Dual Credit: Maximization Problems

Drawing and labeling a diagram, write and simplify an expression for each situation. Your final answer should only use ONE variable.

1. A chicken farmer has 24 feet of fence to build a rectangular pen. Write an equation that expresses the area of the pen in terms of x, the length of the pen.

2. A manufacturing company wants to build an open box from a 10 by 14 sheet of cardboard. To do so, they will cut a congruent square out from each corner so that the box can be folded up. Write an expression for the volume in terms of the height (h) of the box.

3. The management of a restaurant assigns each waitress between 7 and 15 tables. One waitress finds that when she is assigned seven tables, each table brings in $30 per week in tips. If she is assigned more tables, the amount of attention she gives to each table decreases. Thus, each table brings in less per week in tips. Suppose each additional table causes every table to bring in $2 less per week in tips. Write an expression for the amount of money the waitress will bring home in a week in terms of the *x*, the number of tables she is assigned.

Maximizing Problems Name: _____

1. If a car dealership sets the price of their cars at $28,000 they will sell 54 cars. Every time they drop the price $1000, two more cars will be sold. What should the price of the cars be set at to maximize sales?

X = # of $1000 price drops

$$Y = -2000x^2 + 2000x + 1,512,000$$

2. A rectangular field beside a river is to be fenced. No fence is needed along the river bank. What are the dimensions of the field of maximum area which can be enclosed using 80 m of fencing?

$$A = -2x^2 + 80x$$

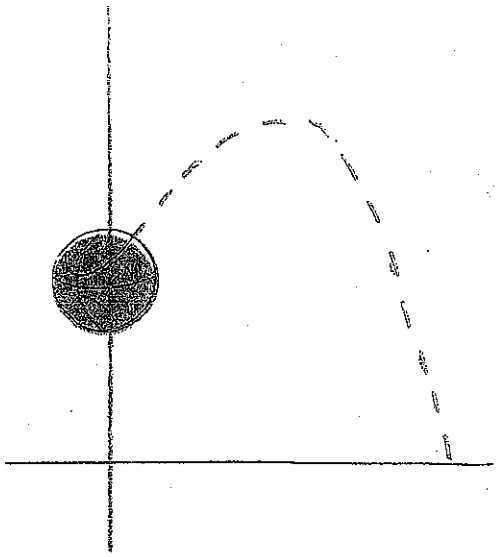
In Class Problems:

If a car dealership sets the price of their cars at $25,000 they will sell 53 cars. Every time they drop the price $1500, two more cars will be sold. What should the price of the cars be set at to maximize sales?

X = # of $1500 price drops

$$Y = -3000x^2 - 29500x + 1,325,000$$

Basketball Problem



A grid is superimposed over a diagram showing the motion of a basketball after it has been thrown in the air.

Let x = the number of seconds since the ball was thrown
Let y = the height of the ball

The equation that describes the motion of the ball is $y = -.25x^2 + 2x + 2$

a. Find the initial height of the ball.

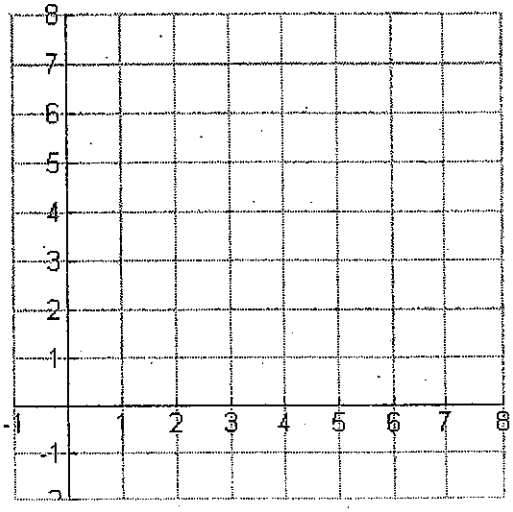
b. You want to find when the ball will reach its maximum height. What "math term" describes the maximum value of the parabola?

c. Find the time when the ball will reach its max (Remember, x = time)

d. Find what the maximum height of the ball will be (Remember, y = height)

e. The ball will eventually hit the ground. Find the time when this will happen.

f. Using what you found in parts *a-e*, plot the graph including the y-intercept, the vertex, and the x-intercept.



g. Write, in interval notation, a reasonable domain for this problem.

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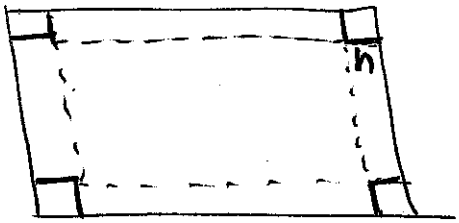
Sell Warm UP

2. A manufacturing company wants to build an open box from a 10 by 14 sheet of cardboard. To do so, they will cut a congruent square out from each corner so that the box can be folded up. Write an expression for the volume in terms of the height (h) of the box.



