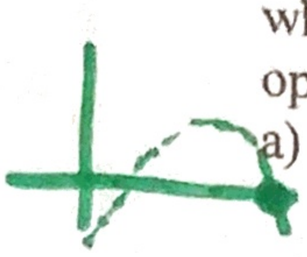
Name: _____ Date: _____ Hour: ____Alg 1____

Unit 7B Day 21: Applications of standard form

Focus Question: How do I use standard form knowledge to solve a word problem?

1) The profits of Mr. Unlucky's company can be represented by the function $P(x) = -3x^2 + 18x - 4$, where P is the amount of profit in hundreds of thousands of dollars and x is the number of years of operation.

a) How long can Mr. Unlucky stay in business before going into debt? his profit is below zero



Further x int.

$0 = -3x^2 + 18x - 4$

$a = -3$ $b = 18$ $c = -4$

$b^2 - 4ac$

$18^2 - 4(-3)(-4)$

$324 - 48$

276

$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

$x = \frac{-18 \pm \sqrt{276}}{2(-3)}$

$\sqrt{276}$

$\sqrt{4 \cdot 69}$

$x = \frac{-18 \pm 2\sqrt{69}}{-6}$

$x = \frac{-18+2\sqrt{69}}{-6}$ $x = \frac{-18-2\sqrt{69}}{-6}$

$x \approx 0.2$ yrs $x \approx 5.8$ yrs

b) When should Mr. Unlucky sell his business for the most profit?

xvalue → a.o.s. ← vertex

$x = \frac{-b}{2a}$ $x = \frac{-18}{2(-3)} \Rightarrow \frac{-18}{-6}$

3 yrs.

c) If Mr. Unlucky sold his business after 4 years, how much less would his profit be than if he had sold it for the maximum profit?

$P(3) = -3(3)^2 + 18(3) - 4$

$= -3(9) + 54 - 4$

$= -27 + 50$

$= 23$

$P(4) = -3(4)^2 + 18(4) - 4$

$= -3(16) + 72 - 4$

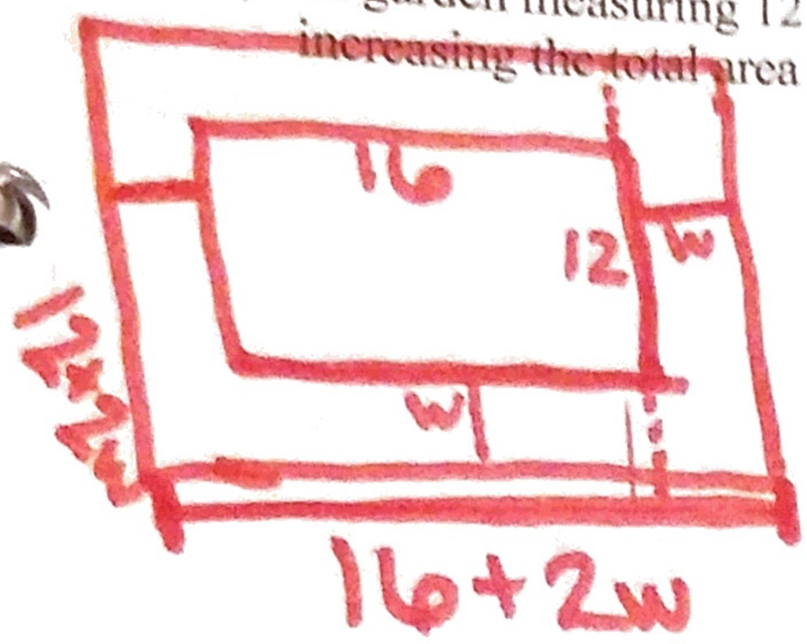
$= -48 + 68$

$= 20$

$23 - 20 = 3$ hundred thousand

$300,000

2) A garden measuring 12 meters by 16 meters is to have a pedestrian pathway installed all around it increasing the total area to 285 square meters. What will be the width of the pathway?



$A = lw$

$285 = (16+2w)(12+2w)$

$285 = 4w^2 + 56w + 192$

$-285 \quad -285$

$0 = 4w^2 + 56w - 93$

	16	2w
12	192	24w
2w	32w	$4w^2$

$a = 4$

$b = 56$

$c = -93$

$b^2 - 4ac$

$56^2 - 4(4)(-93)$

$3136 + 1488$

4624

$x = \frac{-56 \pm \sqrt{4624}}{2(4)} \Rightarrow \frac{-56 \pm 68}{8}$

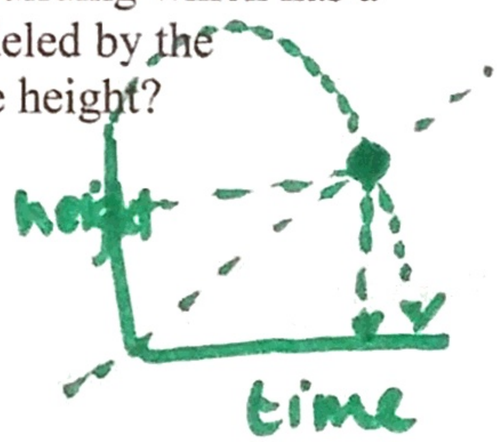
$x = \frac{-56-68}{8}$ width can't be neg.

$x = \frac{-56+68}{8}$

$x = \frac{12}{8}$

$X = 1.5$ meters (width)

3) An airplane took off from JFK airport with a climbing altitude of 30 feet per second. At the same time, George threw a penny off the Main Deck observatory at the Empire State Building which has a height of 1050 feet. The height of the penny, h, in feet after t seconds can be modeled by the function $h(t) = -16t^2 + 18t + 1050$. When are the penny and the plane at the same height?



$h(t) = h(t)$

$30t = -16t^2 + 18t + 1050$

$-30t \quad -30t$

$0 = -16t^2 - 12t + 1050$

$a = -16$

$b = -12$

$c = 1050$

$b^2 - 4ac$

$(-12)^2 - 4(-16)(1050)$

$144 + 67200$

67344

$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

$x = \frac{--12 \pm \sqrt{67344}}{2(-16)}$

$x \approx \frac{12 + 259.51}{-32}$ would be negative time!!!

or $x \approx \frac{12 - 259.51}{-32}$

$x \approx 7.73$ sec.