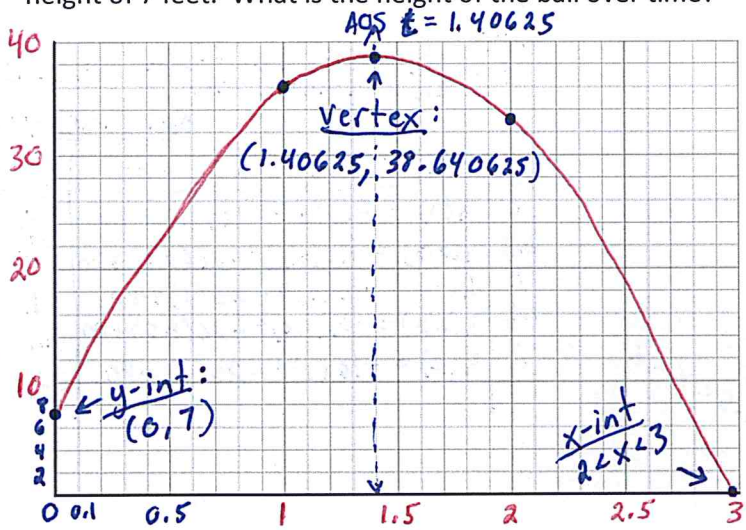
Unit 2B: Quadratic Functions - Modeling

PRE-TEST

For each of the following:

- **A. Write the equation modeled by the given problem**
- **B. Graph the function labeling the VERTEX and the AXIS OF SYMMETRY**
- **C. Identify the x-intercept(s) and tell what they mean**
- **D. Identify the y-intercept and tell what it means**
- **E. Identify the maxima/minima of the function and tell what it means**

1. The local high schools quarterback can throw a football 45 feet per second after releasing it from a height of 7 feet. What is the height of the ball over time?



Scale: $\frac{38.64}{4} = 9.66$ Round to 10

Scale: $\frac{3}{6} = \frac{1}{2} = 0.5$ No need to round

(A) $h(t) = -16t^2 + 45t + 7$

AOS: $t = \frac{-b}{2a} = \frac{-45}{2(-16)} = \frac{-45}{-32} = 1.40625$

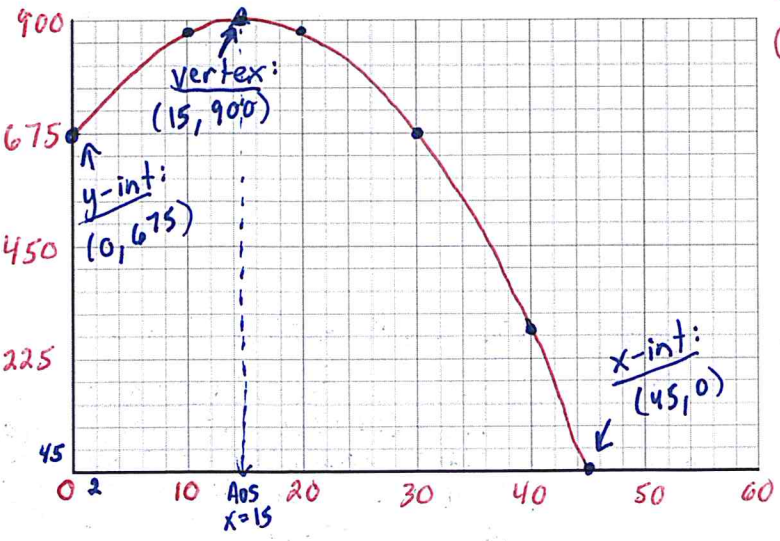
t	$h(t) = -16t^2 + 45t + 7$	$(t, h(t))$
0	$h(0) = -16(0)^2 + 45(0) + 7$	(0, 7)
1	$h(1) = -16(1)^2 + 45(1) + 7$	(1, 36)
1.406	$h(1.40625) = -16(1.40625)^2 + 45(1.40625) + 7$	(1.40625, 38.64)
2	$h(2) = -16(2)^2 + 45(2) + 7$	(2, 33)
3	$h(3) = -16(3)^2 + 45(3) + 7$	(3, -2) Reached a neg y STOP

(C) $2 < x < 3$ Time ball took to hit the ground.