10

14

$V = l \cdot w \cdot h$

$(14-2h)(10-2h)h$

Not on Quiz

3. The management of a restaurant assigns each waitress between 7 and 15 tables. One waitress finds that when she is assigned seven tables, each table brings in $30 per week in tips. If she is assigned more tables, the amount of attention she gives to each table decreases. Thus, each table brings in less per week in tips. Suppose each additional table causes every table to bring in $2 less per week in tips. Write an expression for the amount of money the waitress will bring home in a week in terms of the *x*, the number of tables she is assigned. past 7.

Not on Quiz

X-coord of vertex

$\frac{-b}{2a}$

$a = -2$

$b = 16$

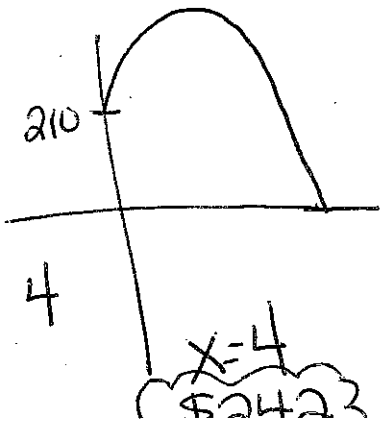
$\frac{-16}{2(-2)} = \frac{-16}{-4} = 4$

Income = (# of tables)(amt $ per table)

$(7+x)(30-2x)$

$210 - 14x + 30x - 2x^2$

$-2x^2 + 16x + 210$



Find the vertex!!!

$x = 4$

$523

Tables = 11

Maximizing Problems Name: _____

1. If a car dealership sets the price of their cars at $28,000 they will sell 54 cars. Every time they drop the price $1000, two more cars will be sold. What should the price of the cars be set at to maximize sales?

$$Y = -2000x^2 + 2000x + 1{,}512{,}000$$
(a = −2000, b = 2000, c = 1,512,000)

vertex!

X = # of $1000 price drops

$$X = \frac{-b}{2a} = \frac{-2000}{2(-2000)} = .5$$

Price: $28{,}000 - \frac{1}{2}(1000) = \$27{,}500$

2. A rectangular field beside a river is to be fenced. No fence is needed along the river bank. What are the dimensions of the field of maximum area which can be enclosed using 80 m of fencing?

$$A = -2x^2 + 80x$$

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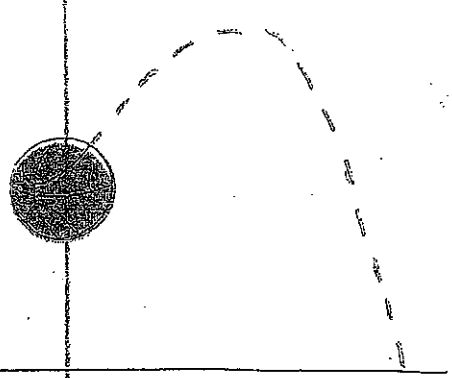
Basketball Problem



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The equation that describes the motion of the ball is $y = -.25x^2 + 2x + 2$

a. Find the initial height of the ball.

y-int 2

$y = -.25(x^2 - 8x + 16) + 2 + 4$

$y = -.25(x-4)^2 + 6$

b. You want to find when the ball will reach its maximum height. What "math term" describes the maximum value of the parabola? Vertex

c. Find the time when the ball will reach its max (Remember, x = time)

$$x\text{-coord of vertex} = \frac{-b}{2a} = \frac{-2}{2(-.25)} = \frac{-2}{-.5} = 4$$

d. Find what the maximum height of the ball will be (Remember, y = height)

y-coord of vertex $= -.25(4)^2 + 2(4) + 2$ (4, 6)

$= 6$

e. The ball will eventually hit the ground. Find the time when this will happen.

x-int

Set $y = 0$

$0 = -.25x^2 + 2x + 2$

$0 = -.25(x-4)^2 + 6$

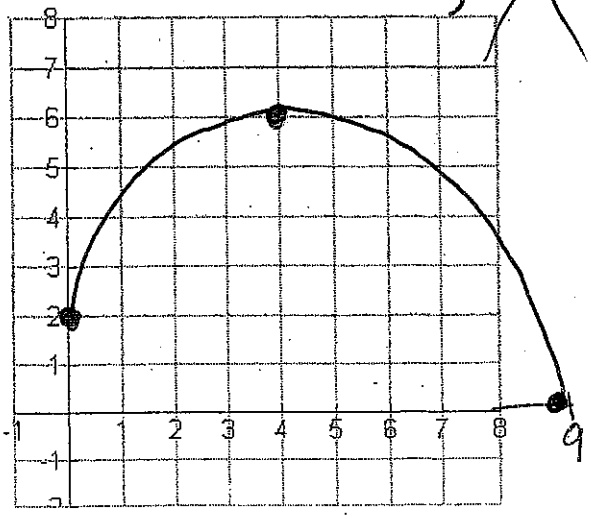
$-6 = -.25(x-4)^2$

$\sqrt{24} = \sqrt{(x-4)^2}$

$x - 4 = \pm\sqrt{24}$

f. Using what you found in parts *a-e*, plot the graph including the y-intercept, the vertex, and the x-intercept.

$x = 8.9, -.9$



g. Write, in interval notation, a reasonable domain for this problem.

$[0, 8.9]$