

Name _____ Time _____

1. Differentiate the following using the derivative rules.

(a) $f(x) = x^3(3x^2 + 1)^5(6x - 7)^4$

(b) $f(x) = \frac{3 \cos^2(2x)}{x + 3 \sin(2x)}$

(c) $f(x) = 3 \tan^3(x^2)$

(d) $f(x) = \sqrt{(4x - 3)^3 + x^2 - 1}$

(e) $f(x) = \left(\left((8x^3 - 3x + 1)^3 + 6x \right)^4 + 5 \sin(3x) \right)^2$

2. Determine the equation of the tangent line to the curve $(2x + y)^4 - 3y + xy - 4 = 0$ at the point $(2, -3)$.

3. Find the points on the ellipse $x^2 + 2y^2 = 1$ where the tangent line has a slope of 1.
(Hint: Solve for x in terms of y where $\frac{dy}{dx} = 1$.)

4. (a) Determine the equation of the tangent line to the curve $x^2 + y^2 + y \cos x + 3x = 0$ at the point $(0, -1)$.

(b) Use linear approximation (the tangent line) to estimate y when $x = 0.1$.

5. Determine the limit.

(a) $\lim_{x \rightarrow 4} \frac{x^2 - 5x + 4}{x - 4}$

(b) $\lim_{h \rightarrow 2^-} \frac{x^2 - 3x - 2}{x - 2}$

(c) $\lim_{x \rightarrow 2^+} \frac{x^2 - 3x - 2}{x - 2}$

(d) $\lim_{x \rightarrow \infty} \frac{4 - x^2}{3x^2 - 7x + 5}$

(e) $\lim_{x \rightarrow 1^-} \frac{|x^2 - 1|}{x - 1}$

(f) $\lim_{x \rightarrow 1^+} \frac{|x^2 - 1|}{x - 1}$