Grade Level/Course: Algebra 1
Lesson/Unit Plan Name: Evaluating Functions Graphically and Algebraically
Rationale/Lesson Abstract: This lesson is in handout form for students to practice finding the output value of a function given its input value from both a graph and a rule. This lesson condenses these two skills into one handout and includes linear, quadratic and absolute value functions.
Timeframe: 55 minutes.
Common Core Standard(s): F-IF.2—Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

Instructional Resources/Materials: **Copies of handout (pgs. 7-8)**
Copies of exit tickets (p. 9)

Activity/Lesson:

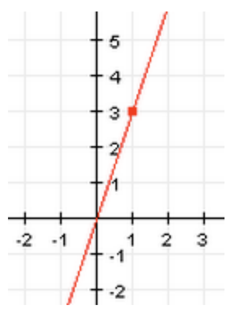
<u>Do Now: (5 minutes)</u>

Simplify:

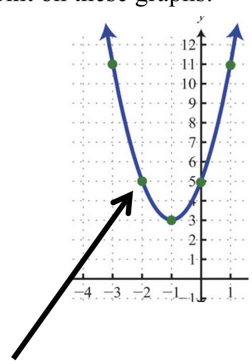
$$-(3)^2+4(3)+24$$
$$=-(9)+12+24$$
$$=-9+12+24$$
$$=3+24$$
$$=27$$

$$|-7+3|-1$$
$$=|-4|-1$$
$$=4-1$$
$$=3$$

Identify the designated point on these graphs:



"When the input is 1, the output is 3." (1,3)



(-2,5)
"When the input is -2, the output is 5."

We Do: (10 minutes)

Ask students to read (silently, chorally, volunteer) the title and the objective of the lesson.

Ask another volunteer or random student to read the We Do. Emphasize that *f(t)* is pronounced "*f of t*".

Ask a random student: "What does this graph represent?" [the height of a ball thrown from a rooftop]

Ask a random student: "What equation is expressed by this graph?" $\left[f(t) = -t^2 + 4t + 24 \right]$

"This equation is stating that the ball's height will change depending on how long it is in the air. Or rather the ***ball's height is a function of the time in the air***."

Turn and Talk—"What does the *x*-axis represent? What does the *y*-axis represent?" [elicit responses and confirm with various students—How do you know?]

Ask a random student (give think time) "What is the problem asking us to find?" [the height of the ball after 2 seconds]

Say "We are going to find the solution graphically and algebraically? Two different ways. How many different ways, class?" [chorally…2]

Say "To find the height of the ball using the graph, let's read the step-by-step directions and do this together."

1. Find your input value of 2 seconds on the *x*-axis. ["Put your finger on the origin and then move your finger across to the input value 2 on the *x*-axis."]
2. Move your finger vertically until it reaches the graphed function.
3. Read the height value where your finger is on the *y*-axis. [The height of the ball is 28 feet.]

Let's write a statement: "After 2 seconds, the height of the ball is 28 feet."

Let's do this algebraically. We start with the equation and we will substitute 2 for the variable *t*, which represents *time*.

$$f(t) = -t^2 + 4t + 24$$
$$f(2) = -(2)^2 + 4(2) + 24$$
$$f(2) = -4 + 8 + 24$$
$$f(2) = 4 + 24$$
$$f(2) = 28$$

"*f(2)* means we are looking for the output value when the input value is 2."

You Try: (5 minutes)

Students use the same graph and equation to find the height of the ball after 6 seconds.

"Now it's your turn. Read the You Try silently to yourself and try it out."

Solution:

After 6 seconds, the height of the ball is 12 feet.

$$f(t) = -t^2 + 4t + 24$$
$$f(6) = -(6)^2 + 4(6) + 24$$
$$f(6) = -36 + 24 + 24$$
$$f(6) = -12 + 24$$
$$f(6) = 12$$

Teamwork: (30 minutes)

Students work in teams together to find solutions to the remaining problems.

Some good team norms are:
--Same problem, same time.
--Help each other.
--Math discussions only.
--Team questions only.

Solutions found on pgs. 5-6

Assessment--Exit Ticket: (4 minutes)

Distribute exit tickets, remind students this is quiet time, and collect at the door as student are excused.

