Day 2 – Forms of a Quadratic

Task 1. For each of the following situations, answer these three questions:

A. Find the y-intercept of this function and describe what the y-intercept means in context of the given situation.
B. Find the vertex of this function and describe what the vertex means in context of the given situation.
C. Find the zeros of this function and describe what the zeros means in context of the given situation.

1. Larry launched a rocket from the rooftop of a building. This function models the height of the rocket over time(t).

$$H(t) = -16t^2 + 96t + 112$$

A. There is a y-intercept when x is 0 (or t in this case). Also, this function is written in Standard Form, which tells the "c" is our y-intercept.

$H(0) = -16(0)^2 + 96(0) + 112$

$H(0) = 112$ (0 ↑ t, 112 ↑ y)

The y-intercept is (0, 112), which means the rocket is launched from a rooftop 112 units high.

B. The vertex can be found by finding the axis of symmetry first using the formula $t = \frac{-b}{2a}$ and then substituting that value into our H(t) function.

$H(t) = -16t^2 + 96t + 112$

$a = -16 \quad b = 96 \quad c = 112$

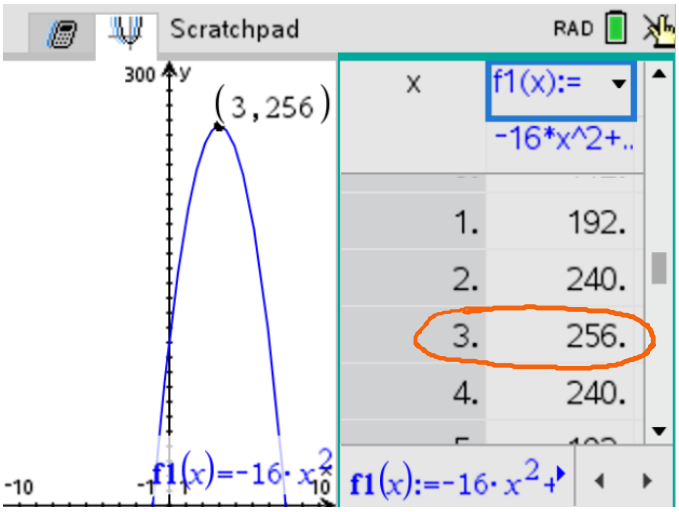
$t = \frac{-96}{2(-16)} = \frac{-96}{-32} = 3$

$H(3) = -16(3)^2 + 96(3) + 112$ Use your calculator.

$H(3) = 256$

or

The vertex can be found by using the graph or table of $H(t)$.



Remember, the vertex is the maximum or minimum point; also, remember that quadratics are symmetrical.

The vertex is (3, 256), which means the rocket reaches its maximum height of 256 units at time $t = 3$.

