Real-World Applications – Day 6

Unit 2B: Quadratic Functions - Modeling

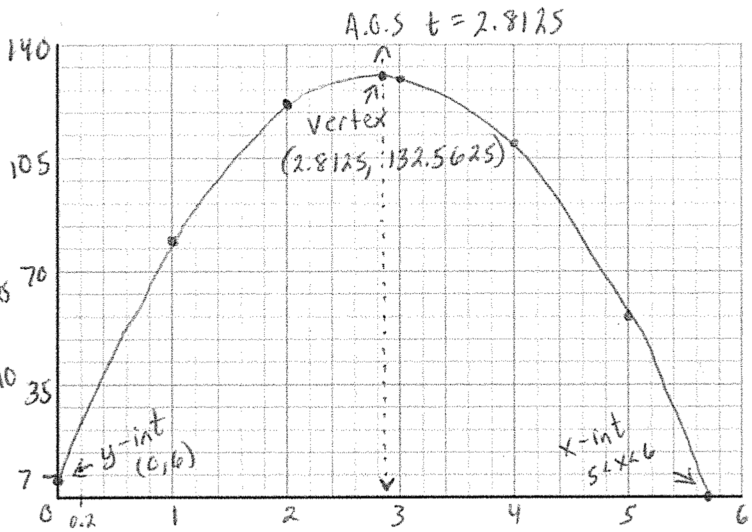
For each of the following:

- **A. Identify the x-intercept(s) and tell what they mean**
- **B. Identify the y-intercept and tell what it means**
- **C. Identify the maxima/minima of the function and tell what it means**
- **D. Graph and label the function**

1. Kevin throws a baseball at 90 feet per second from a height of 6 foot. The equation that shows the path of the baseball is $h(t) = -16t^2 + 90t + 6$.

A.O.S $\rightarrow t = \frac{-b}{2a} = \frac{-90}{2(-16)} = \frac{-90}{-32} = 2.8125$

Scale: $\frac{132.5625}{4} = 33.140625$ Round to 35 or 40



Scale $\frac{6}{6} = 1$ No need to round.

t	$h(t) = -16t^2 + 90t + 6$	$(t, h(t))$
0	$h(0) = -16(0)^2 + 90(0) + 6$	(0, 6)
1	$h(1) = -16(1)^2 + 90(1) + 6$	(1, 80)
2	$h(2) = -16(2)^2 + 90(2) + 6$	(2, 122)
2.8125	$h(2.8125) = -16(2.8125)^2 + 90(2.8125) + 6$	(2.8125, 132
3	$h(3) = -16(3)^2 + 90(3) + 6$	(3, 132)
4	$h(4) = -16(4)^2 + 90(4) + 6$	(4, 110)
5	$h(5) = -16(5)^2 + 90(5) + 6$	(5, 56)
6	$h(6) = -16(6)^2 + 90(6) + 6$	(6, -30)

Reached 0 or a neg STOP

A) $5 < x < 6$ (5.6908947, 0) Time for ball to hit ground.

B) (0, 6) Point of release.

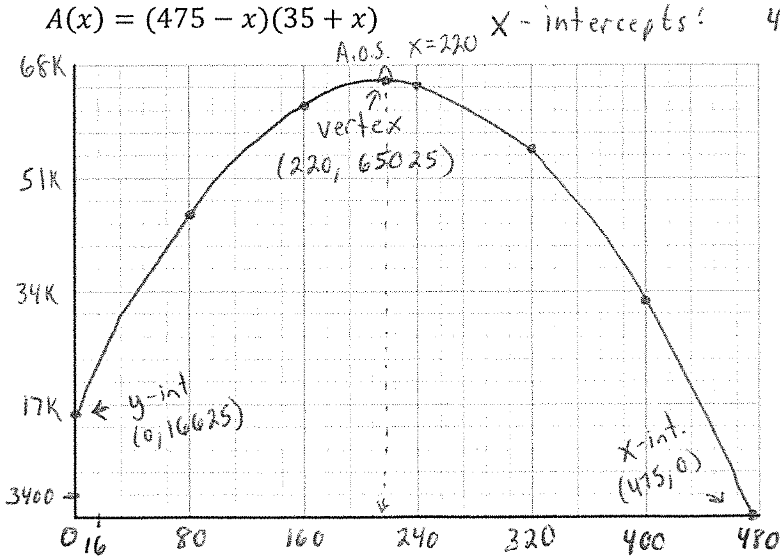
C) 132.5625 Max height obtained before gravity takes over.

