

Name: _____

Quiz Score: ____/10

Student Number: _____

Answer questions in the space provided. Show your work. No calculators or notes.

1. For $x > 0$, $x^n = e^{\ln(x^n)} = e^{n \ln(x)}$. We can use this identity to show that $\frac{d}{dx}(x^n) = nx^{n-1}$, for $x > 0$ with constant n .
- (a) (2 points) Determine $\frac{d}{dx}(e^{n \ln(x)})$. [Do not convert back to x^n and use the power rule]

- (b) (1 point) Rewrite your answer from part (a) in a form that does not contain e or \ln .

2. (3 points) Is $y(t) = \left(\frac{2}{3}t + 1\right)^{\frac{3}{2}}$ a solution to the following differential equation? [You must show work to receive marks]

$$\frac{dy}{dt} = y^{\frac{1}{3}}, \quad y(0) = 1$$

3. For constant C , $y(t) = \sqrt{2t + C}$ is a solution to the differential equation

$$\frac{dy}{dt} = \frac{1}{y}$$

(a) (1 point) Determine the value of C so that $y(t)$ satisfies the initial condition $y(0) = y_0$, where $y_0 > 0$.

(b) (1 point) For $y(0) > 0$, determine the time it takes for $y(t)$ to become three times its initial value.

4.

$$\frac{dy}{dt} = 3 - y, \quad y(0) = 2$$

(a) (1 point) Determine the solution to the differential equation.

(b) (1 point) Determine $\lim_{t \rightarrow \infty} y(t)$.