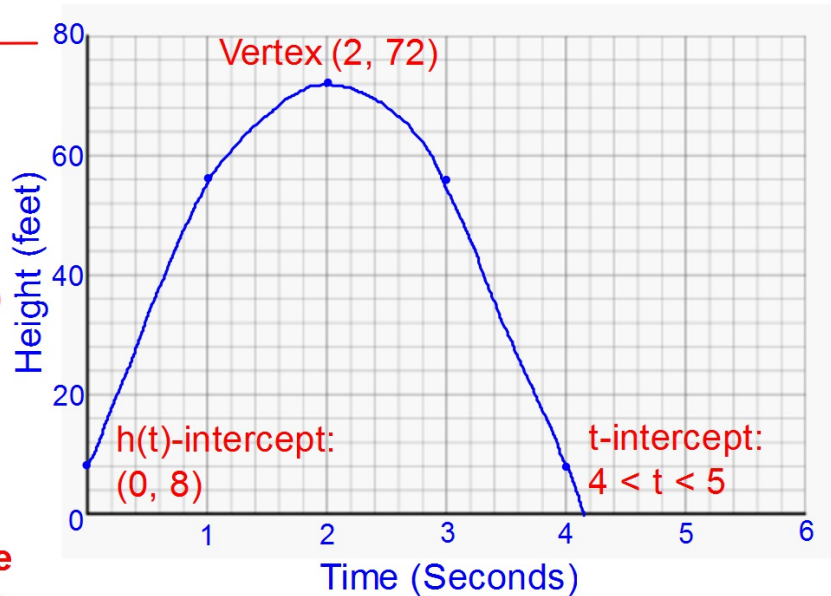


Example: Upward Velocity

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

$$\text{AOS: } t = \frac{-(64)}{2(-16)} = \frac{-64}{-32} = 2$$

t	$h(t) = -16t^2 + 64t + 8$	(t, h(t))
0	$h(0) = -16(0)^2 + 64(0) + 8$	(0, 8)
1	$h(1) = -16(1)^2 + 64(1) + 8$	(1, 56)
2	$h(2) = -16(2)^2 + 64(2) + 8$	(2, 72)
3	$h(3) = -16(3)^2 + 64(3) + 8$	(3, 56)
4	$h(4) = -16(4)^2 + 64(4) + 8$	(4, 8)
5	$h(5) = -16(5)^2 + 64(5) + 8$	(5, -72)



NOTE: See next page for more explanation of this problem.

Explanation of Example #1

Determining the scales:

1. *t*-axis (the *x*-axis) - The chart goes from 0 to 5 becoming negative for the *h*(*t*) meaning the ball goes underground. The chart has 6 darker lines that we can use going up and down. Since we only need to show from 0 to 5 we can go by 1's.
2. *h*(*t*)-axis (the *y*-axis) - The chart shows the largest value to be 72. The chart has 4 darker lines that we can use going left to right. If we make each darker line 20, each of the smaller lines represents 4 feet.

Creating the chart:

How do you know what values to use for the *t*-values when plugging into the function?

We found the AOS to be $t = 2$. Using this and the fact that any time a ball is tossed into the air it doesn't stay there very long, we can go by 1's until we get to a negative number for the output after plugging it in. This is because a negative number would represent the ball going underground.

h(*t*)-intercept (The *y*-intercept):

(0, 8) means that before any time went past, the ball was release from 8 feet.

Vertex:

(2, 72) means that after 2 seconds the ball had reached a height of 72 feet. 72 would then be your MAXIMA.

t-intercept (The *x*-intercept):

$4 < t < 5$ means the ball hit the ground after 4 seconds and 5 seconds in the air.

