Key

Math 4 Name ____________

5-3 **Practice** Work shown on following pages. Date ________

In 1–3, find the derivative of the function at the given value of x. *Use the algebraic definition to find the equation of the derivative for each function.*

Show your work on another piece of paper.

1. $f(x) = 3x^2 + 4; x = 2$ 12

2. $g(x) = -12x + 8; x = .5$ -12

3. $h(x) = 22; x = 7$ 0

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

   a. Compute $f'(0)$. 1

   b. Compute $f'(3)$. -11

5. The typical number of mosquitoes $m(r)$ in hundreds of thousands in a certain county during the month of June is approximated by $m(r) = 8r - r^2$, where r is the average total rainfall for the month in inches.

   Use the algebraic definition to find the equation of the derivative for the function. Show your work on another piece of paper.

   a. Find the derivative of m when $r = 2$. 4

   b. What does your answer to part a mean?

   See following pages.

6. The height h in feet of a small rocket t seconds after launch is approximated by $h(t) = 320t - 16t^2$.

   Use the algebraic definition to find the equation of the derivative for the function. Show your work on another piece of paper.

   a. Find the instantaneous velocity at time $t = 5$. 160 ft/s

   b. Find the instantaneous velocity at time $t = 14$. -128 ft/s

   c. Find the instantaneous velocity at time $t = 10$. 0 ft/s

   d. At what time does the rocket reach its maximum height? 10 seconds

7. A pebble is dropped from a cliff 60 feet high. The height of the pebble in feet above the ground at time t seconds is given by $h(t) = -16t^2 + 60$.

Use the algebraic definition to find the equation of the derivative for the function. Show your work on another piece of paper.

a. Find the instantaneous velocity of the pebble at time $t = 0.5$ second. -16 ft/s

b. At what time does the pebble hit the ground? $t \approx 1.94$ seconds

c. Find the instantaneous velocity of the ball at the moment just before it hits the ground. -61.97 ft/s

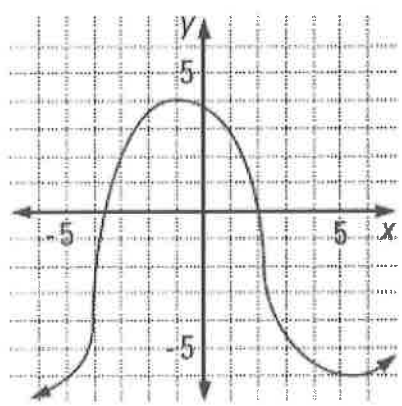
8. Refer to the graph of f at the right. Give a value of x for which $f'(x)$ is

Answers vary

a. positive. $x = -3$

b. negative. $x = 1$

c. zero. $x = -1$

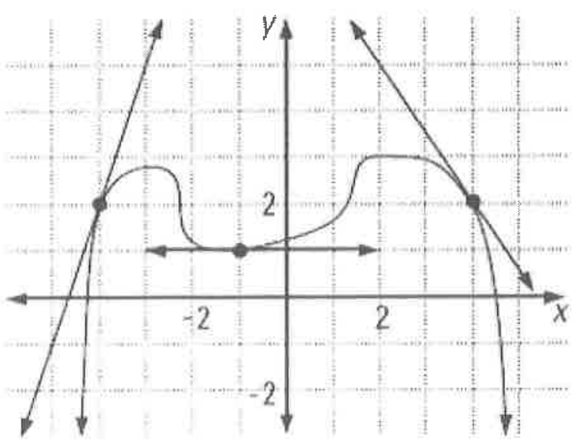


9. Refer to the graph of g at the right. Estimate g' for each value of x given below.

a. $x = -4$ 3

b. $x = -1$ 0

c. $x = 4$ $-\frac{3}{2}$



$$\boxed{f'(x)=\lim_{\Delta x\to 0}\frac{f(x+\Delta x)-f(x)}{\Delta x}}$$

M4 U7 L1 I2 Practice ANSWERS

1.) $$f'(2)=\lim_{\Delta x\to 0}\frac{3(2+\Delta x)^2+4-(3(2)^2+4)}{\Delta x}$$
$$=\lim_{\Delta x\to 0}\frac{3(4+4\Delta x+\Delta x^2)+4-16}{\Delta x}$$
$$=\lim_{\Delta x\to 0}\frac{\cancel{12}+12\cancel{\Delta x}+3\Delta x^{\cancel{2}}+\cancel{4}\cancel{-16}}{\cancel{\Delta x}}$$
$$=\lim_{\Delta x\to 0} 12+3\Delta x$$
$$=\boxed{12}$$

2.) $$g'(0.5)=\lim_{\Delta x\to 0}\frac{-12(0.5+\Delta x)+8-(-12(0.5)+8)}{\Delta x}$$
$$=\lim_{\Delta x\to 0}\frac{\cancel{-6}-12\cancel{\Delta x}+\cancel{8}\cancel{+6}\cancel{-8}}{\cancel{\Delta x}}$$
$$=\lim_{\Delta x\to 0} -12$$
$$=\boxed{-12}$$

