Name: _____ **Precalculus Unit 4, Lesson 4**

Aim: How do we use quadratic equations and higher degree polynomials to solve optimization problems?

I. Do Now (Review Problems):

1. Write an equation for a parabola with vertex (3, –5) and that passes through the point (6, 2).

2. Write in vertex form: $y = -2x^2 + 20x - 15$

II. Applications Involving Quadratics

3. A punter punts a football at a height of 3 feet above the ground. The height of the ball (in feet) at any particular time is given by the following equation:

$$f(t) = -16t^2 + 128t + 3, \text{ where } t \text{ is the time, in seconds}$$

(a) How high is the ball at the start?
(b) How high is the ball after 2 seconds?
(c) After how many seconds does the ball reach its maximum height?
(d) What is the maximum height?
(e) To the nearest tenth of a second, how long does it take for the ball to reach the ground? (Assume that the ball is not caught.)

4. Lorenzo wants to build a rectangular chicken enclosure with maximum area. He has only 100 feet of fencing. What should the dimensions of his enclosure be if:
(a) he has to build all 4 sides (b) he uses the side of a barn as one of the sides

5. A rectangular dog pen is constructed using a barn wall as one side and 60 meters of fencing for the other three sides. Find the dimensions of the pen that give the greatest area.

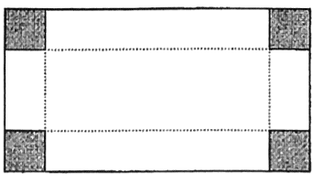
6. Find the number of units that produces a maximum revenue, given by the function $R(x) = 500x - 0.25x^2$, where $R(x)$ represents the total revenue in dollars and x is the number of units sold.

HW26
• p. 96: 7, 8, 28, 40, 85
• p. 68: 59, 65, 111, 114

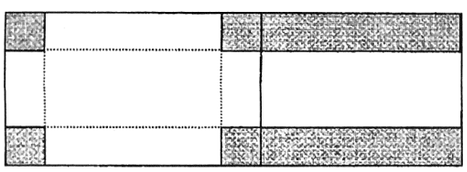
III. Applications Involving Cubics

7. Use your graphing calculator to find the coordinates of the turning points for $y = x^3 - 14x^2 + 48x$

8. Squares with sides of length x are cut from the corners of a rectangular piece of sheet metal with dimensions of 6 inches by 10 inches. The metal is then folded to make an open-top box. What is the maximum volume of such a box?



9. A 10 inch by 20 inch piece of sheet metal is cut and folded as indicated in the diagram to make a box with a top.
   (a) Find the volume, V, of the box.
   (b) What is the domain of V.
   (c) Find the value of x, to the nearest thousandth, that maximizes the volume.
   (d) Find the maximum volume, to the nearest thousandth.



10. A rectangular piece of sheet metal with perimeter 50 cm is rolled into a cylinder with open ends. The side with length x is the circumference of the base.
    (a) Express the area of the base as a function of x.
    (b) Express the volume of the cylinder as a function of x. Then, state the domain of this function.
    (c) Find the value of x, to the nearest hundredth, that maximizes the volume.
    (d) Find the maximum volume, to the nearest hundredth.