NAME_____DATE_____
ALGEBRA II WORKSHEET: APPLICATIONS OF QUADRATIC EQUATIONS

Write all answers in complete sentences. Show work on a separate sheet of paper.

Geometric Examples

1. A farmer has 1200 m of fencing. He wants to enclose a rectangular field bordering a river, with no fencing needed along the river. Find the dimensions of the field if the area of the field is 180,000 square meters.
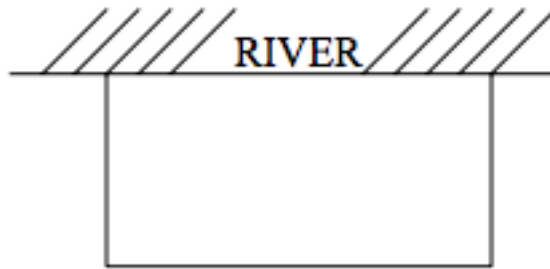

2. A 13-foot ladder leans against a wall. The foot of the ladder is 5 feet from the wall. How much would the foot of the ladder have to be pulled away from the wall so that the top of the ladder would slide down the wall by the same amount?
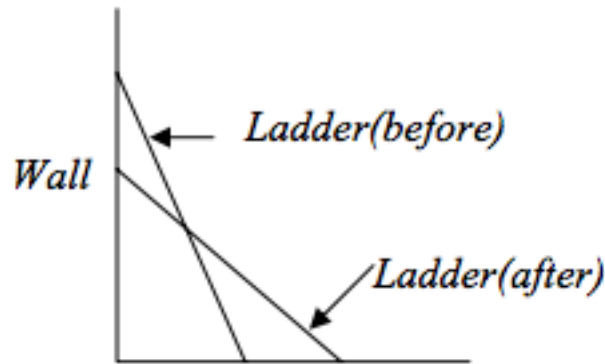
3. A triangle has a height that is four cm greater than its base length and an area of 33 cm^2. Find the height and the length of the base of this triangle.

4. A rectangular in-ground pool is 25 feet wider than it is long. If the area of the pool is 3150 feet, what are the dimensions of the pool?

5. A landscape designer included a cloister (a rectangular garden surrounded by a covered walkway on all four sides) in his plans for a new public park. The garden is to have a length of 35 feet and a width of 23 feet, and the total area of the cloister (garden and walkway together) is 1200 square feet. To the nearest inch, how wide does the walkway need to be?
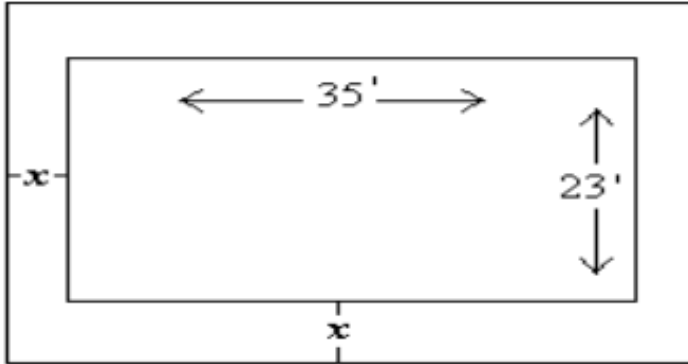
a)   Write the formula used to determine the area of a rectangle.

b)   What is the total area of the cloister?

c)   Write an expression that represents the length of the cloister.

d)   Write an expression that represents the width of the cloister.

e)   Using the formula from part (a), substitute the values/expressions from parts (b), (c), and (d).

f)   Note that the equation that you developed in part (e) is a quadratic equation. Solve it to answer the question posed in this problem.

6. Roger Williams Zoo's wolf exhibit is a rectangular enclosure with dimensions of 50 feet by 60 feet. Per national regulations, they must increase the area by 1000 square feet. The contractors will increase the length and width by the same amount. By how many feet will they need to increase each dimension of the enclosure?

    a. On a separate sheet of paper, draw a sketch modeling the situation.

    b. Estimate some possible solutions. Check them using your calculator.

    c. Write an equation representing the situation. Solve it using an appropriate algebraic method.

Projectile Motion Examples

7. A ball is thrown vertically upward from the top of a 96-foot building with an   initial
    velocity of 80 ft./sec. The distance s (in feet) of the ball from the ground after t seconds is
    given by the formula

    $$s = -16t^2 + 80t + 96.$$

    a. After how many seconds does the ball strike the ground?

    b. What is the maximum height attained by the ball? When does this occur?

    c. After how many seconds will the ball pass the top of the building on its way down?

8. A football player kicks a ball such that its flight path can be modeled by the equation
    $h = -0.3x^2 + 2x + 2$, where x represents the horizontal distance the ball traveled and h
    represents the height.

    a. How far does the ball travel until it reaches its highest point?

    b. How high does the ball go?

    c. How far does it travel horizontally until it hits the ground?

9. The Green Arrow shoots an arrow from a height of 6 feet with an initial upward velocity of
    150 feet per second. In how many seconds will the arrow reach a height of 100 feet?

Numerical Examples

10. Find two consecutive odd integers whose product is 143.

11. Find two consecutive integers such that the sum of their squares is 145.

12. Find a rational number such that the sum of the number and its reciprocal
     is $2\frac{1}{6}$.

13. Find two consecutive integers whose product is 462.

Optimization Examples

14. The profit earned by running a bakery can be modeled by $P = -0.014x^2 + 16.56x - 1345$, where x represents the number of items baked each week and P represents the profit in dollars per week. How many items should the bakery produce each week in order to earn the greatest profit, and what is the maximum profit?

15. The enrollment each year at East Greenwich High School can be modeled by the equation $E = 725 - 17.5t + 1.5t^2$, where t represents the number of years since 1990. In what year did the high school have its lowest enrollment, and what was the enrollment that year?

16. Bryce Harper hits a popup in the ninth inning against the Red Sox. The equation $h = 4 + 102.5t - 16t^2$ models the height of the ball in feet after t seconds, as h represents the height of the ball in feet. Find the maximum height attained by the ball.

17. The number of employees at Startek can be modeled by the equation $E = -5.42t^2 + 90.5t + 12$, where t represents the year (t = 0 represents 1990) and E represents the number of employees. In what year did the company have the most employees? How many employees did the company have?

18. The profit earned by producing and selling Kim Kardashian's CD can be modeled by $P = -x^2 + 15x - 20$, where x is the number of CD's produced (in hundreds) and P is the record company's profit in hundreds of dollars. How many CD's should the record company produce in order to maximize profit? Round your answer to the nearest whole number.

19. When a bicycle shop charges $50 for a standard tune-up, it attracts 100 customers per month. For each dollar it increases the price, it loses four customers.

    a. How much revenue will the shop earn from those 100 customers?

    b. How much revenue would the shop earn by charging $51?

    c. How much revenue would the shop earn by charging $49 per tune-up?

    d. Write an equation relating the number of dollar price increases to the total revenue.

    e. At what price should the shop charge for tune-ups in order to earn the greatest revenue?