AB Calculus Rules for Differentiation Day 1 Practice **Name:** _____

1. What does the derivative of a function tell you about the function?

2. What is the power rule for derivatives? (How do you take the derivative of $y = x^n$?

3. For each of the following, find $\frac{dy}{dx}$

a) $y = -2x^3 + x$

b) $y = \frac{x^4}{3} - \frac{x^2}{7} + 5$

$y = \frac{1}{3}x^4 - \frac{1}{7}x^2 + 5$

c) $y = -\frac{5}{x^2} + \frac{6}{x} - 8x^3$

$y = -5x^{-2} + 6x^{-1} - 8x^3$

d) $y = \frac{x^{-3}}{2} + 5x^{-4} - 3x^{-6}$

$\frac{1}{2}x^{-3}$

e) $y = 5x^4 + 2x^3 - 8x^2 - 7x + 11$

f) $y = 7x - 8$

g) $y = (x^2 - 3)(x + 4)$

Distribute OR Product Rule

h) $y = \sqrt{x} + \frac{3}{\sqrt{x}} - 6x^{\frac{5}{3}} + \frac{7}{x^3}$

$y = x^{\frac{1}{2}} + 3x^{-\frac{1}{2}} - 6x^{\frac{5}{3}} + 7x^{-3}$

i) $y = \frac{x^5 - 2x^4 + 3x^3}{x^5}$

$y = 1 - 2x^{-1} + 3x^{-2}$

4. (Calculator) Find all points where $y = x^4 - 5x^3 - 3x^2 + 13x + 10$ has a horizontal tangent line.

5. Find the equation of the tangent line to the function $y = \frac{x^2+x-2}{2x}$ at the point where $x = 1$.

① Derivative

$\frac{dy}{dx} = \frac{1}{2} + 1x^{-2} \rightarrow \left.\frac{dy}{dx}\right|_{x=1} = \frac{1}{2} + 1(1)^{-2} = \frac{3}{2}$

$y = \frac{1}{2}x + \frac{1}{2} - 1x^{-1} \rightarrow y(1) = \frac{1}{2} + \frac{1}{2} - 1 = 0$

$y - 0 = \frac{3}{2}(x - 1)$

6. Find the equation of the normal line to the function $y = x^3 - 5x + 1$ at the point where $x = 2$.

7. Find the points on the curve $y = x^3 + 3x^2 - 9x + 7$ where the tangent line is parallel to the x-axis.

8. Find all x-values on the curve $y = x^3 + x$ where the slope is 4.

9. The normal line to the graph of f at $(1, 2)$ passes through the point $(-1, 1)$. Find the value of $f'(1)$.

10. Find the values of a and b so that $g(x)$ is both continuous and differentiable at $x = 0$.

$$g(x) = \begin{cases} ax + b, & x > 0 \\ 1 - x + x^2, & x \leq 0 \end{cases}$$

11. Let $f(x) = \sqrt{x}$. Find c if the rate of change of f at $x = c$ is twice the rate of change at $x = 1$.

12. Find the equation of the tangent line to the function $f(x) = x^4 + 2x^2$ at the point where $f'(x) = 1$.