Key

Math 4

5-3 ~~U7 L1 12~~ **Learn Check**

Name____________________

Date________

In this Learning Check, you will be assessed on the following learning goals:
I can use the definition of derivative to compute derivatives
I can use derivatives and their graphs to identify properties of functions

1a. Let f be the function $f(x) = 3x^2 - 2x + 4$. Use the *definition of derivative* to find $f'(x)$.

$$f'(x) = \lim_{\Delta x \to 0} \frac{3(x+\Delta x)^2 - 2(x+\Delta x) + 4 - (3x^2 - 2x + 4)}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{3(x^2 + 2x\Delta x + \Delta x^2) - 2x - 2\Delta x + 4 - 3x^2 + 2x - 4}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{\cancel{3x^2} + 6x\cancel{\Delta x} + 3\Delta x^{\cancel{2}} - \cancel{2x} - 2\cancel{\Delta x} \cancel{+4} \cancel{-3x^2} \cancel{+2x} \cancel{-4}}{\cancel{\Delta x}}$$

$$= \lim_{\Delta x \to 0} 6x + 3\Delta x - 2 \longrightarrow = \boxed{6x - 2}$$

1b Find the slope of the tangent line to $f(x)$ at $x = -8$.

$$f'(-8) = 6(-8) - 2 = -48 - 2 = \boxed{-50}$$

1c. Is f increasing or decreasing when $x = -8$? Justify your answer.

f is decreasing. The slope of the tangent line at that point is negative.

3. A projectile follows along a path given by the formula $h(t) = 480t - 16t^2$. The derivative function for $h(t)$ is $h'(t) = 480 - 32t$ (t in seconds, $h(t)$ in feet). Answer the below questions based on the functions.

3a. Find the instantaneous velocity when ~~x~~ t = 20. Explain what your answer means about the projectile.

$h'(20) = 480 - 32(20) = -160 \rightarrow$ Height is decreasing

The projectile is traveling down at 160 ft/s after 20 seconds.

3b. Find the instantaneous velocity when ~~x~~ t = 8. . Explain what your answer means about the projectile.

$h'(8) = 480 - 32(8) = 224 \rightarrow$ Height is increasing

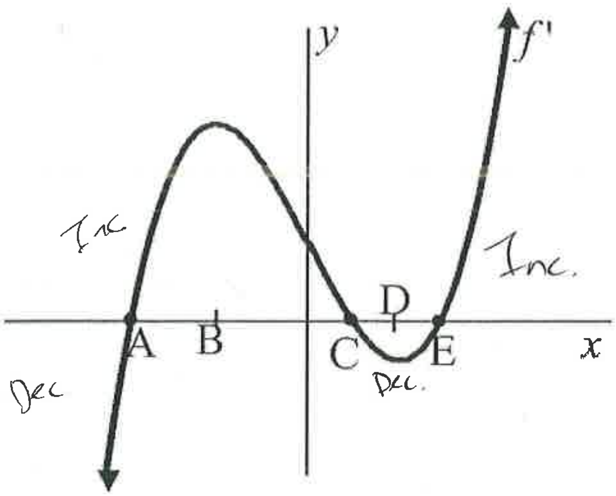
After 8 seconds, the projectile is traveling upward at a speed of 224 ft/sec.

3c. Find the instantaneous velocity when ~~x~~ t = 15. . Explain what your answer means about the projectile.

$h'(15) = 480 - 32(15) = 0 \rightarrow$ Projectile at maximum height

After 15 seconds, the projectile is sitting still.

Below is a graph of $f'(x)$ (*the derivative function*). Use the graph to answer the below questions.
Remember, the derivative is the instantaneous rate of change at a specific x-value.



5. On what intervals (use A, B, C, D, and E) is the graph of $f(x)$ increasing?

(A, C) (E, ∞)
Between A & C To the right of E
Derivative is positive

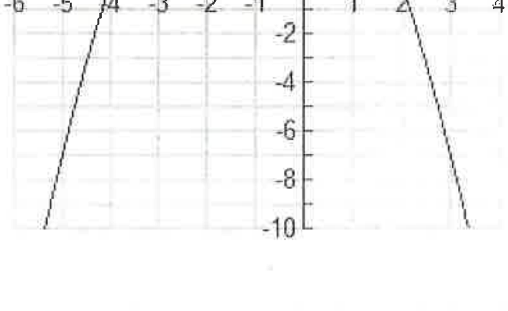
6. On what intervals (use A, B, C, D, and E) is the graph of $f(x)$ decreasing?

(−∞, A) (C, ~~D~~ E)
Derivative is negative

7. What do the x-intercepts of the above graph of $f'(x)$ tell you about the graph of $f(x)$?

f(x) has max or min points at those three x-values.
Specifically, minimums at A & E; maximum at C.

Use the graph below to estimate the value of the derivative at the given points.



8. $x = -1$

$g'(-1) = 0$

9. $x = 1$

$g'(1) = \cancel{\frac{1}{3}}$ $\boxed{\frac{-3}{1}}$