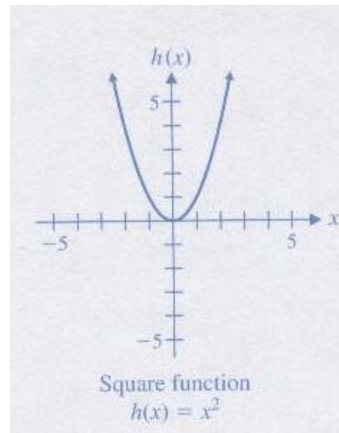


Math 142 Lecture Notes Section 2.3 – Quadratic Functions

★ Quadratic Functions:

Definitions:

- 1) a second-degree function, $f(x) = ax^2 + bx + c$, whose graph is a parabola
- 2) $y = x^2$ symmetry about the y-axis
- 3) lowest point on the graph is at the origin: (0,0)



- 4) domain _____
- 5) range _____

★ Parabolas: Use the rules we introduced for transformations of a basic curve and describe each of the following functions.

1. $f(x) = 2(x - 1)^2$
2. $g(x) = -3(x + 5)^2$
3. $h(x) = \frac{1}{2}(x - 4)^2$
4. $F(x) = -6(x - 3)^2 + 2$

5. $G(x) = \frac{1}{a}(x+b)^2 - c$, where $a, b, c \in I^+$

Intercepts of a parabola: $y = ax^2 + bx + c$

1) x-intercept:

2) y-intercept:

Quadratic formula

Example: $f(x) = 3x^2 + 30x + 75$

$$f(x) = 3(x^2 + 10x) + 75$$

1) Graph

2) Find the x- and y-intercepts.

3) Solve $3x^2 + 30x + 75 \geq 0$ graphically.

Standard form: $y = ax^2 + bx + c$, $a \neq 0$

Vertex form: $y = a(x-h)^2 + k$ where **(h, k)** is the vertex.

Where is the vertex?

Where is the axis of symmetry?

What is the maximum or minimum value?

Complete the square and transform the following function into vertex form:

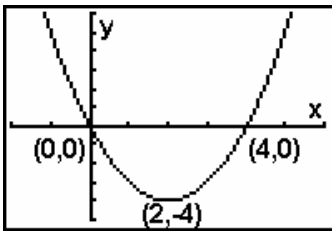
$$y = 5x^2 - 40x + 87$$

Describe the graph of the function $y = 5x^2 - 40x + 87$.

Note: For parabolas that open up/down, with the vertex at (h,k), the axis of symmetry is the line $x=h$.

For parabolas that open right/left, with the vertex at (h,k), the axis of symmetry is the line $y=k$.

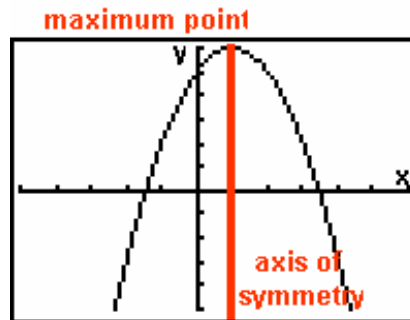
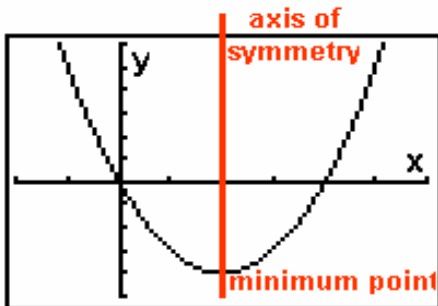
Find the axis of symmetry for the following graph:



What is the domain? _____ What is the range? _____

Find the equation of the parabola shown above.

- ★ **Vertex:** The maximum or minimum point on a parabola that opens up or down.
- ★ Vertex = (h , k)



★ **Example:** $f(x) = 0.5x^2 - 4x + 12$

Find the vertex form for $f(x)$.

Find the vertex and the maximum or minimum.

Find the range.

Describe the graph.

★ Applications

A survey of shops at the mall, shows the following data:

The price demand function for making x items is $96 - 3x$.

The cost to make x items is $165 + 48x$.

Find the break-even point(s) given that x represents hundreds of circuits, and cost is measured in thousands of dollars.

What is the wholesale price per circuit (rounded to the nearest dollar) that produces the maximum revenue?

★ Break-Even Analysis

Find all points where revenue = costs

★ Polynomial and Rational Functions

Polynomials
Degree

Domain

The graph of a polynomial is continuous.

Rational Functions

Any function which can be written as a fraction where the numerator and the denominator are polynomials, and the denominator is not zero.

Domain