

Name _____

- You have 20 minutes
- No calculators
- Show sufficient work

1. (2 points) The normal line to a curve at a point P is the line through P that is perpendicular to the tangent line at P . Find the slope of the normal line to the given curve at $x = \pi/6$. Simplify your answer.

$$f(x) = 12 \tan(x) + 3 \sec(x)$$

2. (2 points each) Using Leibniz notation (i.e., $\frac{dy}{dx}$, $\frac{dP}{dt}$, etc.), find derivatives for each of the following functions.

(a) $\theta = x^3 \left(\frac{x\sqrt{x}}{\sqrt[3]{x}} \right)^6$ (simplify your answer)

(b) $q = \frac{1}{t^6} + \ln(5e^2)$

(c) $r = \frac{\cot(w)}{\sqrt{w} + \sin(w)}$

3. (2 points) Determine the x -value for each point on the curve where the tangent line is horizontal.

$$g(x) = e^x (x^2 + x - 11)$$