1) The profit in dollars \((P)\) depends on the quantity \((q)\) of widgets produced:
\[
P(q) = -q^2 + 1000q - 3000
\]

The graph for \(P(q)\) is given below:

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a) The point \((200, 157000)\) lies on this graph. Interpret this in terms of profits and widgets.

b) What is the breakeven point for producing widgets? In other words, how many widgets should be produced in order to have zero profit? (First answer this based on your graph. Then do algebra to get the exact value of \(q\). Compare your answers from both methods to be sure they agree.)

c) What is the maximum profit that can be made from producing widgets? How many widgets must be produced to obtain the maximum profit?
2) A ball is thrown upward from the top of an 800 foot tower. It’s height above ground $t$ seconds after being thrown is given by: $h(t) = -16t^2 + 64t + 800$

The graph of $h(t)$ is given below:

a) The point $(4, 800)$ lies on this graph. Interpret what this means in terms of height and time.

b) What is the maximum height reached by the ball? At what time does it reach that height?

c) At what time does the ball reach a height of 400 feet?

d) At what time does the ball hit the ground? (First answer this based on your graph. Then algebraically determine the exact value of $t$.)
3) The average cost per bike in hundreds of dollars for producing \( n \) thousand bikes is given by:

\[
C(n) = (n - 4)^2 + 1.
\]

Questions a and b below are to help you understand the units being used in this question.

a. If \( n = 1 \), how many bikes are being produced? What is the value of \( C(1) \)? What cost does this represent?

b. If you wished to know the cost of producing 3000 bikes, what should \( n \) be?

Graph \( C(n) \) on your calculator. And use your calculator’s functions to answer the questions below.

c. How many bikes should be produced in order to minimize the average cost per bike? What is the minimum average cost?

d. How many bikes should be produced to have the average cost per bike be $300?

4) Find the radius, \( r \), and height, \( h \), of a cylindrical can with a surface area of 80 square centimeters and the largest possible volume.