3.) $$h'(7)=\lim_{\Delta x\to 0}\frac{22-22}{\Delta x}=\boxed{0}$$

4.) $$f'(x)=\lim_{\Delta x\to 0}\frac{-2(x+\Delta x)^2+(x+\Delta x)-3-(-2x^2+x-3)}{\Delta x}$$
$$=\lim_{\Delta x\to 0}\frac{-2(x^2+2x\Delta x+\Delta x^2)+x+\Delta x-3+2x^2-x+3}{\Delta x}$$
becomes 1
$$=\lim_{\Delta x\to 0}\frac{\cancel{-2x^2}-4x\cancel{\Delta x}-\Delta x^{\cancel{2}}\cancel{+x}+\cancel{\Delta x}\cancel{-3}+\cancel{2x^2}\cancel{-x}\cancel{+3}}{\cancel{\Delta x}}$$
$$=\lim_{\Delta x\to 0} -4x-\Delta x+1=\boxed{-4x+1}$$

a) $f'(0)=-4(0)+1=\boxed{1}$

b) $f'(3)=-4(3)+1=\boxed{-11}$

→

5.) a) $m'(2) = \lim_{\Delta r \to 0} \dfrac{8(2+\Delta r) - (2+\Delta r)^2 - (8(2) - (2)^2)}{\Delta r}$

$= \lim_{\Delta r \to 0} \dfrac{16 + 8\Delta r - (4 + 4\Delta r + \Delta r^2) - (16 - 4)}{\Delta r}$

$= \lim_{\Delta r \to 0} \dfrac{\cancel{16} + 8\cancel{\Delta r} \cancel{-4} - 4\cancel{\Delta r} - \Delta r^{\cancel{2}} \cancel{-16} \cancel{+4}}{\cancel{\Delta r}}$

$= \lim_{\Delta r \to 0} 8 - 4 - \Delta r$

$= \boxed{4}$

b) When there are 2 inches of rainfall one month, the mosquito population is increasing at a rate of 4 hundred thousand mosquitos per inch of rainfall.

6.) $h'(t) = \lim_{\Delta t \to 0} \dfrac{320(t+\Delta t) - 16(t+\Delta t)^2 - (320t - 16t^2)}{\Delta t}$

$= \lim_{\Delta t \to 0} \dfrac{320t + 320\Delta t - 16(t^2 + 2t\Delta t + \Delta t^2) - 320t + 16t^2}{\Delta t}$

$= \lim_{\Delta t \to 0} \dfrac{\cancel{320t} + 320\cancel{\Delta t} - \cancel{16t^2} - 32t\cancel{\Delta t} - 16\Delta t^{\cancel{2}} - \cancel{320t} \cancel{+16t^2}}{\cancel{\Delta t}}$

$= \lim_{\Delta t \to 0} 320 - 32t - 16\Delta t$

$= \boxed{320 - 32t}$

a) $h'(5) = 320 - 32(5) = \boxed{160 \text{ ft/s}}$

b) $h'(14) = 320 - 32(14) = \boxed{-128 \text{ ft/s}}$

c) $h'(10) = 320 - 32(10) = \boxed{0 \text{ ft/s}}$

d) $0 = 320 - 32t$

$32t = 320$ $\quad t = \dfrac{320}{32} = \boxed{10 \text{ seconds}}$

7.) a) $h'(t) = \lim_{\Delta t \to 0} \dfrac{-16(t+\Delta t)^2 + 60 - (-16t^2+60)}{\Delta t}$

$= \lim_{\Delta t \to 0} \dfrac{-16(t^2 + 2t\Delta t + \Delta t^2) + 60 + 16t^2 - 60}{\Delta t}$

$= \lim_{\Delta t \to 0} \dfrac{\cancel{-16t^2} - 32t\cancel{\Delta t} - 16\Delta t^{\cancel{2}} \cancel{+60} \cancel{+16t^2} \cancel{-60}}{\cancel{\Delta t}}$

$= \lim_{\Delta t \to 0} -32t - 16\Delta t$

$= \boxed{-32t}$

$h'(0.5) = -32(0.5) = \boxed{-16 \text{ ft/s}}$

b) $0 = -16t^2 + 60$

$-60 = -16t^2$

$\dfrac{60}{16} = t^2$

$\boxed{t \approx 1.94 \text{ seconds}}$

c) $h'\left(\sqrt{\frac{60}{16}}\right) = -32\left(\sqrt{\frac{60}{16}}\right) \approx \boxed{-61.97 \text{ ft/s}}$

8.) a) $x = -3$ → Any x where f(x) is increasing.

b) $x = 1$ → Any x where f(x) is decreasing

c) $x = -1$ → Any max or min point

9.) a) $g'(-4) = 3$

b) $g'(-1) = 0$

c) $g'(4) = -\frac{3}{2}$

Find slope of the tangent line.