FLUENCY

1. Consider the function $g(x) = 3x^2 + 2x - 4$. Evaluate the following using your graphing calculator.

   (a) $g(-2) =$ 12 - 4 - 4
   4

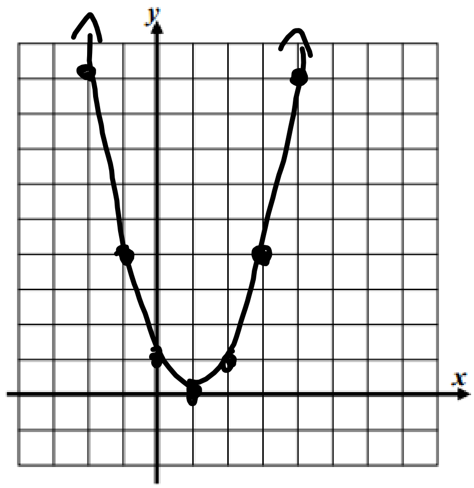
   (b) $g(0) =$ - 4

   (c) $g(4) =$ 52

   (d) $g(15) =$ 701

2. Given the function $f(x) = x^2 - 2x + 1$, fill in the missing values in the table then using the table graph the function on the grid for the interval. Use your calculator.

x	y	(x, y)
-2	9	(-2, 9)
-1	4	$(-1,4)$
0	1	(0, 1)
1	0	(1, 0)
2	1	(2, 1)
3	4	(3, 4)
4	9	(4, 9)



3. Which of the following values of x will make the equation $3(x-2)^2 - 4 = 23$ true? Show the table on your calculator that justifies your choice.

(1) $x = 1$ (3) $x = 5$

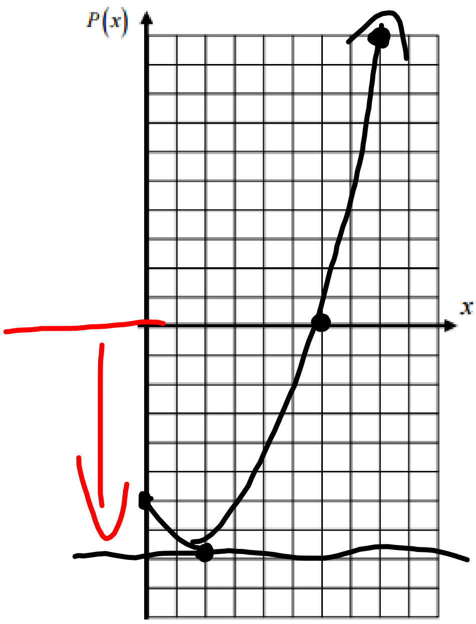
(2) $x = 4$ (4) $x = 0$

APPLICATIONS

4. Profits for the upcoming year for a shipping company have been quantified and put into the equation $P(x)=\frac{1}{2}(x-2)^2-8$ where x is the number of packages shipped in thousands and $P(x)$ is the corresponding profit in millions of dollars.

   (a) Use your calculator to fill out the following table and graph the function on the grid for the interval $0 \le x \le 10$.

x	$P(x)$	(x, y)
0	-6	(0, -6)
2	-8	(2, -8)
4	-6	(4, -6)
6	0	(6, 0)
8	10	(8, 10)
10	24	(10, 24)



   (b) Over what interval is $P(x)<0$? What does this interval represent?

   $0 \le x < 6$

(c) Evaluate $P(0)$. What might this stand for?

-6

(d) Explore the table to determine the value of x for which $P(x)=0$. What might this stand for?

Where the company breaks even.

REASONING

5. After placing an equation into his calculator Rob got the following table. He then determines that $x=6$ when $f(x)=-4$. Is he correct? Explain.

x	$f(x)$
-4	6
-2	3
0	-1
2	-4

No, $f(x)=-4$ at $x=2$, not at $x=6$.

Bell Ringer:

A population, p(x), of wild turkeys in a certain area is represented by the function $p(x) = 17(1.15)^{2x}$, where x is the number of years since 2010. How many more turkeys will be in the population for the year 2015 than 2010?

1) 46
2) 49
3) 51
4) 68

$17(1.15)^{2\cdot 0} \to 17(1.15)^{0} \to 17$

$17(1.15)^{2\cdot 5} \to 17(1.15)^{10} \to 68.77$

Unit 3 Quick Review:

A function is shown in the table below.

