More Quadratic Models

1. A penny is dropped from the top of the Empire State Building, which is 1250 ft high (excluding the lightning rod). How long does it take the penny, **falling freely**, to hit the ground? (Use $h(t) = -16t^2 + v_o t + h_o$)

2. A man drops his keys off a building 144 ft high. How long does it take the keys, **falling freely**, to hit the ground? (Use $h(t) = -16t^2 + v_o t + h_o$)

3. The number of mosquitoes $M(x)$, in millions, in a certain area depends on the June rainfall x, in inches, according to the equation $M(x) = 10x - 2x^2$. What rainfall produces the maximum number of mosquitoes?

4. The polynomial function $I(t) = -0.1t^2 + 1.9t$ represents the yearly income (or loss) from a real estate investment, where t is time in years after 1970. During what year is the maximum income occur?

5. A bottle rocket is fired from the ground upwards at 64 feet per second.
   a) What is the maximum height the bottle rocket reaches?
   b) How long does it take for the bottle rocket to hit the ground?

6. Your company uses the quadratic model $y = -7x^2 + 350x$ to represent how many units y of a new product will be sold x weeks after its release. How many units can you expect to sell in week 27?

7. Your company uses the quadratic model $y = -4.5x^2 + 150x$ to represent the average number of new customers who will be signed on x weeks after the release of your new service. How many new customers can you expect to gain in week 8?

8. Suppose the cost of producing x crates of pencils is given by $C(x) = \frac{1}{2}x^2 - 10x + 1000$.

   a) How much does it cost to produce 100 crates of pencils?
   b) How many crates of pencils will minimize the cost of production?

9. A rectangular pen for a dog uses 80 feet of fencing. What dimensions will result in an area of 384 ft²?

10. The length of a room is 5 feet more than its width. If the area of the room is 266 ft², what is the width of the room?

11. The length of a rectangular frame is 4 cm more than the width. The area inside the frame is 60 square cm. Find the width of the frame.

12. Find the equation that represents the height of an object on Earth that is launched from a pad 25 feet off of the ground with a velocity of 350 feet per second.

13. Find the equation that represents the height of an object on Earth that is launched from a pad on the ground with a velocity of 2000 feet per second.

Answers: 1) about 8.8 seconds 2) 3 seconds   3) 2.5 inches   4) 1979   5) a. 64ft b. 4 seconds
6) 4347 units   7) 912 new customers 8) a) $5000 b) 10 crates   9) 16 ft by 24 ft   10) 14 ft
11) 6 cm   12) $h(t) = -16t^2 + 350t + 25$ 13) $h(t) = -16t^2 + 2000t$