

There are 10 questions. Each question is worth 3 marks. Show your work.

1. Find an equation of the line tangent to the curve $y = \frac{2e^x}{x}$ at the point $(2, e^2)$.

2. The size $P(t)$ of a bacterial population is assumed to grow exponentially as a function of time t . Given that $P(0) = 0.1$ and $P(2) = 3.2$, find an equation for $P(t)$.

3. Differentiate $x^{\sinh(x)}$.

4. Show that the equation $e^x = 5 - x^2$ has exactly 2 solutions.

5. Use differentials or a linear approximation to estimate $\sqrt[3]{7.7}$.

6. Find the 29th derivative of e^{-3x} .

7. Find the absolute maximum and minimum values (and where they are attained) of

$$f(x) = x^5 - 5x + 5$$

on the interval $[0, 2]$.

8. Find $\lim_{x \rightarrow 0} \frac{\sec x - 1}{x^2}$.

9. Sketch the curve $y^3 = x^2 - 1$.

10. Sketch the curve $y = e^{x^3-3x^2}$.