C. Remember, zeros is another name for x-intercepts and there is an x-intercept when y is 0.

$H(t) = -16t^2 + 96t + 112$ $H(t)$ is y

$0 = -16t^2 + 96t + 112$

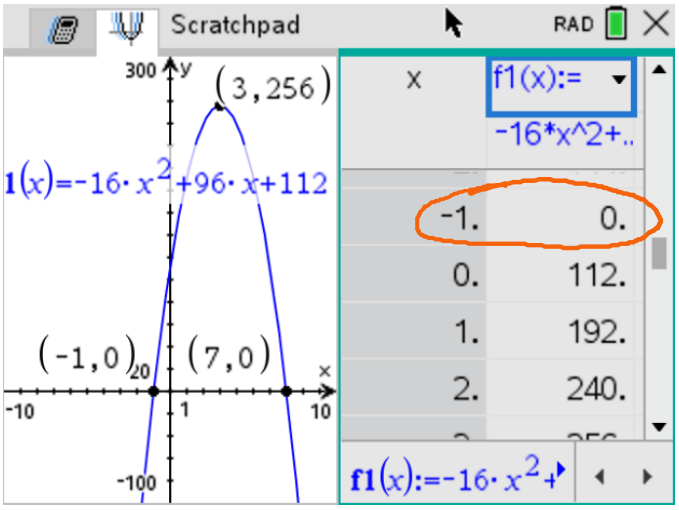
$0 = -16(t^2 - 6t - 7)$ GCF

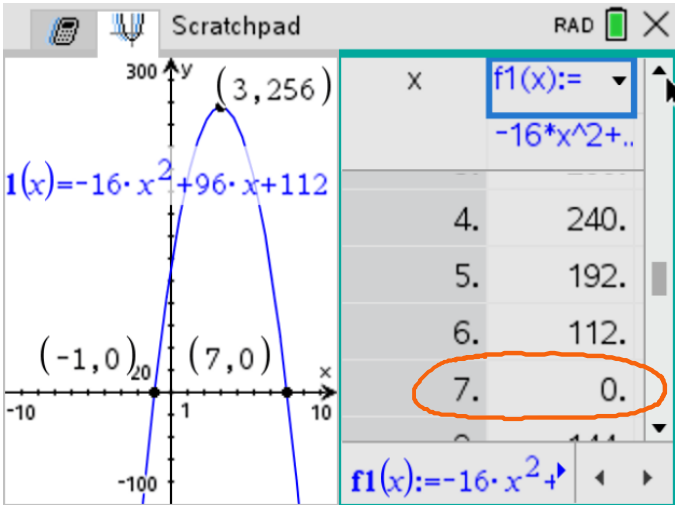
$0 = -16(t - 7)(t + 1)$ Find

$t = 7$ and $t = -1$

Change the sign of number in parenthesis.

or





The zeros occur at $t = -1$ and $t = 7$.

The zeros represent when the rocket

has a height of 0 (or when it is on the ground). $t=-1$ is an extraneous solution because we cannot have a negative time (the rocket launched at $t=0$) and $t=7$ is when the rocket landed.

2. The height of John's rocket followed this function.

$$y = -16(t-18)(t+2)$$

A. The y-intercept is when x is 0 (or t in these cases).

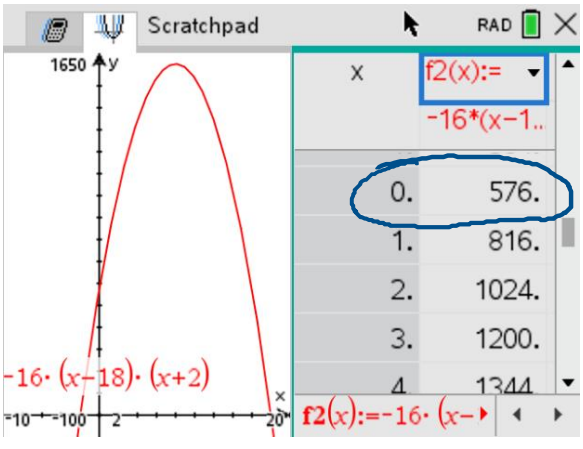
$y = -16(0-18)(0+2)$

$y = -16(-18)(2)$

$y = 576$

Use your calculator.

or



The rocket launches from an initial height of 576 units at time $t=0$.

B. The vertex can be found by knowing the axis of symmetry, which cuts the parabola in half. The x-intercepts for $y = -16(t-18)(t+2)$ are $(18,0)$ and $(-2,0)$.

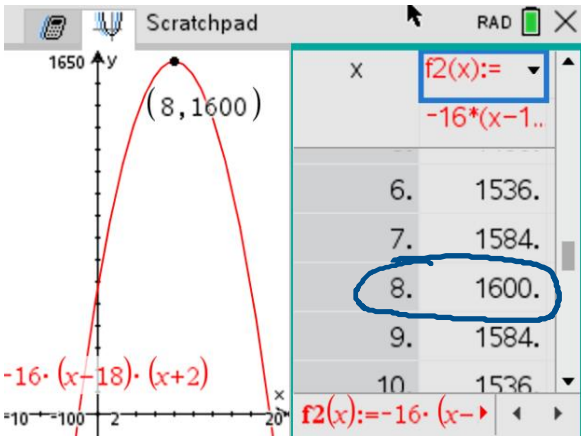
The number in the middle of 18 and -2 is 8.

$y = -16(8-18)(8+2)$

$y = -16(-10)(10)$

$y = -16(-100)$

$y = 1600$ or



The vertex is $(8,1600)$, which means the rocket reaches its max height of 1600 units at time $t=8$.

C. Zeros (or x-intercepts) are when $y = 0$ and this function $y = -16(t-18)(t+2)$ is already written in Factored Form.

$0 = -16(t-18)(t+2)$

$t = 18$ and $t = -2$

Again, change the sign of the numbers in parenthesis.

The zeros represent when the height of the rocket is 0 (or is on the ground). $t = -2$ is an extraneous solution (as the rocket launches at $t = 0$) and $t = 18$ is when the rocket lands.

3. Sherry collected the following data from a sensor on a rocket she designed and launched.

x seconds	0	1	2	3	4	5	6	7
y feet	-160	-72	0	56	96	120	128	120

A. The y-intercept is when x is 0.

The y-intercept is (0, -160) which means when the rocket was

launched at 0 seconds, the rocket was at a height of -160 feet (which means the rocket was probably launched below ground level).

x seconds	0	1	2	3	4	5	6	7
y feet	-160	-72	0	56	96	120	128	120

B. The vertex is the center point of a quadratic (which is symmetrical or the same on both sides).

The vertex is (6, 128). This represents that the rocket reaches its max height of 128 feet at 6 seconds.

x seconds	0	1	2	3	4	5	6	7
y feet	-160	-72	0	56	96	120	128	120
x	12	11	10	9	8	7		

C. Remember, zeros occur when y

is 0 and quadratics are symmetrical. So, we need to finish the table (similar to our Angry Birds Project).

y is 0 at x = 2 and x = 10.

