Bellwork

1. List all the key elements for the graph of a quadratic function. (Any graph that has the equation $y = ax^2 + bx + c$)

2. How do you find the Axis of Symmetry given a function in standard form?

Real World Application

Preview:

In this unit we will be looking at 4 of the ways that quadratic equations are used in the real world.

There are several other uses, however we won't have time to explore all of the uses.

Maximum Height - Object Thrown Upward

General Equation (Standard Form):

$h(t) = -16t^2 + v_o t + h_o$

Where:

1. $h(t)$ = the height after t seconds.
2. t = time AFTER release in seconds.
3. v_o = the initial velocity in feet per second.
   (For these problems this is always +)
4. h_o = the initial height of the object in feet.
   (The point of release for the object)
5. -16 = the effect of gravity on the object.

Maximizing Area

General Equation (Intercept Form):

$$A(x) = (L - x)(w + x)$$

Where:

1. $A(x)$ = the area of the enclosure.
2. L = the initial length.
3. w = the initial width.
4. x = the amount of space removed from the length given to the width to form the largest possible area.

Maximum Height - Object Thrown Downward

General Equation (Standard form):

$$h(t) = -16t^2 + v_o t + h_o$$

Where:

1. $h(t)$ = the height after t seconds.
2. t = time AFTER release in seconds.
3. v_o = the initial velocity in feet per second.
   (For these problems this is always -)
4. h_o = the initial height of the object.
   (The point of release for the object)
5. -16 = the effect of gravity on the object.

Important: **The AOS will not be on the graph!**

Maximizing Profit

General Equation (Intercept Form):

$$C(r) = (P + dr)(S + Lr)$$

COST SALES

Where:

1. C(r) = the maximum profit you will receive.
2. P = initial price you are charging.
3. d = difference in cost you are considering
   (+ if increasing, - if decreasing cost)
4. S = initial sales
5. L = difference in sales you are expecting to see
   (+ if increasing sales, - if decreasing sales)
6. r = the number of increases and losses/gains from the shift in cost.

Graphing Each of the Functions: Standard Form

Process:

1. Find the Axis of Symmetry using t = -b/(2a)
2. Create a chart with the AOS in the middle of the chart. (The chart starts with t = 0)
3. Extend the chart until you find the x-int. (Only using positive values)
4. Identify the y-intercept (0,c)
5. Create the graph of the function making your scale showing as much detail as you can.

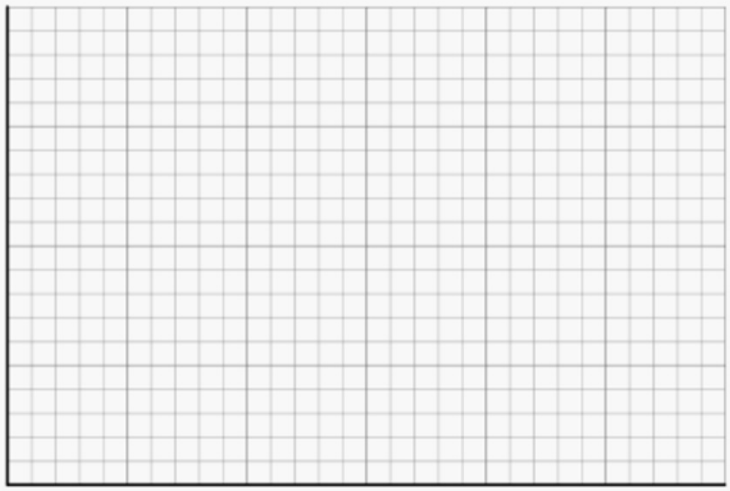
Graphing Each of the Functions: Intercept Form

Process:

1. Set each set of ( ) = 0 and solve for the variable. (These are your x-intercepts)
2. $\frac{\text{Largest Value - Smallest Value}}{2}$
   (This is your AOS)
3. Find the value of Lw or PS (depending on the problem type) this is your y-intercept.
4. Create the graph of the function making your scale showing as much detail as you can.

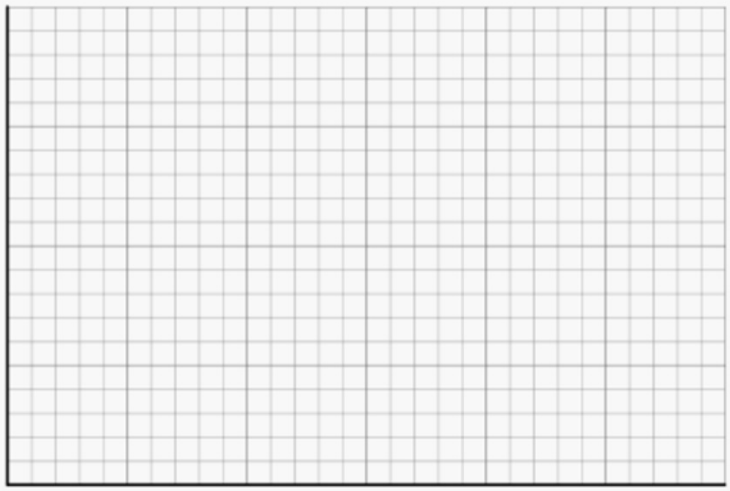
Example: Upward Velocity

1. Mason hits the soccer ball off his head at 64 feet per second from a height of 8 feet. $h(t) = -16t^2 + 64t + 8$



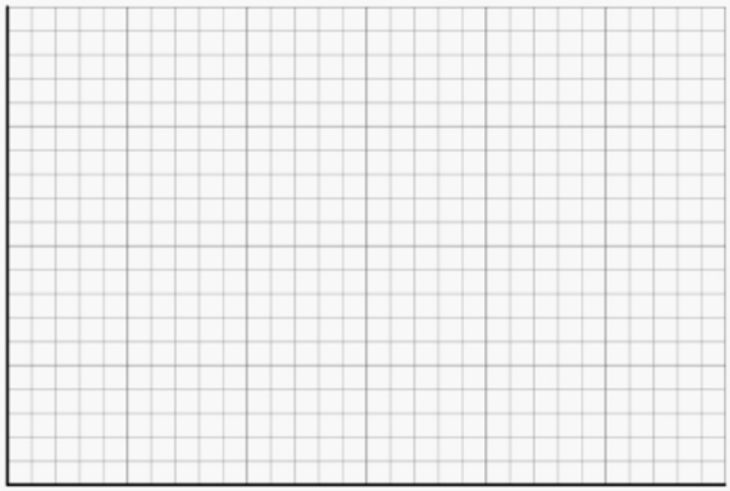
Example: Maximizing Area

2. Mr. Maynard wants to put together a small garden behind the garage. The space that they have is 125 feet long and 25 feet wide. How can they maximize the amount of area they have to plant a garden? $A(x) = (125 - x)(25 + x)$



Example: Downward Velocity

3. Coach Kearney heads up to the top of the press box but realizes that he forgot to give Kameron the keys to open up the locker room at half time. Kearney throws the keys down at 10 feet per second from a height of 200 feet. $h(t) = -16t^2 - 10t + 200$



Example: Maximizing Profits

4. The boy scouts are selling popcorn this year and as a special for the holidays they are selling white chocolate covered popcorn with peppermint bits in it for $10 per tin. Based off sales of another group that tried this one year they project that they will sell 1500 units for this price. In order to maximize their profits though they are thinking about increasing their price by increments of $1. For every increase they believe that they will lose only 100 sales.

   How can they maximize their profits? C(r) = (10 + 1r)(1500 - 100r)