

NAME:

INSTRUCTIONS: Calculators, notes, cell phones, or other materials are not permitted. Show all your work: even correct answers may receive little or no credit if a method of solution is not shown.

1. Differentiate the function $f(x) = (\sin x)(\cos x)$.

2. Differentiate the function $f(x) = \sqrt{1 + \sqrt{x}}$.

3. Calculate the second derivative of the function $f(x) = \frac{3x + 1}{2x - 1}$.

4. Calculate the second derivative of the function $f(x) = \sin(x^2)$.

5. Use implicit differentiation to find $\frac{dy}{dx}$ when $x^2 + 2xy - y^2 + x = 2$.

6. Find an equation for the tangent line to the curve $y = \cos^2 x$ at the point $(\frac{\pi}{4}, \frac{1}{2})$

7. Find an equation for the tangent line to the curve $x^2 + y^4 = 5$ at the point $(2, 1)$.

8. If $y = x^2 - 2x + 2$ and $\frac{dx}{dt} = 2$, find $\frac{dy}{dt}$ when $x = 3$.

9. Two people leave a point at the same time. The first person jogs North at 4 m/s and the second person jogs West at 3 m/s. How fast is the distance between the people increasing 2 seconds after they leave?

10. Use a linear approximation of $f(x) = x^{\frac{3}{2}}$ at 4 to estimate the value of $(4.2)^{\frac{3}{2}}$. (You may make use of the fact that $f(4) = 8$).

11. Determine if the function

$$f(x) = \begin{cases} x^2 & \text{if } x < 1 \\ x & \text{if } x \geq 1 \end{cases}$$

is differentiable at $x = 1$.

12. Use the definition of the derivative to find $f'(1)$ for $f(x) = x^2 - 5x$.