These two values represent when the rocket was at ground level in seconds.

Task 2 Directions: Using the digits 0 to 9 at most one time each, fill in the boxes to create three equations that produce the exact same parabola.

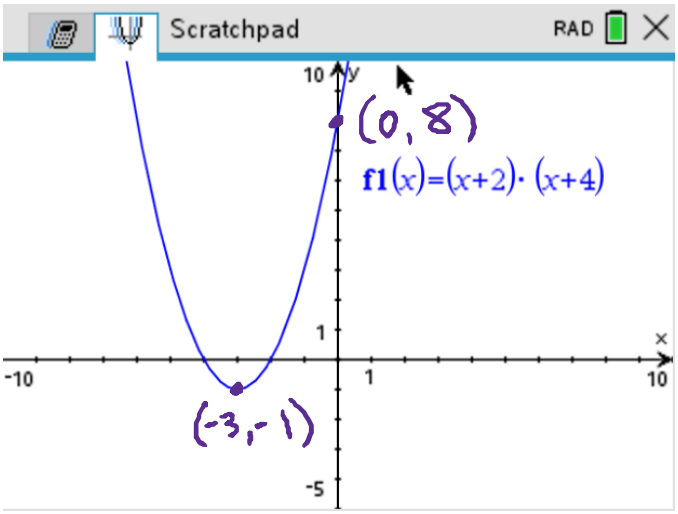
$y = (x+\square)^2-\square$ Vertex Form

$y = (x+\square)(x+\square)$ Factored Form

$y = x^2 + \square x + \square$ Standard Form

This task involves mostly guess and check, but knowing that Vertex Form gives us the Vertex,

Factored Form gives us the X-intercepts, and Standard Form gives us the Y-intercept. Also, remember, that the sign will change when it "portals" through the parenthesis.



I graphed in factored form and kept my numbers close together. As you can see, I chose x-intercepts of (-2,0) and (-4,0) which is $y=(x+2)(x+4)$ because of changing the sign in parenthesis. Inbetween $x=-2$ and $x=-4$ is $x=-3$ (the axis of symmetry) which tells me

the vertex is is $(-3,-1)$. This point gives the equation $y=(x+3)^2-1$ because of changing the sign in parenthesis. So far, I have four different numbers. Next, I see the graph tells me the y-intercept is $(0,8)$, which gives the equation $y=x^2+\square x+8$. Now, since I'm still okay with having different numbers, the last number I need to find is my "b" in Standard Form. All I need to do is convert either Factored Form or Vertex Form into Standard Form. I'll choose Factored Form →

$y = (x+2)(x+4)$

$y = x^2 + 4x + 2x + 8$

$y = x^2 + 6x + 8$

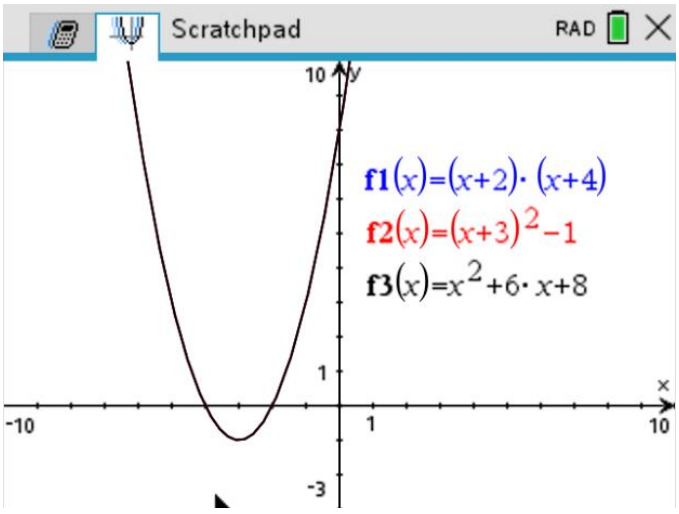
I have not used the number 6 yet, so I'm good.

$y = (x+\boxed{3})^2 - \boxed{1}$

$y = (x+\boxed{2})(x+\boxed{4})$

$y = x^2 + \boxed{6}x + \boxed{8}$

The equations I ended up with have all different numbers from 0 to 9.



And when I graph all 3, I see they are the same. I could also look at the table for each.