Chart

$\$20 \times 80$ (players) $= \$1600$

New cost

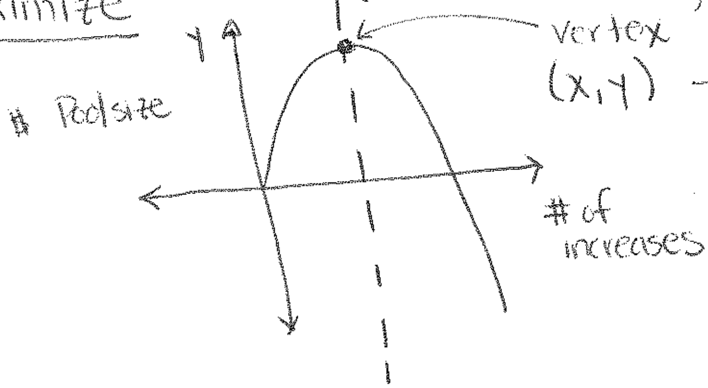
	original, increase, new		original, loss, new	#
1 more entry	$\$20 + 5(1) = \$25$	$\longrightarrow$	$80 - 5(1) = 75$	1875
2 more entries	$\$20 + 5(2) = \$30$	$\longrightarrow$	$80 - 5(2) = 70$	2100
3 more players	$\$20 + 5(3) = \$35$	$\longrightarrow$	$80 - 5(3) = 65$	2275

$$\$20 + 5(x) \longrightarrow 80 - 5(x)$$

$$P(x) = [\$20 + 5(x)] \cdot [80 - 5(x)]$$

$$P(x) = -25x^2 + 300x + 1600$$

Maximize



axis of symmetry

vertex

$(x, y) \longrightarrow x = -b/2a$

$x = 6$

Let's check: $[\$20 + 5(\overset{x}{6})][80 - 5(6)] = \overset{Y}{\$2500}$ (maximum) ↓

$[20 + 5(7)][80 - 5(7)] = \$2475$

Problem 1

Original: 200 x \$6 = \$1200

$P(x) = [200 - 10(x)][6 + 0.50(x)] =$

$P(x) = 1200 + 100x - 60x - 5x^2$

$P(x) = -5x^2 + 40x + 1200$

Max $x = \frac{-b}{2a} = \frac{-(+40)}{2(-5)} = \frac{40}{10} = 4$ increases

a) $4 \times 0.50 = \$2$

$\$6 + \$2 = \boxed{\$8}$

(b) $P(x) = P(4) = -5(4)^2 + 40(4) + 1200$

$= -80 + 160 + 1200$

$\boxed{= \$1200}$ $\boxed{\$1280}$

Problem 2

$P(x) =$ 1400 videos x \$2.25 per video = \$3150 makes

$P(x) = [1400 - 100(x)] \times [\$2.25 + 0.25(x)]$

$= 3150 + 350x - 225(x) + ^{-}25x^2$

$= {}^{-}25x^2 + 125x + 3150$

Max $x = \frac{-b}{2a} = \frac{-125}{2(^{-}25)} = \frac{+125}{50} =$ 2.50 increases

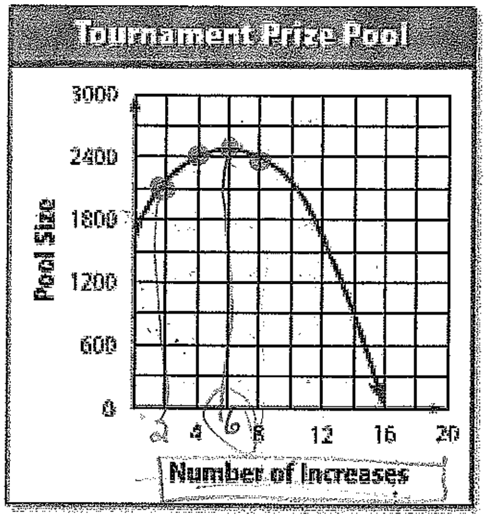
$\$2.25 + 0.25(2.5) =$

$\$2.25 + 0.625 = \$2.875 \approx \$2.88$

LT 3.1-3.3 Graphing Quadratic Function using the equation of the axis of symmetry

Eddie is organizing a charity tournament. He plans to charge a \$20 entry fee for each of the 80 players. He recently decided to raise the entry fee by \$5, and 5 fewer players entered with the increase. He used this information to determine how many fee increases will maximize the money raised.

The quadratic function at the right represents this situation. The tournament prize pool increases when he first increases the fee, but eventually the pool starts to decrease as the fee gets even higher.



People x fee

$(80 \times \$20) = \$1600$

① -5 $+5$ $75 \times \$25 = 1{,}875$

② -5 $+5$ $70 \times \$30 = 2{,}100$

$(80 - 5x) \times (20 + 5x)$

Real-World Example 4 Quadratic Equations in the Real World

CHARITY Refer to the beginning of the lesson.

a. How much should Eddie charge in order to maximize charity income?

Words	Total	equals	fee	times	number of entrants.
Variable	Let x = the number of price increases. Let $P(x)$ = the total pool as a function of x.				
Equation	$P(x)$	$=$	$20 + 5x$	$\cdot$	$(80 - 5x)$

Solve for the x-value of the vertex.

$P(x) = (20 + 5x) \cdot (80 - 5x)$

$= 20(80) + 20(-5x) + 5x(80) + 5x(-5x)$ Distribute.

$= 1600 - 100x + 400x - 25x^2$ Multiply.

$= 1600 + 300x - 25x^2$ Simplify.

$\boxed{= -25x^2 + 300x + 1600}$ $ax^2 + bx + c$ form

Use the formula for the axis of symmetry, $x = -\frac{b}{2a}$, to find the x-coordinate.

$x = -\frac{300}{2(-25)}$ or 6 $a = -25$ and $b = 300$

Eddie needs to have 6 price increases, so he should charge $20 + 6(5)$ or \$50.

$20 + 5(6) = \$50$

roblem #2: Maximum and Minimum

BUSINESS A store rents 1400 videos per week at \$2.25 per video. The owner estimates that they will rent 100 fewer videos for each \$0.25 increase in price. What price will maximize the income of the store?

$1400 \times \$2.25 = \$3150$

$(1400 - 100x) \times (\$2.25 + 0.25x)$

blem #3

CCSS MODELING A financial analyst determined that the cost, in thousands of dollars, of producing bicycle frames is $C = 0.000025f^2 - 0.04f + 40$, where f is the number of frames produced.

a. Find the number of frames that minimizes cost.

b. What is the total cost for that number of frames?