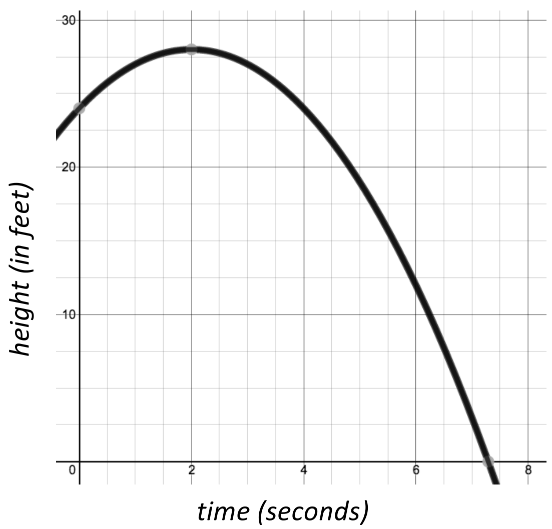
Assess your success by quickly checking exit tickets and modifying your next class' lesson accordingly.

Solutions---

MA#______: Evaluating Functions Graphically and Algebraically (F-IF.2) Name:___________________________

O2.3 and 2.4-Today you will learn to find the solution to a problem using both a graph and an equation!

We Do: Here's a graph that represents the height of a ball thrown from a rooftop. It can be expressed by the equation $f(t) = -t^2 + 4t + 24$, where *f(t)* is the height of the ball after *t* seconds. What is the ball's height after 2 seconds?



Graphically:

1. Find your input value of 2 seconds on the x-axis.
2. Move your finger vertically until it reaches the graphed function.
3. Read the height value where your finger is on the y-axis.

Write a statement as your solution:

After 2 seconds, the height of the ball is 28 feet.

Algebraically: Substitute t = 2 for the equation

$$f(t) = -t^2 + 4t + 24$$
$$f(2) = -(2)^2 + 4(2) + 24$$
$$f(2) = -4 + 8 + 24$$
$$f(2) = 4 + 24$$
$$f(2) = 28$$

You Try: Using the same graph, find the height of the ball after 6 seconds.

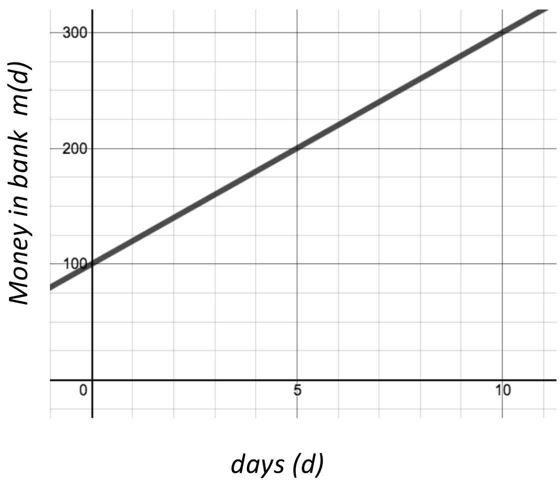
Using the graph, what did you find?

After 6 seconds, the height of the ball is 12 feet.

Now solve it algebraically:

$$f(t) = -t^2 + 4t + 24$$
$$f(6) = -(6)^2 + 4(6) + 24$$
$$f(6) = -36 + 24 + 24$$
$$f(6) = -12 + 24$$
$$f(6) = 12$$

Teamwork: 1. Tommy has $100 in the bank and saves $20 per day. This can be represented as $m(d) = 100 + 20d$, where *m(d)* is the amount he saves after *d* number of days. Find the amount he has in the bank after 4 days both graphically and algebraically.



Write a statement with your conclusion:

After 4 days, Tommy will have $180 in the bank.

