10.2 – Quadratic Functions

Math 111
Warnock - Class Notes

Quadratic Function

A **quadratic function** is defined by

$$f(x) = ax^2 + bx + c,$$

where a, b, and c are real numbers, with $a \neq 0$.

The graph of a quadratic is called a ________________________ .

The lowest (or highest) point is called the ___________________ .

Graph

$y = x^2$

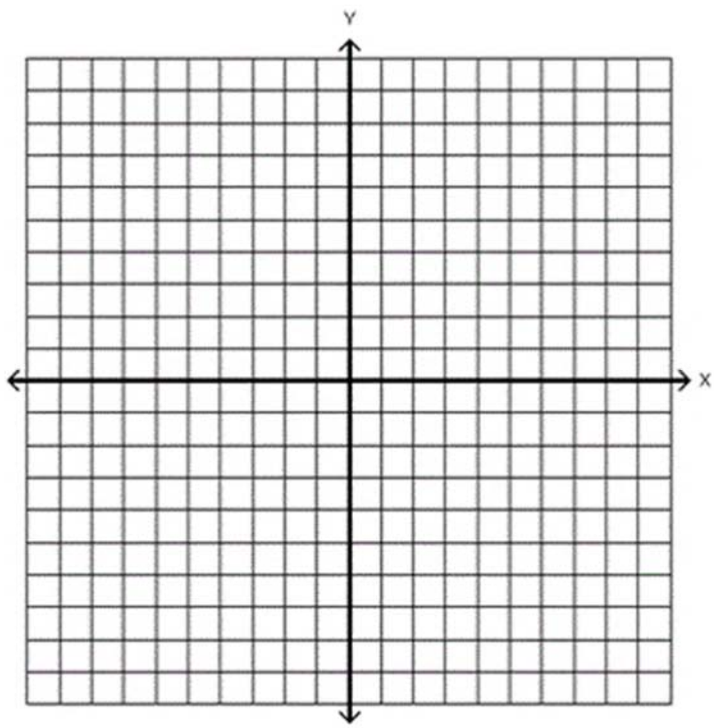
$y = x^2 - 4$

$y = (x-3)^2$

$y = 2x^2$

$y = -x^2$

$y = -2(x-3)^2 + 5$



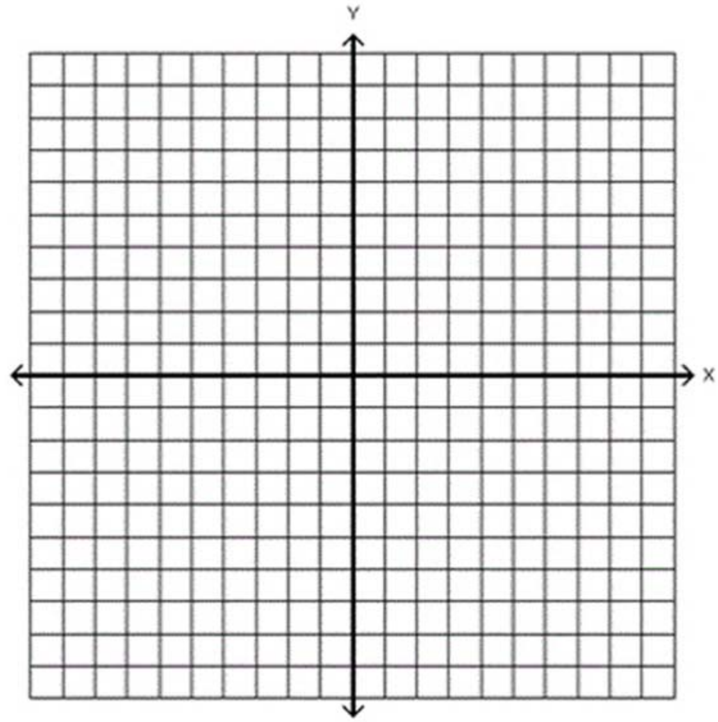
Graph of the Quadratic Function

The graph of the quadratic function $f(x) = ax^2 + bx + c$ has its vertex at

$$\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right).$$

The graph opens upward if $a > 0$ and downward if $a < 0$.

#1. **Graph** $y = x^2 + 4x - 5$



#2. **A hockey team plays in an arena with a seating capacity of 15,000 spectators. With the ticket price set at $14, average attendance at recent games has been 9500. A market survey indicates that for each dollar the ticket price is lowered, the average attendance increases by 1000.**

a) **Setup a quadratic function to model the total Revenue as a function of how many dollars off of $14 are taken.**

b) **What price maximizes revenue from ticket sales?**

c) **What is the maximum revenue?**

Revenue is always ___________ times the ____________ _______ .

#3. **Maximizing Revenue** The demand for a certain type of cosmetic is given by

$$p = 500 - x,$$

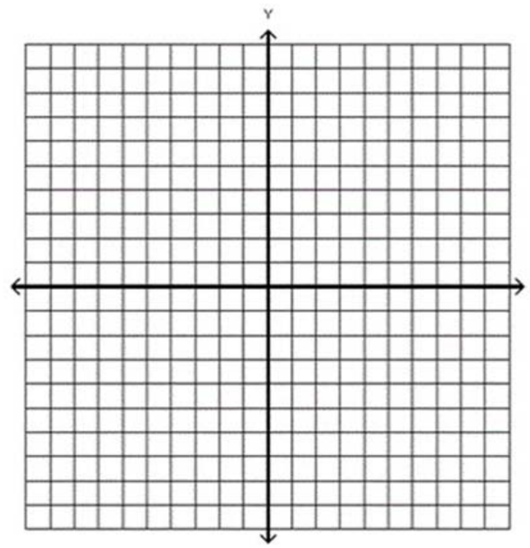
where p is the price in dollars when x units are demanded.

a. Find the revenue $R(x)$ that would be obtained at a price p. (*Hint:* Revenue = Demand × Price)

b. Graph the revenue function $R(x)$.

c. Find the price that will produce maximum revenue.

d. What is the maximum revenue?



Review:

Quadratic Formula

The solutions of the quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

#4. **The demand for a deli owner's vegetable cream cheese is $p = 30 - x$, where p is the selling price and x is the number of pounds demanded.**

(So at $30 a pound, there is no demand, and at $20 a pound there is 10 pounds demanded.)

His daily fixed costs are $100 with a per pound cost of $5.

a) **Find $C(x), R(x)$, and $P(x)$.**

b) **Find the minimum break-even quantity.**

b) **Find the maximum revenue**

c) **Find the maximum profit.**

#5.

Income The manager of an 80-unit apartment complex is trying to decide what rent to charge. Experience has shown that at a rent of $800, all the units will be full. On the average, one additional unit will remain vacant for each $25 increase in rent.

a. Let x represent the number of $25 increases. Find an expression for the rent for each apartment.

b. Find an expression for the number of apartments rented.

c. Find an expression for the total revenue from all rented apartments.

d. What value of x leads to maximum revenue?

e. What is the maximum revenue?