Quadratic Application Problems Unit 4

1. A watermelon is launched out of the window of an office building, and its path can be modeled by the equation $y = -4x^2 + 32x + 15$, where "y" is the watermelon's height (in feet) and "x" is the time it has been in the air (in seconds).
   a. How high will the watermelon be after 2 seconds? 63 feet
   b. How long will it take for the watermelon to reach its highest point? 4 sec.
   c. What is the maximum height? 79 feet
   d. When will the watermelon hit the ground? 8.4 sec.

2. The path of a batted baseball as it sails toward the outfield can be modeled by the equation $y = -2x^2 + 20x + 6$, where "y" is the height of the baseball (in feet) and "x" is the time the baseball has been in the air (in seconds).
   a. How high will the baseball be after 7 seconds? 48 feet
   b. How long will it take for the baseball to reach its maximum height? 5 sec.
   c. What is the maximum height? 56 feet
   d. When will the baseball hit the ground? 10.3 sec.

3. The path of a roller coaster as it shoots over a hill of its track can be modeled by the equation $y = -x^2 + 8x + 24$, where "y" is the roller coasters height (in feet) and "x" is the time (in seconds) it has been on the hill.
   a. How long will it take the roller coaster to get to the top of the hill? 4 sec.
   b. How high is the hill of the roller coaster? 40 feet

4. A golfer is standing directly behind a tree, and decides to try to hit the golf ball over the tree. The path of the golf ball can be modeled by the equation $y = -3x^2 + 18x$, where "y" is the golf ball's height (in feet) and "x" is the time it has been in the air (in seconds).
   a. How long will it take the golf ball to reach its highest point? 3 sec.
   b. If the tree in front of the golfer is 23 feet tall, will the shot be able to clear the tree? yes max 27 feet
   c. When will the ball hit the ground? 6 sec.

5. You and a friend are hiking in the mountains. You want to climb to a ledge that is 20 feet above you. The height of the grappling hook you throw is given by the function $y = -16x^2 - 32x + 5$.
   a. What is the maximum height of the grappling hook? 69 feet
   b. Can you throw it high enough to reach the ledge? yes.

6. A diver starts on a platform 50 feet above the pool. His starting upward velocity is 6 feet/second.
   a. Use the equation $y = -16x^2 + v_0x + h$ to find the number of seconds (x) it takes for the diver to hit the pool. 1.97 seconds
   b. What is maximum height of the diver? 50.6 feet
   c. How long does it take for the diver to reach the maximum height? 0.2 seconds

7. A toy rocket is launched upward from the ground with an initial velocity of 112 feet per second.
   a. Use $y = -16x^2 + v_0x + h$ to find the number of second it takes for the rocket to hit the ground. 7 sec.
   b. What is the maximum height of the rocket? 196 feet
   c. How long does it take for the rocket to reach the maximum height? 3.5 seconds

8. A ball is thrown directly upward from an initial height of 200 feet with an initial velocity of 96 feet per second.
   a. After how many seconds will the ball reach its maximum height? 3 seconds
   b. What is the maximum height? 344 feet
   c. How long will it take for the ball to reach the ground? 7.6 seconds

9. A soccer ball is kicked with an initial velocity of 50 feet/second from a starting height of 3.5 feet.
   a. What is the maximum height of the ball? 42.6 feet
   b. How long will it take for the ball to reach the maximum height? 1.6 seconds
   c. How long will it take for the ball to land on the ground? 3.2 seconds.

10. A flare is fired from the deck of a ship that is 56 feet above the water, at a velocity of 104 feet per second.
    a. How long will it take for the flare to reach the water? 7 seconds.
    b. What is the maximum height of the flare? 225 feet
    c. How long did it take for the flare to reach the maximum height? 3.3 seconds

11. A penny is dropped from the top of the Empire State building, which is 1250 feet high.
    a. How long does it take the penny, **falling freely**, to hit the ground? 8.8 seconds

12. A water balloon is shot into the air at a velocity of 35 feet per second from a height of 2.5 feet.
    a. What is the maximum height of the water balloon? 21.6 feet
    b. How long does it take for the water balloon to reach that height? 1.1 seconds
    c. How long does it take for the water balloon to reach the ground? 2.3 seconds.

Challenge Problems

13. For a period of 48 months, the monthly operating cost for a small company can be modeled by $y = 0.55x^2 + 550$, where "x" is the number of months. In which month was the operating cost $1430?

month 40

14. A ball is thrown straight up from 3 meters above the ground, with a velocity of 14 meters/second. When does the ball hit the ground? $y = -9.8x^2 + v_0x + h$ 1.62 seconds.

15. A shot-put throw can be modeled using the equation $y = -0.0241x^2 + x + 5.5$, where x is the distance traveled, in feet, and y is the height, in feet. How long was the throw? 46.41 feet

16. A baseball is "popped" straight up by a batter. The ball's height (in feet) above the ground "x" seconds later is given by the equation $y = -16x^2 + 64x + 3$. What is the maximum height of the ball? How long does it take to reach the ground? How long does it take to reach an outfielder who is 6 feet tall? → 3.95 seconds.

max: (2, 67) ground: 4.1 seconds.

17. A man stands on the edge of a 960 foot tall building and spits directly downward. ~~If the spit travels at 64 feet per second:~~

    a. Use $y = -16x^2 + v_0x + h$ to find how long will it take for it to hit the ground? 7.8 seconds.

18. Suppose the cost of producing "x" crates of pencils is given by the equation $y = 0.5x^2 - 10x + 100$

    a. How much does it cost to produce 100 crates of pencils? $4100

    b. How many crates of pencils will minimize the cost of production? 10 crates