



Tuesday 27th February

Name: _____

Time: 45 minutes

Part A: 29

Part B: 14

Total: 43

%

- Answer all questions neatly in the spaces provided. **Show all working.**

- You are permitted to use the Formula Sheet for both sections, and an A4 page of notes, plus up to 3 permitted calculators in the Calculator Allowed section.

Topic	Confidence
<div>• Logarithm laws and solving equations</div> <div>• Logarithmic graphs and scales</div> <div>• Exponential growth and decay</div>	<div>Low \longleftrightarrow High</div> <div>Low \longleftrightarrow High</div> <div>Low \longleftrightarrow High</div>
<div>• Differentials and integration rules</div> <div>• Exponential functions</div> <div>• Natural logarithmic functions</div>	<div>Low \longleftrightarrow High</div> <div>Low \longleftrightarrow High</div> <div>Low \longleftrightarrow High</div>

Self reflection (eg. comparison to target, content gaps, study and work habits etc)

1. [10 marks]

Solve the following equations, giving exact answers in simplest form.

a) $2^{x-1} = 7$

[2]

b) $\log_4 x = \frac{3}{2}$

[2]

c) $\log_3(3x+1) = 2 + \log_3(x)$

[3]

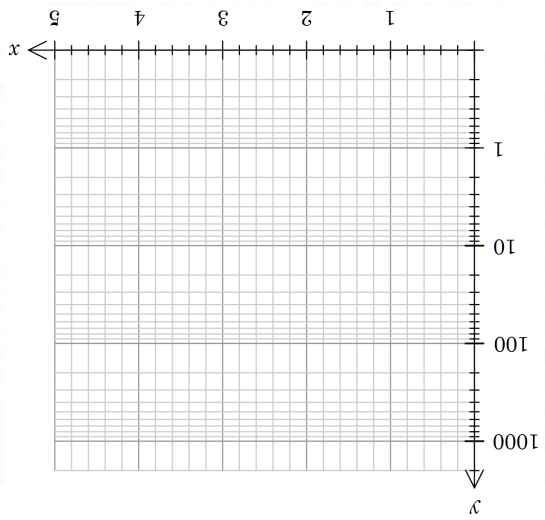
d) $e^{2x} - e^x = 6$

[3]

6. [5 marks]

a) Plot the function $y = 4^x$ on the axes below.

Note the logarithmic scale on the y-axis.



b) The 'db' or Decibel scale for sound level measuring loudness of sound is given by:

$$\text{Sound level} = 10 \log(I \times 10^{12}) \text{ db}$$

Where I is the intensity of the sound in Watts per m^2

Show that doubling the intensity of a sound increases the sound level by only a few db.

[3]

2.

[5 marks]

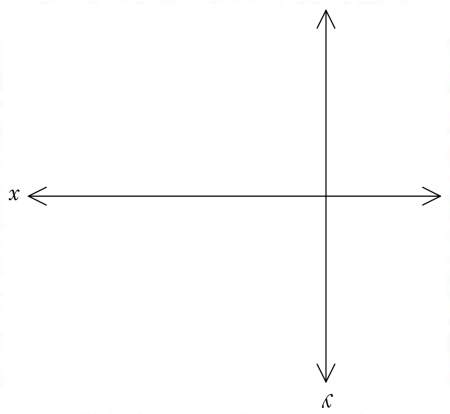
Given that $\log_2 3 = m$ and $\log_2 5 = p$,
a) express $\log_2 30$ in terms of m and p

b) evaluate 2^{p-2m}

3.

[5 marks]

a) Sketch the graph of $y = \log_2(x + 2) - 1$ labelling asymptotes, intercepts and a key point.



b) Explain why graphs of equations of the form $y = \log_a(x + a) - 1$ $a > 0$ always pass through the origin.

[2]

4. [9 marks]

a) Differentiate the following equations. Answers should be in the same form as the question but do not need to be simplified or expressed in factored form.

i) $y = \frac{x^3}{e^x}$

[2]

ii) $y = \sqrt{x^2 - 1} (5x - x^2)$

[3]

b) Given $y = \frac{u^3}{3} - u$ and $u = \ln(2x - 3)$ determine $\frac{dy}{dx}$ in terms of x .

[4]

Name: _____

Calculator Allowed Section

15 minutes

/14

5. [9 marks]

The size of a population, W , is measured every year and has an instantaneous rate of change given by the equation $\frac{dW}{dt} = \frac{W}{20}$, where t is the number of years after recording commenced.

The initial population is 2500.

a) State whether the population is increasing or decreasing, giving a mathematical reason for your answer.

[2]

b) State an equation for W in terms of t .

[2]

c) Find the size of W when $t = 4$. (Round to the nearest integer).

[1]

d) Find the rate of change of W when $t = 4$, (correct to 2 decimal places).

[2]

e) Determine the year in which the instantaneous rate of change first reaches 500 units per annum.

[2]