the measure of the amplitude/intensity of the earthquake wave and A_0 is the amplitude/intensity of a standard wave.

A recent earthquake measured 6.8 on the Richter scale. How many times more intense was this earthquake than an earthquake that measured 4.3 on the Richter scale?

8. (7 marks)

Luigi's farm currently produces 10.1 tonnes of barley annually. Over an extended period of drought, he has found that the productivity of his land is decreasing but at a slowing rate. He decides that he will keep his barley farm until annual productivity reaches 0, so he uses a logarithmic function to model the annual productivity of his land t years from now.

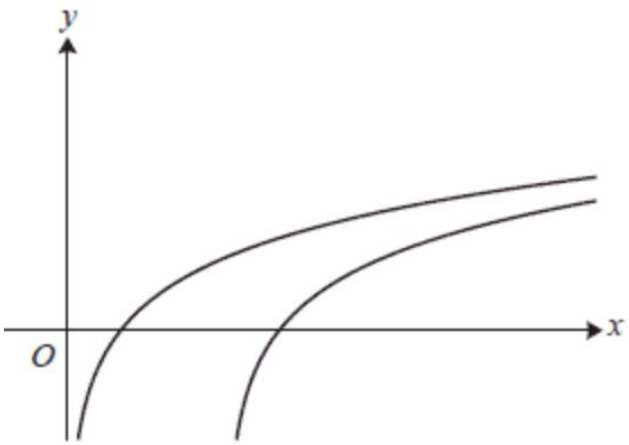
(a) Using the model $P(t) = A + k\ln(t+1)$ where $P(t)$ is the annual productivity in tonnes after t years, solve for A and k if production drops to 7 tonnes after 1 year. [3]

(b) Assuming Luigi sells at the end of the year that the farms productivity reaches zero, determine after how many years he will sell his farm. [2]

(c) At the end of the last year that Luigi runs the farm, at what rate will annual productivity be decreasing? [2]

9. (4 marks)

The diagram below shows the curves $y = \log_2 x$ and $y = \log_2(x-3)$.



(a) Describe the geometrical transformation that transforms the curve $y = \log_2 x$ to the curve $y = \log_2(x-3)$. [1]

(b) The point P lines on $y = \log_2 x$ and has an x-coordinate of c. The point Q lies on $y = \log_2(x-3)$ and also has an x-coordinate of c. Given that the distance PQ is 4 units determine the exact value of c. [3]