(D) (0, 7) Release height

(E) 38.64 Max height reached before falling do

2. A farmer has noticed that some of the wild animals around have been picking through their garden and want to put a fence around it. The area of land that he wants to fence in is given by the equation $A(x) = (45 - x)(15 + x)$



Scale: $\frac{900}{4} = 225$

Scale: $\frac{\text{Pos x-int}}{6} = \frac{45}{6} = 7.5$ Round to 10

(A) $A(x) = (45 - x)(15 + x)$

(C) $45 - x = 0$ $\quad +x \quad +x$ $\quad 45 = x$ (45, 0) $\quad 15 + x = 0$ $\quad -15 \quad -15$ $\quad x = -15$ (-15, 0) use to create scale

AOS: $x = \frac{45 + (-15)}{2} = \frac{30}{2} = 15$

x	$A(x) = (45 - x)(15 + x)$	$(x, A(x))$
0	$A(0) = (45 - 0)(15 + 0)$	(0, 675)
10	$A(10) = (45 - 10)(15 + 10)$	(10, 875)
15	$A(15) = (45 - 15)(15 + 15)$	(15, 900)
20	$A(20) = (45 - 20)(15 + 20)$	(20, 875)
30	$A(30) = (45 - 30)(15 + 30)$	(30, 675)
40	$A(40) = (45 - 40)(15 + 40)$	(40, 275)
45	$A(45) = (45 - 45)(15 + 45)$	(45, 0)

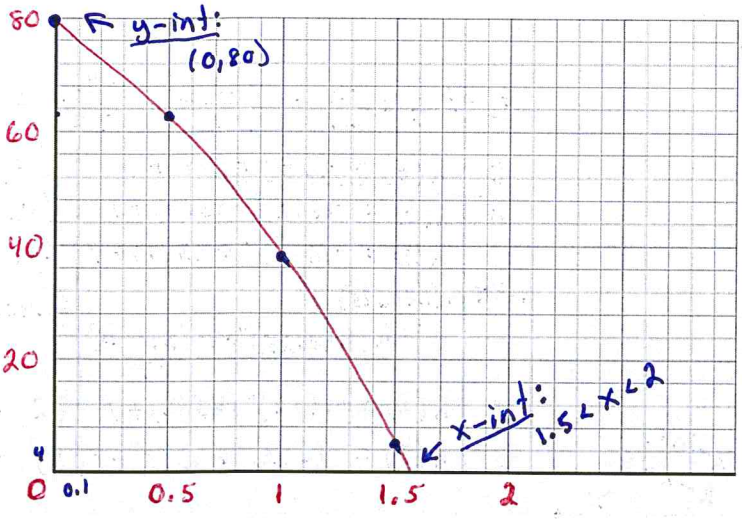
(D) (0, 675) Started with 675 ft² of area.

(E) 900 Max amount of area obtainable.

For each of the following:

- **A. Write the equation modeled by the given problem**
- **B. Graph the function labeling the VERTEX and the AXIS OF SYMMETRY**
- **C. Identify the x-intercept(s) and tell what they mean**
- **D. Identify the y-intercept and tell what it means**
- **E. Identify the maxima/minima of the function and tell what it means**

3. After the semester is over, you discover that the school has changed textbooks and the bookstore will not buy your book back. For fun you decide to climb to the top of a building overlooking a pool and throw your book into it. You throw the book downward at 26 feet per second from a height of 80 feet.



scale: $\frac{2}{6} = \frac{1}{3} = 0.\overline{3}$ Round to 0.5

Ⓐ $h(t) = -16t^2 - 26t + 80$

AOS: $t = \frac{-b}{2a} = \frac{26}{2(-16)} = \frac{26}{-32} = -0.8125$ Not Graphable

t	$h(t) = -16t^2 - 26t + 80$	$(t, h(t))$
0	$h(0) = -16(0)^2 - 26(0) + 80$	(0, 80)
0.5	$h(0.5) = -16(0.5)^2 - 26(0.5) + 80$	(0.5, 63)
1	$h(1) = -16(1)^2 - 26(1) + 80$	(1, 38)
1.5	$h(1.5) = -16(1.5)^2 - 26(1.5) + 80$	(1.5, 5)
2	$h(2) = -16(2)^2 - 26(2) + 80$	(2, −36)

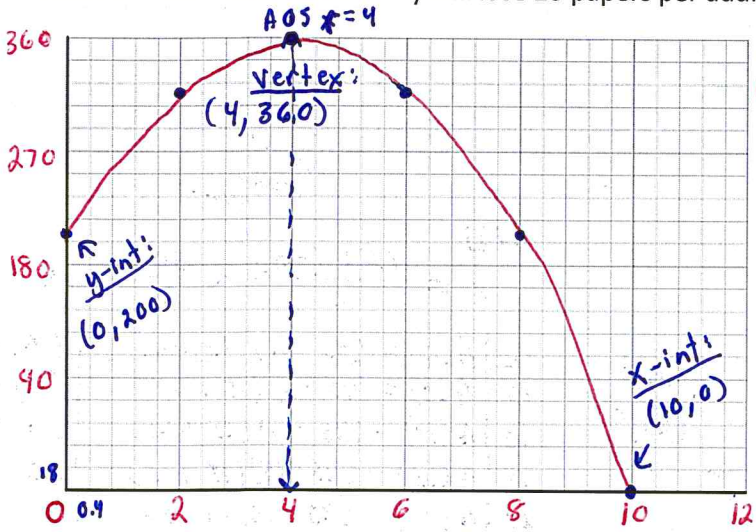
Reached a neg STOP

Ⓒ $1.5 < x < 2$ Time it took the book to hit the water.