2. A farmer has a plot of land marked off for a garden, but believes that he can put more in the space then he is currently by moving one side in, and another side out. The current plot of land that he has marked off is 475 foot by 35 feet. The area they cover as they walk is given by the equation $A(x) = (475 - x)(35 + x)$

X - intercepts: $475 - x = 0$, $+x \quad +x$, $475 = x$ $\qquad$ $35 + x = 0$, $-35 \quad -35$, $x = -35$

AOS $\rightarrow x = \frac{475 + (-35)}{2} = \frac{440}{2} = 220$

Scale $\frac{65025}{4} = 16256.25$ Round to 17K, 18K, 20K



Create Table using scale from x-axis

X	$A(x) = (475 - x)(35 + x)$	$(x, A(x))$
0	$A(0) = (475 - 0)(35 + 0)$	(0, 16625)
80	$A(80) = (475 - 80)(35 + 80)$	(80, 45425)
160	$A(160) = (475 - 160)(35 + 160)$	(160, 61425)
220	$A(220) = (475 - 220)(35 + 220)$	(220, 65025)
240	$A(240) = (475 - 240)(35 + 240)$	(240, 64625)
320	$A(320) = (475 - 320)(35 + 320)$	(320, 55025)
400	$A(400) = (475 - 400)(35 + 400)$	(400, 32625)
475	$A(475) = (475 - 475)(35 + 475)$	(475, 0)

Scale : $\frac{\text{Pos x-int}}{6} = \frac{475}{6} = 79.1\overline{6}$ round to 80

A) (475, 0) Entire length has been removed, No area enclosed.

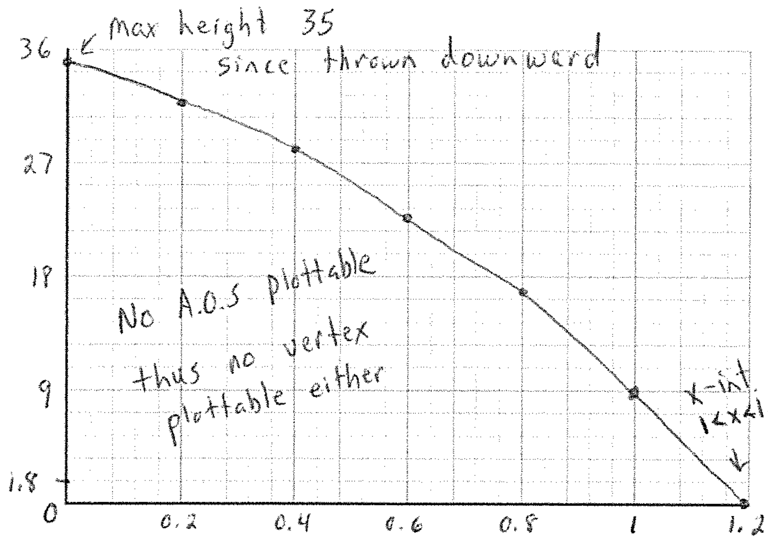
B) (0, 16625) Initial area of the garden

3. John is up in the tree house and is asked to throw down the rope for his brother to climb up to join him. He throws the rope downward at 10 feet per second from a height of 35 feet. This is modeled by the equation

$h(t) = -16t^2 - 10t + 35$

A.O.S. $\rightarrow$ $t = \frac{-b}{2a} = \frac{-(-10)}{2(-16)} = \frac{10}{-32} = -0.3125$

NOT GRAPHABLE



Scale $\frac{35}{4} = 8.75$ round to 9

t	$h(t) = -16t^2 - 10t + 35$	$(t, h(t))$
0	$h(0) = -16(0)^2 - 10(0) + 35$	(0, 35)
0.2	$h(0.2) = -16(0.2)^2 - 10(0.2) + 35$	(.2, 32.36)
0.4	$h(0.4) = -16(0.4)^2 - 10(0.4) + 35$	(.4, 28.44)
0.6	$h(0.6) = -16(0.6)^2 - 10(0.6) + 35$	(.6, 23.24)
0.8	$h(0.8) = -16(0.8)^2 - 10(0.8) + 35$	(.8, 16.76)
1	$h(1) = -16(1)^2 - 10(1) + 35$	(1, 9)
1.2	$h(1.2) = -16(1.2)^2 - 10(1.2) + 35$	(1.2, -.04)

Plugged in 0, 1, and 2 first. Since 2 is neg, broke up into small intervals

Scale: Guessed 0.2 and tried it.

