AP Calculus AB - Worksheet 23 **Tangent and Normal Lines (Power Rule)**

Example:

$f(x) = x^2 + 3$

Point	Slope
$f(1) = 4$	$f'(x) = 2x$
	$f'(1) = 2$

Tangent Line: $y - 4 = 2(x - 1)$

Normal Line: $y - 4 = -\frac{1}{2}(x - 1)$

For each of the following:

a) Find the slope of the tangent line at the given point.
b) Find the equation of the tangent line at the given point.
c) Find the equation of the normal to the curve at the given point.
d) Graph all THREE functions on your graphing calculator to verify.

1. $y = x^2 - 3,\ (2,1)$
2. $f(x) = 6 - x^2\ \ (2,2)$
3. $f(x) = \sqrt{x},\ (4,2)$
4. $y = 2 - 4x^{-2},\ \ (2,1)$

5. Find the equations of the tangent line to the curve $y = 4x^2 + 8x + 1$ at $x = 1$.

6. Find the equation of the normal line to the curve $y = 3x^2 - x^3$ at $x = -2$.

7. Find the point(s) on the curve $y = 2x^3 + 3x^2 - 12x + 1$ where the tangent is horizontal.

8. Show that the curve $y = 6x^3 + 5x - 3$ has no tangent line with slope 4.

9. Find an equation of the tangent line to the curve $y = x^{\frac{3}{2}}$ that is parallel to the line $y = 1 + 3x$.

10. **Challenge Problem** Find a parabola with equation $y = ax^2 + bx + c$ that has slope 4 at $x = 1$, slope -8 at $x = -1$, and passes through the point $(2,15)$.
(Hint: You will create 3 different equations in order to solve for *a*, *b*, and *c*.)

11. Evaluate $\lim_{h \to 0} \frac{(x+h)^3 - 2(x+h) - (x^3 - 2x)}{h}$ using the Power Rule.