Now solve algebraically:

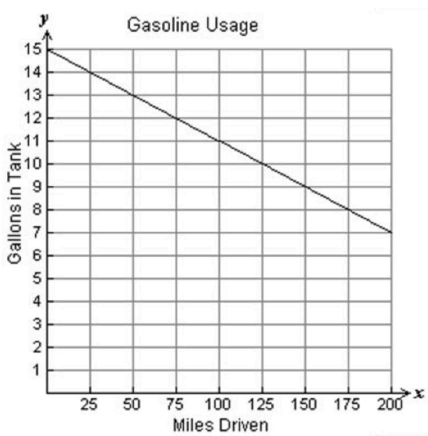
$m(d) = 100 + 20d$

$m(4) = 100 + 20(4)$

$m(4) = 100 + 80$

$m(4) = 180$

2. On the graph below, you can see that the more miles you drive, the fewer gallons there are in the tank. This relationship can be represented by the equation $g(m) = 15 - \frac{m}{25}$. Find $g(m)$ when $m = 75$.



Statement:

After 75 miles, there will be 12 gallons in the tank.

Solve Algebraically:

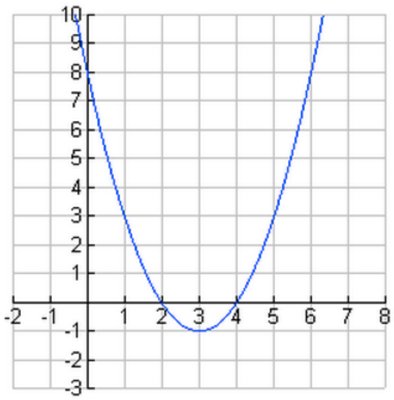
$g(m) = 15 - \frac{m}{25}$

$g(75) = 15 - \frac{75}{25}$

$g(75) = 15 - 3$

$g(75) = 12$

3. This is the graph for the function $f(x) = x^2 - 6x + 8$. Find $f(x)$ when $x = 5$.



Statement:

When the input is 5, the output is 3.

Solve Algebraically:

$$f(x) = x^2 - 6x + 8$$
$$f(5) = (5)^2 - 6(5) + 8$$
$$f(5) = 25 - 30 + 8$$
$$f(5) = -5 + 8$$
$$f(5) = 3$$

4. For the graph in #3, find $f(x)$ when $x = 3$

Algebraic Proof:

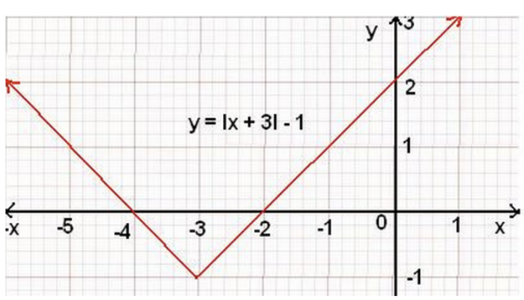
$$f(x) = x^2 - 6x + 8$$
$$f(3) = (3)^2 - 6(3) + 8$$
$$f(3) = 9 - 18 + 8$$
$$f(3) = -9 + 8$$
$$f(3) = -1$$

5. For the graph in #3, find $f(x)$ when $x = 0$

Solve Algebraically:

$$f(x) = x^2 - 6x + 8$$
$$f(0) = (0)^2 - 6(0) + 8$$
$$f(0) = 0 - 0 + 8$$
$$f(0) = 0 + 8$$
$$f(0) = 8$$

6. This is the graph for the function $f(x) = |x + 3| - 1$. Find $f(x)$ when $x = -4$.



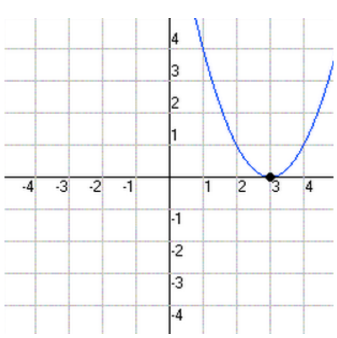
Statement:

When the input value is -4, the output value is 0.

Solve Algebraically:

$$f(x) = |x + 3| - 1$$
$$f(-4) = |(-4) + 3| - 1$$
$$f(-4) = |-1| - 1$$
$$f(-4) = 1 - 1$$
$$f(-4) = 0$$

EXIT TICKET   Below is the graph for $g(x) = x^2 - 6x + 9$. Find $g(x)$ when $x = 1$.



Statement:

When the input value is 1, the output value is 4.

