

## Practice for Exam 2

1. Use the definition of the derivative to find the derivative of  $f(x)$  at the indicated point:

a)  $f(x) = x^2 - x$  at  $x = 3$ .

b)  $f(x) = \sqrt{x}$  at  $x = 16$ .

2. Find the equation for the tangent line to the graph of  $y = f(x)$ :

a)  $f(x) = \frac{1}{2}x^2 - 3x + 2$  when  $x = 2$ .

b)  $f(x) = e^{2x-1}$  when  $x = 1$ .

c)  $f(x) = \tan(4x)$  when  $x = \frac{\pi}{16}$

3. Find the derivative:

a)  $y = e^x \sin x$

b)  $g(t) = \frac{t + \sec t}{t^3}$

c)  $y = [\cos(x^5 - 4x^2 + 2)]^7$

d)  $f(x) = (\ln x)^3$

4. Show that the tangent line to the curve  $y = x^2$  at the point  $(1,1)$  passes through the point  $(0,-1)$ .

5.  $\lim_{x \rightarrow 0} \frac{e^{2x} - 1}{5x}$

6. Let  $f(x) = \sqrt{5+x^2}$ ,  $x \geq 0$ . Find  $\frac{d}{dx} f^{-1}(3)$ , note that  $f(2) = 3$ .

7. Find the linear approximation for  $f(x) = \frac{1}{1-x}$  at  $a = 0$ .

8. Find the first three derivatives of  $f(x) = \tan 3x$ .

9. Assume the radius  $r$  and the volume  $V = \frac{4}{3}\pi r^3$  of a sphere are differentiable functions of time  $t$ . Express  $\frac{dV}{dt}$  in terms of  $\frac{dr}{dt}$ .

10. Find  $\frac{dy}{dx}$  by implicit differentiation.

a)  $y = x^2 + xy$

b)  $x^{3/4} + y^{3/4} = 1$

11. Find the equation for the tangent line and the normal line to the curve given by  $y^2 = x^2 - x^4$  at the point  $\left(\frac{1}{2}, \frac{\sqrt{3}}{4}\right)$