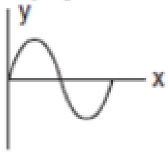
-4, 1

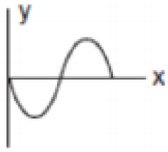
x	f(x)
−4	2
−1	−4
0	−2
3	16

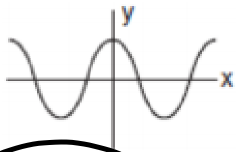
1, -4

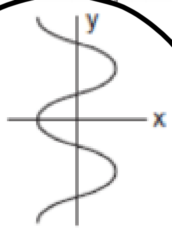
If included in the table, which ordered pair, (−4, 1) or (1, −4), would result in a relation that is no longer a function? Explain your answer.

Which graph does *not* represent a function?

1) 

2) 

3) 

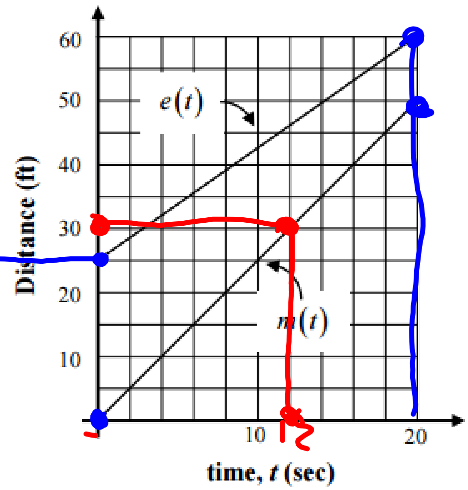
4) 

AVERAGE RATE OF CHANGE
COMMON CORE ALGEBRA I

Functions are rules that give us **outputs** when we supply them with **inputs**. Very often, we want to know how **fast** the outputs are changing compared to a change in the input values. This is referred to as the **average rate of change** of a function.

***Exercise* #1:** Max and his younger sister Evie are having a race in the backyard. Max gives his sister a head start and they run for 20 seconds. The distance they are along in the race, in feet, is given below with Max's distance given by the function $m(t)$ and Evie's distance given by the function $e(t)$.

(a) How do you interpret the fact that $m(12) = 30$? Illustrate your response by using the graph.



(b) If both runners start at $t = 0$, how much of a head start does Max give his little sister? How can you tell?

25ft.

(c) Does Max catch up to his sister? How can you tell?

No.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

SUBTRACTION

(d) How far does Max run during the 20 second race? How far does Evie run? What calculation can you do to find Evie's distance?

50 $60-25$

35

(e) How fast do both Evie and Max travel? In other words, how many feet do each of them run per second? Express your answers as decimals and attach units.

MAX'S SPEED (FEET PER SECOND)	EVIE'S SPEED (FEET PER SECOND)
0,0	0,25
20,50	20,60
$\frac{50-0}{20-0}$	$\frac{60-25}{20-0}$
$\frac{50}{20}=2.5$ ft/s	$\frac{35}{20}=1.75$ ft/s

In the first exercise we were calculating the **rate** that the **function's output (y-values)** were changing compared to the **function's input (or x-values)**. This is known as finding the **average rate of change** of the function. You might think you've seen this before. And you have.

***Exercise* #2:** Finding the average rate of change is the same as finding the slope of a line.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

There is, of course, a formula for finding average rate of change. Let's get it out of the way.

> **AVERAGE RATE OF CHANGE**
>
> For the function $y = f(x)$, the average rate that $f(x)$ changes from $x = a$ to $x = b$ is given by:
>
> $$\frac{f(b) - f(a)}{b - a} = \frac{\text{how much the y-values have changed}}{\text{how much the x-values have changed}}$$

***Exercise* #3:** Consider the function given by $f(x) = x^2 + 3$. Find its average rate of change from $x = -1$ to $x = 3$. Carefully show the work that leads to your final answer.

$a = -1$

$b = 3$

$$\frac{3^2 + 3 - ((-1)^2 + 3)}{3 - -1}$$

$$\frac{12 - 4}{4} = \frac{8}{4} = 2$$

$3-9=-6 \Rightarrow -\frac{6}{4}$
$6-2=4$

***Exercise* #4:** The function $h(x)$ is given in the table below. Which of the following gives its average rate of change over the interval $2 \le x \le 6$? Show the calculations that lead to your answer.

(1) $-\frac{3}{2}$

(2) $\frac{6}{4}$

(3) $-\frac{7}{6}$

(4) -1

x	$h(x)$
0	10
2	9
4	6
6	3

$\frac{9-3}{2-6} = \frac{6}{-4}$

***Exercise* #5:** Frances is selling glasses of lemonade. The function $g(t) = \frac{t^2+4}{2}$ models the number of glasses she has sold, g, after t-hours. What is the average rate at which she is selling lemonade between $t = 2$ and $t = 6$ hours. Include proper units in your answer.

$9 = 2$
$5 = 6$

$\frac{20-4}{6-2} = \frac{16}{4} = 4 \text{ g/hr}$