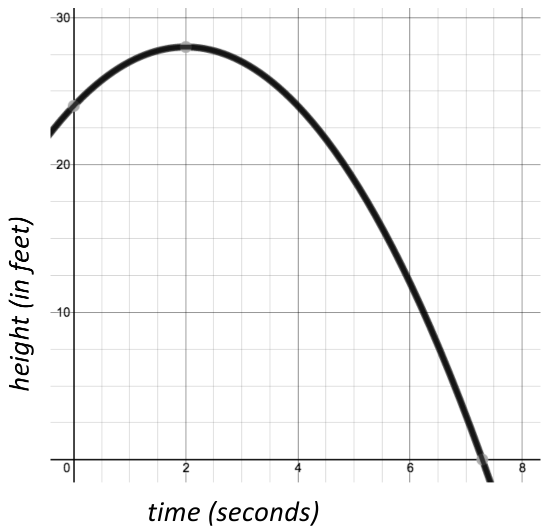
Solve Algebraically:

$$g(x) = x^2 - 6x + 9$$
$$g(1) = (1)^2 - 6(1) + 9$$
$$g(1) = 1 - 6 + 9$$
$$g(1) = -5 + 9$$
$$g(1) = 4$$

MA#______: Evaluating Functions Graphically and Algebraically (F-IF.2) Name:____________________________

O2.3 and 2.4-Today you will learn to find the solution to a problem using both a graph and an equation!

We Do: Here's a graph that represents the height of a ball thrown from a rooftop. It can be expressed by the equation $f(t) = -t^2 + 4t + 24$, where *f(t)* is the height of the ball after *t* seconds. What is the ball's height after 2 seconds?



Graphically:

1. Find your input value of 2 seconds on the *x*-axis.
2. Move your finger vertically until it reaches the graphed function.
3. Read the height value where your finger is on the *y*-axis.

Write a statement as your solution:

Algebraically: Substitute *t* = 2 for the equation

$$f(t) = -t^2 + 4t + 24$$

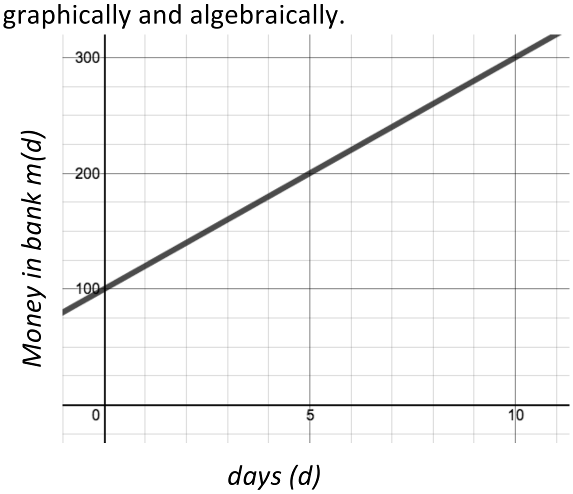
You Try: Using the same graph, find the height of the ball after 6 seconds.

Using the graph, what did you find?

Now solve it algebraically:

$f(t) = -t^2 + 4t + 24$

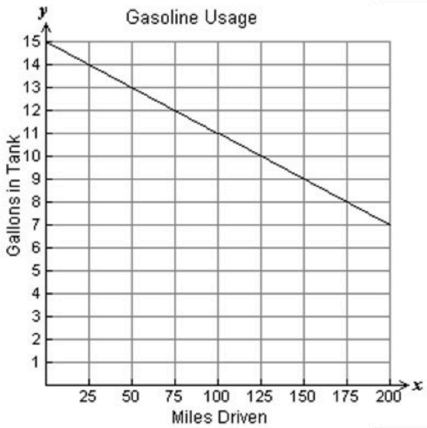
Teamwork: 1. Tommy has $100 in the bank and saves $20 per day. This can be represented as $m(d) = 100 + 20d$, where *m(d)* is the amount he saves after *d* number of days. Find the amount he has in the bank after 4 days both graphically and algebraically.