Ⓑ (0,80) Height ab book released from

Ⓔ 80 Since book thrown down, Release point also the maxima.

4. The local paper sells the Sunday newspaper for $1 each and averages 200 papers. The people in the business office believe that they will lose 20 papers per additional 50 cents charged.



scale: $\frac{10}{6} = \frac{5}{3} = 1.\overline{6}$ Round to 2

Ⓐ $C(r) = (1 + 0.5r)(200 - 20r)$

Ⓒ $1 + 0.5r = 0$; $r = -2$; $(-2, 0)$

$200 - 20r = 0$; $r = 10$; $(10, 0)$ use to create scale

AOS: $r = \frac{10 + (-2)}{2} = \frac{8}{2} = 4$

r	$C(r) = (1 + 0.5r)(200 - 20r)$	$(r, C(r))$
0	$C(0) = (1 + 0.5(0))(200 - 20(0))$	(0, 200)
2	$C(2) = (1 + 0.5(2))(200 - 20(2))$	(2, 320)
4	$C(4) = (1 + 0.5(4))(200 - 20(4))$	(4, 360)
6	$C(6) = (1 + 0.5(6))(200 - 20(6))$	(6, 320)
8	$C(8) = (1 + 0.5(8))(200 - 20(8))$	(8, 200)
10	$C(10) = (1 + 0.5(10))(200 - 20(10))$	(10, 0)

Ⓑ (0,200) Initial profit of $200.

Ⓔ $360 Profit after increase of $2/paper and losing 80 customers.

Without graphing the following functions identify each of the following:

A. The zeros of the function
B. The axis of symmetry
C. The extreme value

5. $g(x) = x^2 + 19x + 84$ Factorable

$(x^2 + 7x) + (12x + 84)$

$x(x+7) + 12(x+7)$

$g(x) = (x+12)(x+7)$

84
1 84
2 42
3 28
4 21
6 14
+7 +12

(A) $x+12=0$ $\quad x+7=0$

$-12\ -12$ $\quad -7\ -7$

$x = -12$ $\quad x = -7$

(B) $x = \frac{-12+(-7)}{2} = \frac{-19}{2} = -9.5$

(C) $g(-9.5) = (-9.5)^2 + 19(-9.5) + 84$

$= -6.25$

Since a value is +; minima

6. $f(x) = x^2 - 12x - 45$ Factorable

$(x^2 + 3x) - (15x + 45)$

$x(x+3) - 15(x+3)$

$f(x) = (x-15)(x+3)$

45
1 45
+3 −15
5 9

(A) $x-15=0$ $\quad x+3=0$

$+15\ +15$ $\quad -3\ -3$

$x = 15$ $\quad x = -3$

(B) $x = \frac{15+(-3)}{2} = \frac{12}{2} = 6$

(C) $f(6) = (6)^2 - 12(6) - 45$

$= -81$

Since a value is +; minima

7. $h(x) = x^2 - 8x + 17$ Unfactorable

(A) $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ $\quad a=1,\ b=-8,\ c=17$

$= \frac{-(-8) \pm \sqrt{(-8)^2 - 4(1)(17)}}{2(1)}$

$= \frac{8 \pm \sqrt{64-68}}{2} = \frac{8 \pm \sqrt{-4}}{2}$

(B) $x = \frac{-b}{2a} = \frac{-(-8)}{2(1)} = \frac{8}{2} = 4$

(C) $h(4) = (4)^2 - 8(4) + 17$

$= 1$

Since a value is +, minima

8. $y = 2x^2 + 24x + 25$ Unfactorable

(A) $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ $\quad a=2,\ b=24,\ c=25$

$= \frac{-(24) \pm \sqrt{(24)^2 - 4(2)(25)}}{2(2)}$

$= \frac{-24 \pm \sqrt{576-200}}{4} = \frac{-24 \pm \sqrt{376}}{4}$

(B) $x = \frac{-b}{2a} = \frac{-(24)}{2(2)} = \frac{-24}{4} = -6$

(C) $y = 2(-6)^2 + 24(-6) + 25$

$= -47$

Since a value is +, minima