Worksheet #4 - Applications of Quadratic Functions

In this worksheet, you will solve word problems that are represented by quadratic equations.

1. Use the technique of ‘completing the square’ to solve each of the following equations. Simplify your answers as much as possible. *(Hint: You might need to rearrange terms before you try to complete the square.)*

(a) $t^2 - 1 = 4t$

(b) $2x^2 + x = 1$
2. Find the value of $x$ indicated by the figure below. Round your answer to the nearest thousandth.

![Triangle Diagram]

3. The perimeter of a square is $x$ feet, and the area is $2x$ square-feet. Find the dimensions (i.e. the length and width) of the square. (Hint: Start by drawing a picture and trying to label the lengths of the sides in terms of $x$.) (Second hint: You might find factoring here to work better than completing the square.)
4. The height of a ball above the ground $t$ seconds after it is thrown is $h(t) = 20 + 32t - 16t^2$. How long will it take for the ball to hit the ground? (Round your answer to the nearest hundredth of a second.)

5. The path of a cannonball is a parabola modeled by the equation $y = 55 + x - 0.002x^2$, where $x$ and $y$ are both measured in feet. In this model, the cannonball starts at the point $(0,55)$ and travels to the right. The ground is represented by the x-axis. Sketch a graph of the cannonball’s path, and determine the horizontal distance traveled by the ball before it hits the ground. *(You may wish to use a graph on your calculator to help you with the sketch.)*
A company manufactures and sells Objects. If the company wants to sell $Q$ objects, it will have to set a price of $P = 300 - 2Q$ dollars.

(a) Write down a formula for the amount of revenue, $R$, the company will generate by selling $Q$ Objects. (Recall that revenue is price times quantity sold.)

(b) The fixed cost for the company is $2400$, and each Object costs the company $20$ to manufacture. Use this information to write down a formula for the company’s profit when it sells $Q$ Objects. (Recall that profit is revenue minus total cost. Also, don’t confuse manufacturing cost with price!)

(c) Sketch the graph of the profit as a function of quantity sold, and determine the break-even values (i.e. the points where the profit is zero).