Write a statement with your conclusion:

Now solve algebraically:

2. On the graph below, you can see that the more miles you drive, the fewer gallons of gas there are in the tank. This relationship can be represented by the equation $g(m)=15-\frac{m}{25}$. Find $g(m)$ when $m=75$.

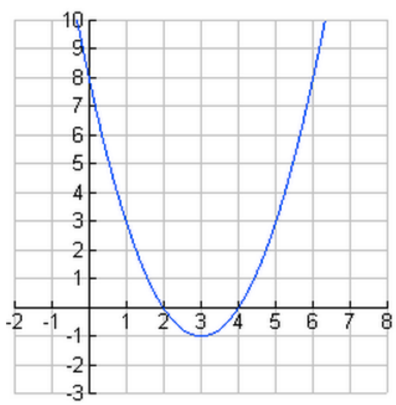


Statement:

Solve Algebraically:

$g(m)=15-\frac{m}{25}$

3. This is the graph for the function $f(x)=x^2-6x+8$. Find $f(x)$ when $x=5$.



Statement:

Solve Algebraically:

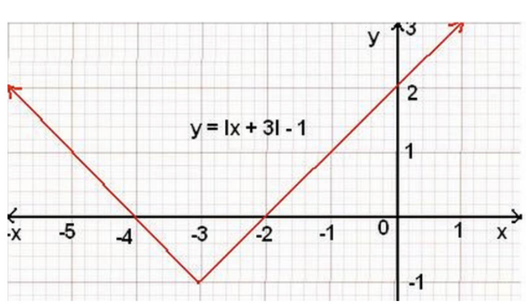
4. For the graph in #3, find $f(x)$ when $x=3$

Algebraic Proof:

5. For the graph in #3, find $f(x)$ when $x=0$

Solve Algebraically:

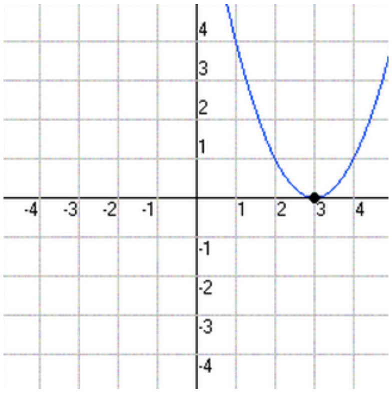
6. This is the graph for the function $f(x)=|x+3|-1$. Find $f(x)$ when $x=-4$.



Statement:

Solve Algebraically:

EXIT TICKET Below is the graph for $g(x) = x^2 - 6x + 9$. Find $g(x)$ when $x = 1$.



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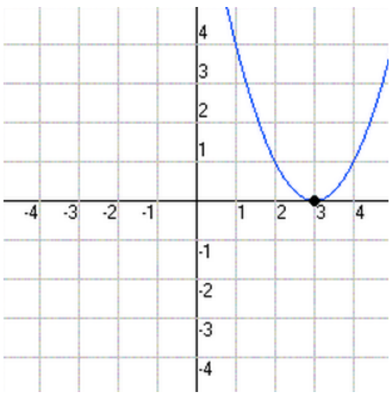

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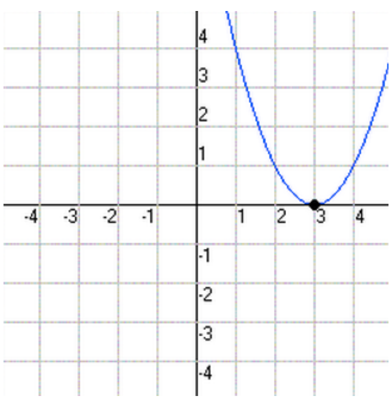

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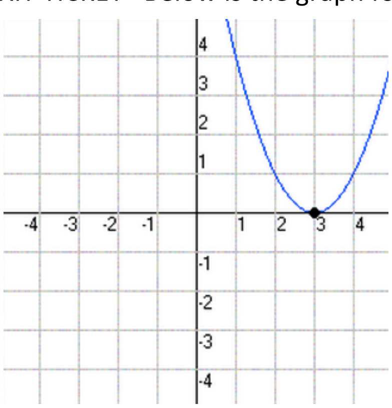

Statement:

Solve Algebraically: