

5-4 Learn Check

I can use the definition of a derivative to compute derivatives.

I can calculate, use and interpret the derivative for a function.

I can use derivatives and their graphs to identify properties of functions.

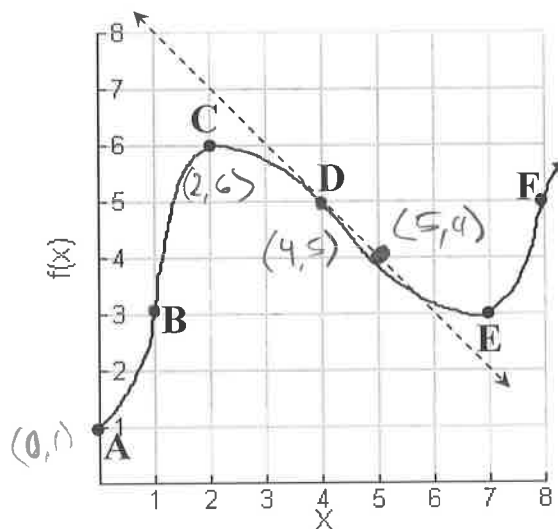
1. Refer to the graph at the right.

a. Find the average rate of change from A to C.

$$\frac{6-1}{2-0} = \boxed{\frac{5}{2}}$$

b. When is the instantaneous rate of change zero?

Point C & Point E
when $x=2$ & $x=7$



c. For what interval(s) of x is $f'(x)$ is negative?

$(1, 2)$ or $(4, 7)$

e. Estimate f' when $x = 4$

$$\frac{5-4}{4-5} = \boxed{-1}$$

2. Use the definition of a derivative, $f'(x) = \lim_{\Delta x \rightarrow 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$, to find the derivative of

$$f(x) = -3x^2 + 5x$$

$$\begin{aligned} &= \lim_{\Delta x \rightarrow 0} \frac{-3(x+\Delta x)^2 + 5(x+\Delta x) - (-3x^2 + 5x)}{\Delta x} \\ &= \lim_{\Delta x \rightarrow 0} \frac{-3(x^2 + 2x\Delta x + \Delta x^2) + 5x + 5\Delta x + 3x^2 - 5x}{\Delta x} \\ &= \lim_{\Delta x \rightarrow 0} \frac{-3x^2 - 6x\Delta x - 3\Delta x^2 + 5x + 5\Delta x + 3x^2 - 5x}{\Delta x} \end{aligned}$$

$$= \lim_{\Delta x \rightarrow 0} -6x - 3\Delta x + 5$$

$$f'(x) = \boxed{-6x + 5}$$

3. Find the derivative of the following functions using the shortcut.

a. $f(x) = 3x^2 - 4x + 5$

$$f'(x) = 6x - 4$$

b. $f(x) = 6x^2 - 8x^4$

$$f'(x) = 12x - 32x^3$$

c. $f(x) = 2x - 3$

$$f'(x) = 2$$

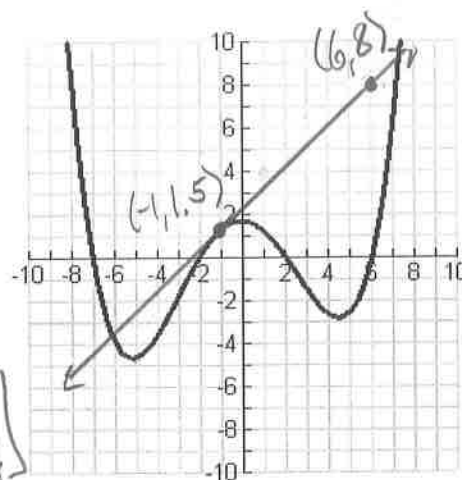
d. $f(t) = -16t^5 + 104t^3 + 12t$

$$f'(t) = -80t^4 + 312t^2 + 12$$

4. Refer to the graph of f shown at the right.

a. For what values of x is the derivative of f positive?

Same $\leftarrow (-5, 0) \cup (4.5, \infty)$ $\left[f \text{ is increasing} \right]$
 $-5 < x < 0$ or $x > 4.5$



b. For what values of x is the derivative of f negative?

$(-\infty, -5) \cup (0, 4.5)$ $\left[f \text{ is decreasing} \right]$

c. For what values of x is the derivative equal to zero?

$$x = -5, 0, 4.5$$

d. Using a straightedge, draw the line that is tangent to the graph at $x = -1$.



e. Estimate the derivative of the function when $x = -1$.

$$\frac{8 - 1.5}{6 - (-1)} = \frac{6.5}{7} \approx \boxed{0.93}$$

f. The equation of the function graphed is:

$$y = .01x^4 + .01x^3 - .46x^2 - .04x + 1.68. \text{ Find } y'$$

$$f'(x) = 0.04x^3 + 0.03x^2 - 0.92x - 0.04$$

g. Check your estimate from part e by substituting $x = -1$ to the derivative you found in part f.

$$f'(-1) = 0.87$$



close to 0.93