201-103-RE - Calculus 1

WORKSHEET: DEFINITION OF THE DERIVATIVE

1. For each function given below, calculate the **derivative at a point** $f'(a)$ using the limit definition.

   (a) $f(x) = 2x^2 - 3x$ $\qquad f'(0) = ?$

   (b) $f(x) = \sqrt{2x+1}$ $\qquad f'(4) = ?$

   (c) $f(x) = \dfrac{1}{x-2}$ $\qquad f'(3) = ?$

   (d) $f(x) = (x-3)^3$ $\qquad f'(4) = ?$

2. For each function $f(x)$ given below, find the **general derivative** $f'(x)$ as a new function by using the limit definition.

   (a) $f(x) = \sqrt{x-4}$ $\qquad f'(x) = ?$

   (b) $f(x) = -x^3$ $\qquad f'(x) = ?$

   (c) $f(x) = \dfrac{x}{3x+1}$ $\qquad f'(x) = ?$

   (d) $f(x) = \dfrac{1}{\sqrt{x}}$ $\qquad f'(x) = ?$

3. For each function $f(x)$ given below, find the **equation of the tangent line** at the indicated point.

   (a) $f(x) = x - x^2$ $\qquad$ at $(2, -2)$

   (b) $f(x) = 1 - 3x^2$ $\qquad$ at $(0, 1)$

   (c) $f(x) = \dfrac{1}{2x}$ $\qquad$ at $x = 1$

   (d) $f(x) = x + \sqrt{x}$ $\qquad$ at $x = 1$

4. Given $f(x) = ax^2 + 2x$ and $f'(1) = 5$, solve for a.

ANSWERS:

1. (a) $f'(0) = -3$ (b) $f'(4) = 1/3$ (c) $f'(3) = -1$ $(d) f'(4) = 3$
2. (a) $f'(x) = \frac{1}{2\sqrt{x-4}}$ (b) $f'(x) = -3x^2$ (c) $f'(x) = \frac{1}{(3x+1)^2}$ (d) $f'(x) = \frac{-1}{2x^{3/2}}$
3. (a) $y = -3x + 4$ (b) $y = 1$ (c) $y = -\frac{1}{2}x + 1$ (d) $y = \frac{3}{2}x + \frac{1}{2}$
4. $a = \frac{3}{2}$