**Section 4.2 Guided Notebook**

## Section 4.2 Applications and Modeling of Quadratic Functions

- ☐ Work through Objective 1
- ☐ Work through Objective 2
- ☐ Work through Objective 3

## Section 4.2 Applications and Modeling of Quadratic Functions

Work through the Introduction Video and take notes here: (Make sure that you write down the formula for the vertex of a quadratic function!)

<u>Section 4.2 Objective 1 Maximizing Projectile Motion Functions</u>

Work through the video that accompanies Example 1:

A toy rocket is launched with an initial velocity of 44.1 meters per second from a 1-meter tall platform. The height *h* of the object at any time *t* seconds after launch is given by the function $h(t) = -4.9t^2 + 44.1t + 1$. How long after launch did it take the rocket to reach its maximum height? What is the maximum height obtained by the toy rocket?

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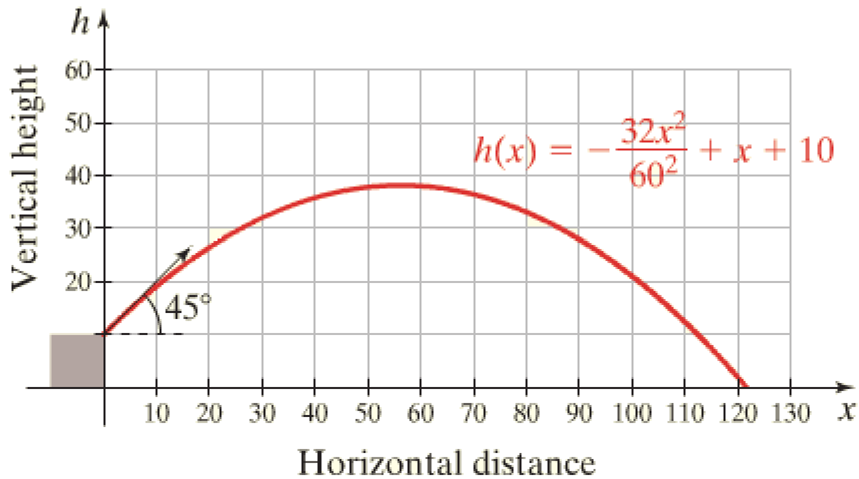
Work through the video that accompanies Example 2: If an object is launched at an angle of 45 degrees from a 10-foot platform at 60 feet per second, it can be shown that the height of the object in feet is given by the quadratic function

$h(x) = -\frac{32x^2}{(60)^2} + x + 10$, where $x$ is the horizontal distance of the object from the platform.




a. What is the height of the object when its horizontal distance from the platform is 20 feet? Round to two decimal places.

b. What is the horizontal distance from the platform when the object is at its maximum height?

c. What is the maximum height of the object?

Section 4.2 Objective 2 Maximizing Functions in Economics

What is the equation that describes revenue?

Work through the video that accompanies Example 3:

Records can be kept on the price of shoes and the number of pairs sold in order to gather enough data to reasonably model shopping trends for a particular type of shoe. Demand functions of this type are often linear and can be developed using knowledge of the slope of the equations of lines. Suppose that the marketing and research department of a shoe company determined that the price of a certain type of basketball shoe obeys the demand equation $p = -\frac{1}{50}x + 110$.

a. According to the demand equation, how much should the shoes sell for if 500 pairs of shoes are sold? 1,200 pairs of shoes?

b. What is the revenue if 500 pairs of shoes are sold? 1,200 pairs of shoes?

c. How many pairs of shoes should be sold in order to maximize revenue? What is the maximum revenue?

d. What price should be charged in order to maximize revenue?

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Work through the video that accompanies Example 4:
To sell $x$ waterproof CD alarm clocks, WaterTime LLC has determined that the price in dollars must be $p = 250 - 2x$, which is the demand equation. Each clock costs \$2 to produce, with fixed costs of \$4,000 per month, producing the cost function of $C(x) = 2x + 4,000$.

a. Express the revenue $R$ as a function of $x$.

b. Express the profit $P$ as a function of $x$.

c. Find the value of $x$ that maximizes profit. What is the maximum profit?

d. What is the price of the alarm clock that will maximize profit?

Work through the interactive video that accompanies Example 5:
A country club currently has 400 members who pay \$500 per month for membership dues. The country club's board members want to increase monthly revenue by *lowering* the monthly dues in hopes of attracting new members. A market research study has shown that for each \$1 decrease in monthly membership price, two additional people will join the club. What price should the club charge to maximize revenue? What is the maximum revenue? **Note that the interactive video that accompanies Example 5 gives you the choice to see the solution using two different methods. Work through BOTH methods and decide for yourself which method is best for you.**

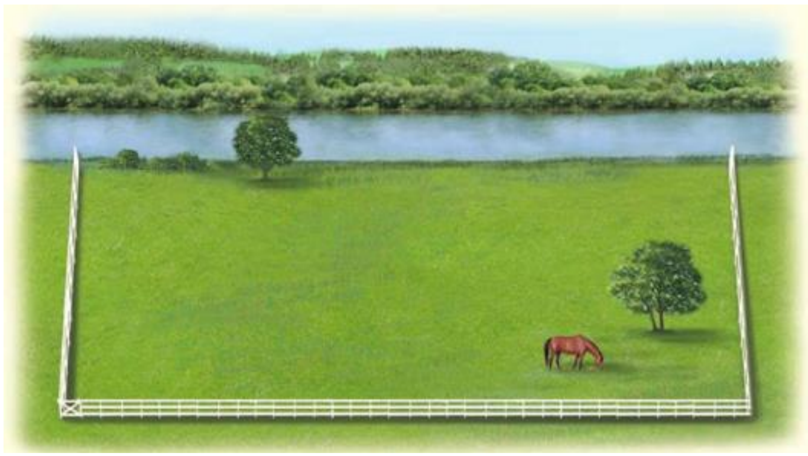
Solve using the method shown in the text:

Now, solve the same problem using an alternate method as shown in the interactive video.:

Example 5 using an **alternate method:**
A country club currently has 400 members who pay $500 per month for membership dues. The country club's board members want to increase monthly revenue by *lowering* the monthly dues in hopes of attracting new members. A market research study has shown that for each $1 decrease in monthly membership price, two additional people will join the club. What price should the club charge to maximize revenue? What is the maximum revenue?

Section 4.2  Objective 3  Maximizing Area Functions

Suppose that you have 3,000 feet of fencing to construct the rectangular pen that borders a river as seen below.  Watch the first video located at the bottom of p. 4.2-19 to see a couple of different ways that you can construct this fence.   What should the length and width of this fence be in order to maximize area?  What is the maximum area?



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Work through the video that accompanies Example 6:

Mark has 100 feet of fencing available to build a rectangular pen for his hens and roosters. One side of the pen will border a river and requires no fencing. He wants to separate the hens and roosters by dividing the pen into two equal areas. Let $x$ represent the length of the center partition that is perpendicular to the river.

a. Create a function $A(x)$ that describes the total area of the rectangular enclosure as a function of $x$ where $x$ is the length of the center partition.

b. Find the length of the center partition that will yield the maximum area.

c. Find the length of the side of the fence parallel to the river that will yield the maximum area.

d. What is the maximum area?