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? $A(x) = (125 - x)(25 + x)$ **NOTE: See next page for more explanation of this problem.**

X-intercepts:

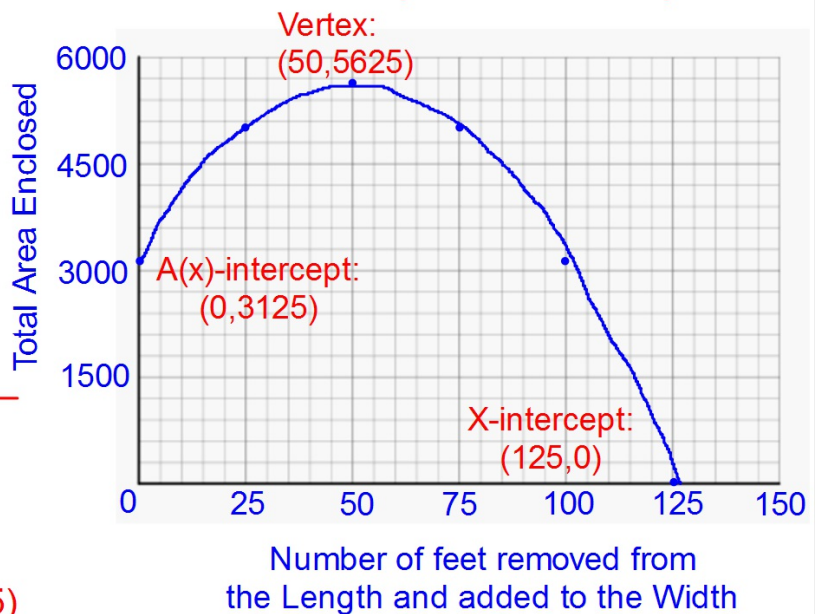
$$125 - x = 0 \text{ \& } 25 + x = 0$$

$$\begin{array}{r} +x \quad +x \\ \hline 125 = x \end{array} \quad \begin{array}{r} -25 \quad -25 \\ \hline x = -25 \end{array}$$

Axis of Symmetry:

$$x = \frac{125 + (-25)}{2} = 50$$

x	$A(x)=(125-x)(25+x)$	(x, A(x))
0	$(125-0)(25+0)$	(0,3125)
25	$(125-25)(25+25)$	(25,5000)
50	$(125-50)(25+50)$	(50,5625)
75	$(125-75)(25+75)$	(75,5000)
100	$(125-100)(25+100)$	(100,3125)
125	$(125-125)(25+125)$	(125,0)



Explanation of Example #2

X-intercepts:

Set each factor = 0 and solve for x. The only positive one will help us create our scale for the x-axis. The intercepts are (125,0) & (-25,0)

Meaning - (125,0) means that Mr. Maynard has taken all of the length and added it to the width leaving him with no area.

(-25,0) means that Mr. Maynard has taken all of the width and added it to the length leaving him with no area.

Axis of Symmetry:

The AOS is the average of the x-intercepts. Add the x-intercepts together and divide by 2. The AOS is $x = 50$.

Determining the scales:

1. X-axis - Since the x-intercept is 125, we have to go to at least 125. To do this nicely, and spread it out as much as we can, let's go by 25's.
2. A(x)-axis - After plugging in 0 - 125 counting by 25's we see that the vertex is at (50,5625). This means that the axis must cover at least 5625. We could go by 2000's, but if we go by 1500's we cover the 5625 and have only a little room above it. Each step = 300 ft².

Vertex:

(50,5625) means if Mr. Maynard shifts 50 foot from the length and adds it to the width then he will have a garden with the maximum amount of area.

A(x)-intercept:

