School of Mathematics and Statistics
Te Kura Mātai Tatauranga

ENGR 121 **Assignment 3**

DUE: 11:59pm Wednesday 27 March 2024

Submission is online via the Submission link in Nuku. Ensure your submission is a single pdf file, with a name that ends with the characters *yourUserName.pdf* . It's a good idea to view your submission after uploading it to check you submitted the right file, etc.

1 Simplify

(a) $\frac{x^2}{x^3 \times x^5}$

(b) $(x^3)^{-2}$

(c) $\left(\frac{8}{z^3}\right)^{\frac{2}{3}}$

2 Calculate the roots of the following linear equations:

(a) $3 - 2x = 4x + 1$

(b) $\frac{x}{3} + \frac{x}{4} = \frac{1}{2}$

3 Solve by factorisation:

$$t^2 - 6t + 5 = 0$$

4 Solve $3w^2 = 6w + 4$ by using the quadratic formula.

There is no need to evaluate complicated square roots if they do not come out to simple numbers.

5 Complete the square, and hence find the roots, of the quadratic equation

$$3w^2 - 2w - 2 = 0$$

There is no need to evaluate complicated square roots if they do not come out to simple numbers.

6 Describe the oblique asymptotes of the rational function

$$y(x) = \frac{3x^3 + 4x^2 + 14x + 17}{x^2 + 4}$$

7 Show that

$$\frac{x}{4} - \frac{3}{8} - \frac{1}{4(3x+1)}$$

can be expressed in the form

$$\frac{6x^2 - 7x - 5}{24x + 8}$$

Sketch this rational function and state any asymptotes.

8 Evaluate (to 1d.p.)

(a) $\log_5(25)$

(b) $\log_4(20)$

(c) $\log_8(65)$

(d) $\log(10,000)$

9 Simplify to a single log term:

(a) $3\log(y) + 4\log(x)$

(b) $\log(x) - (\log(y) + \log(z)$

(c) $\ln(xy) + \ln(y^2)$

10 Solve

(a) $2^x = 1$

(b) $e^{3x-1} = 2$

(c) $\sqrt{e^{3x}} = 1$

(d) $e^{2x} - 4e^x = -3$

(e) $3\log(t) = 5$

(f) $\log_4(t^3) = 2$

(g) $\ln(t-3) = 1$

11 Sketch a graph of the step function:

$$2u(t) + 4u(t-1)$$

12 A ramp function is given by

$$f(t) = \begin{cases} 3t, & t \geqslant 0 \\ 0, & t < 0 \end{cases}$$

Sketch $f(t-1)$