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 \((3, 4)\).