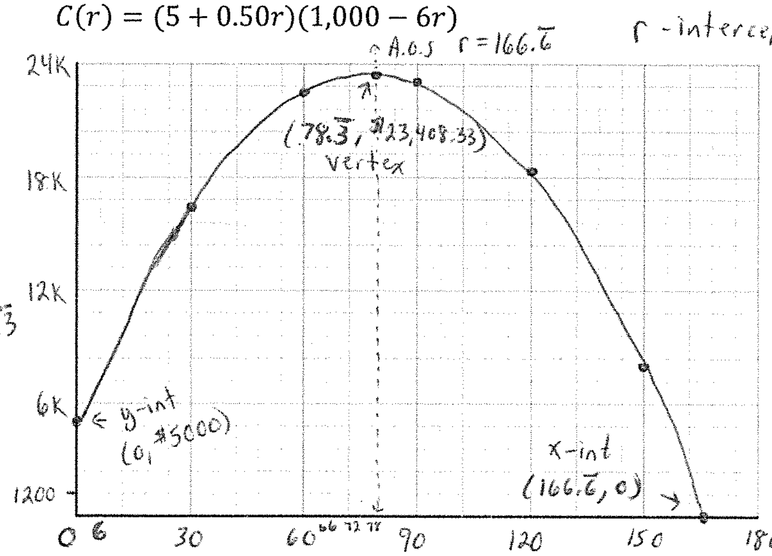
(A) $1 < x < 1.2$ time it took to hit the ground.

(B) (0, 35) Height of release of the rope.

(C) 35 ft since object thrown down, the max height is the height of release.

4. The senior class decides that they want to sell Krispy Kreme donuts for a senior fundraiser again. The suggested cost is \$5 per dozen, and at this cost they sold 1000 units last year. Mr. Brewer has projected that for every \$0.50 increase in cost that the students would only lose 6 units for this year's sales. The maximum profit and the amount of increase you should charge is given by the equation

$C(r) = (5 + 0.50r)(1{,}000 - 6r)$



Scale: $\frac{23408.\overline{3}}{4} = 5852.08\overline{3}$ round to 6000

r-intercepts:

$5 + 0.50r = 0$
$-5 \quad -5$
$\frac{0.5r}{0.5} = \frac{-5}{0.5}$
$r = -10$

$1000 - 6r = 0$
$+6r \quad +6r$
$\frac{1000}{6} = \frac{6r}{6}$
$166.\overline{6} = r$

AOS: $r = \frac{166.\overline{6} + (-10)}{2} = 78.\overline{3}$

r	$C(r) = (5 + 0.5r)(1000 - 6r)$	
0	$C(0) = (5 + 0.5(0))(1000 - 6(0))$	(0, 5000)
30	$C(30) = (5 + 0.5(30))(1000 - 6(30))$	(30, 16400)
60	$C(60) = (5 + 0.5(60))(1000 - 6(60))$	(60, 22400)
$78.\overline{3}$	$C(78.\overline{3}) = (5 + 0.5(78.\overline{3}))(1000 - 6(78.\overline{3}))$	$(78.\overline{3}, 23408.\overline{3})$
90	$C(90) = (5 + 0.5(90))(1000 - 6(90))$	(90, 23000)
120	$C(120) = (5 + 0.5(120))(1000 - 6(120))$	↓
150	$C(150) = (5 + 0.5(150))(1000 - 6(150))$	
$166.\overline{6}$	$C(166.\overline{6}) = (5 + 0.5(166.\overline{6}))(1000 - 6(166.\overline{6}))$	(120, 18200)
		(150, 8000)
		$(166.\overline{6}, 0)$

Scale: $\frac{166.\overline{6}}{6} = 27.\overline{7}$ Round to 30

(A) $(166.\overline{6}, 0)$ Increasing the cost by $166.\overline{6}(0.5) = \$83.33$ No one is buying donuts for \$88.33 per dozen

(B) (0, 5000) Initial Sales Before any increase

(C) \$23408.33 Max profit when cost of 1 dz