

### Precalculus Learning Goals - Week 3

This week we'll continue our section on **Functions – Properties and Examples**, and then we'll start getting more specific, talking about **Linear Functions** and **Quadratic Functions** in more detail.

As a reminder, the general goals for the section **Functions – Properties and Examples** are as follows. At the end of this section, students should be able to:

- *Be comfortable with the language, notation, and pictures of functions, as well as be able to translate between them.*
- *Know several examples of functions and their basic properties, both mathematical and “real-world.”*
- *Be able to generate new functions from old through the standard function operations.*

**More specifically**, at the end of this week you should be able to:

- Define, graph, and state the domain and range of linear functions, quadratic functions, absolute value functions (as piecewise functions), root, and exponential functions.
- Describe how simple graph transformations affect the shape of the graph of a function (translations, compressions, stretches, reflections).

**Sample Problems.** Here are some sample problems, of the type that you would do to demonstrate that you've learned the material. These are not the only types of problems you may see – they're just a sample.

- Sketch a graph of the function  $f(x) = 3^{2-x} + 1$ . What is the range of this function?
- Here's the graph of a function  $g$  (graph omitted). Using the graph, sketch a graph of  $g(2x) - 4$ .
- Write  $f(x) = |x|$  as a piecewise function, without using absolute value signs.

We'll also get more specific about **Linear Functions**. The objectives for this section are that students should be able to:

- *Given the equation of a line, sketch its graph, and vice versa.*

**More specifically**, at the end of this week you should be able to:

- Given the equation of a line, state points on the line and sketch its graph.
- Compute the slope of a line given two points or a graph.
- Compute the  $y$ -intercept of a line given two points or a graph.
- Describe how the slopes of perpendicular lines are related.

**Sample Problems.** Here are some sample problems, of the type that you would do to demonstrate that you've learned the material. These are not the only types of problems you may see – they're just a sample.

- Find the equation of the line that passes through  $(-2, 3)$  and  $(4, -5)$ .
- Find the equation of the line perpendicular to  $y + 3 = 2x - 5$  that passes through the point  $(8, 9)$ .
- Why is a vertical line not a function?

- A ball is falling at a rate of 10 meters per second. Let  $h(t)$  = the height of the ball at time  $t$ . The graph of  $h$  is a line – what is its slope?

Finally, we'll also get specific in dealing with **Quadratic Functions**. The objectives for this section are that students will be able to:

- *Solve any quadratic equation with real solutions.*
- *Transition between formulas and graphs of quadratic functions, and describe their basic properties.*

**More specifically**, you should be able to:

- Factor quadratics of the form  $ax^2 + bx + c$ .
- State and apply the quadratic formula.
- Complete the square.
- Apply graph transformations to graph any quadratic function, given its formula.
- Solve application problems by modeling and then maximizing or minimizing a quadratic function.

**Sample Problems.** Here are some sample problems, of the type that you would do to demonstrate that you've learned the material. These are not the only types of problems you may see – they're just a sample.

- Solve for  $u$ :  $2u^2 - u = 1$ .
- Complete the square and graph:  $-x^2 + 5x + 3$ .
- Is it possible for a quadratic equation to have exactly one solution? If so, give an example; if not, explain why.
- Factor the quadratic  $x^2 + 5x - \sqrt{3}$ . Hint: first use the quadratic formula...
- Find the quadratic function that has a vertex at  $(1, 2)$  and passes through the point  $(3, 4)$ .