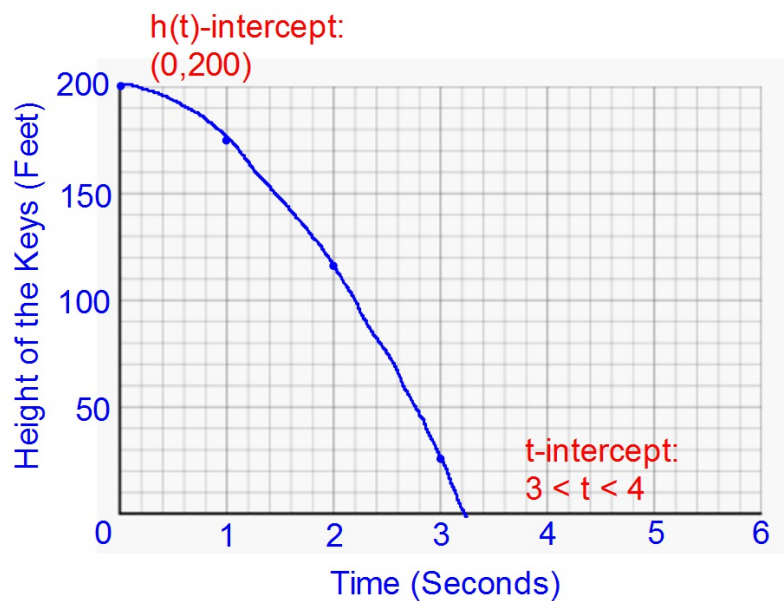
(0,3125) gives us the original area of Mr. Maynard's garden.

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. $h(t) = -16t^2 - 10t + 200$

$$\text{AOS: } t = \frac{-(-10)}{2(-16)} = \frac{-10}{32} = \frac{-5}{16}$$

t	$h(t) = -16t^2 - 10t + 200$	$(t, h(t))$
0	$h(0) = -16(0)^2 - 10(0) + 200$	$(0, 200)$
1	$h(1) = -16(1)^2 - 10(1) + 200$	$(1, 174)$
2	$h(2) = -16(2)^2 - 10(2) + 200$	$(2, 116)$
3	$h(3) = -16(3)^2 - 10(3) + 200$	$(3, 26)$
4	$h(4) = -16(4)^2 - 10(4) + 200$	$(4, -96)$



NOTE: See next page for more explanation of this problem.

Explanation of Example #3

Determining the scales:

1. *t*-axis (the *x*-axis) - The chart goes from 0 to 4 becoming negative for the $h(t)$ meaning the keys go underground. Since we only need to show from 0 to 4 we can go by 1's.
2. $h(t)$ -axis (the *y*-axis) - The chart shows the largest value to be 200. If we make each darker line 50, each of the smaller lines represents 10 feet.

Creating the chart:

How do you know what values to use for the *t*-values when plugging into the function?

We found the AOS to be negative. However, we remember that objects that are thrown are not in the air for very long. This means we can go by 1's until we get to a negative number for the output after plugging it in. This negative means that the keys have been buried underground.

$h(t)$ -intercept (The *y*-intercept):

(0,200) means that before any time went past, the keys were released from 200 feet.

Vertex:

Since the AOS is negative, the vertex is not on the graph. This means that the Maxima would be the initial release height of 200 feet.

t-intercept (The *x*-intercept):

$3 < t < 4$ means the keys hit the ground after being in the air between 3 seconds and 4 seconds.

Explanation of Example #4

r-intercepts:

Set each factor = 0 and solve for r. The only positive one will help us create our scale for the r-axis. The intercepts are (15,0) & (-10,0)

Meaning - (15,0) means that the boy scouts are charging 15 increments of \$1 more per tin (Meaning \$25 per tin now) and no one is buying them any now so they are making no money.

(-10,0) means they are removing \$10 increments of \$1 meaning they are now giving the tins away for free and making no \$.

Axis of Symmetry:

The AOS is the average of the r-intercepts. Add the r-intercepts together and divide by 2. The AOS is $r = 2.5$

Determining the scales:

1. r-axis - Since the r-intercept is 15, we have to go to at least 15. To do this nicely, and spread it out as much as we can, let's go by 2.5's.
2. C(r)-axis - After plugging in 0 - 15 counting by 2.5's we see that the vertex is at (2.5, \$15625). This means that the axis must cover at least \$15,625. Let's go by \$4000's and cover up to \$16,000. Each step = \$800 in sales.

Vertex:

(2.5, \$15625) means if the boy scouts increase the cost by \$1(2.5 increases) = \$2.50 they will make a profit of \$15,625.

A(x)-intercept:

(0, \$15000) tells us that the boy scouts are currently making \$15,000 from selling the tins at the current rate of \$5 per tin without raising the cost.