

Module 3: Exploring Functions

TOPIC 1: FUNCTIONS DERIVED FROM LINEAR RELATIONSHIPS

Students begin this topic with a reminder about absolute value. They calculate the absolute value of given values before considering the linear absolute value function. Students first graph the function $f(x) = x$, and then graph $f(x) = |x|$ discussing how the graph changed. The process is repeated for $f(x) = -|x|$. Students explore transformations of the function, and they graph and analyze linear piecewise functions based on their intuition about given real-world scenarios. At the end of the topic, students derive inverses of linear functions.

Where have we been?

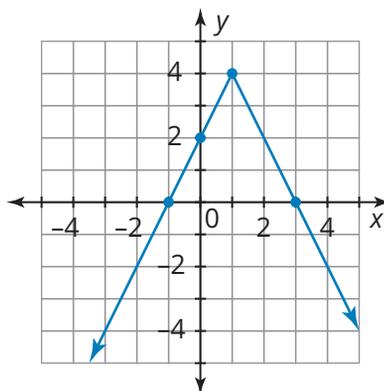
Students enter this topic with a wide range of experiences with linear functions. They have written and graphed linear relationships in middle school and in previous topics of this course. Students have also transformed linear functions, focusing primarily on vertical dilations, vertical translations, and reflections.

Where are we going?

Although derived from linear relationships, linear absolute value functions, linear piecewise functions, and step functions are more complex than the linear functions students have dealt with previously. They share enough characteristics with linear functions to be familiar to students, but they also serve as a bridge to the nonlinear functions students will study later in this course: exponential functions and quadratic functions.

Linear Absolute Value Function

The coordinate plane shows the graph of the linear absolute value function $f(x) = -2|x - 1| + 4$.



The graph increases to a vertex and then decreases and is symmetric across a vertical line through the vertex.

Error, Error!

In the real world, absolute values are often used to describe measurement errors or tolerance levels in manufacturing. This is particularly important when controlling waste produced in the manufacturing process.

For example, if a company uses a machine to fill a cereal box with cereal, it wants to make sure that the machine is operating within tolerance. This means that the machine may overfill some boxes and underfill others, but the overfill and underfill should be within a certain distance from a specified value.

For that calculation, absolute value functions are used:

$$|\text{machine amount} - \text{expected amount}| \leq \text{tolerance}.$$

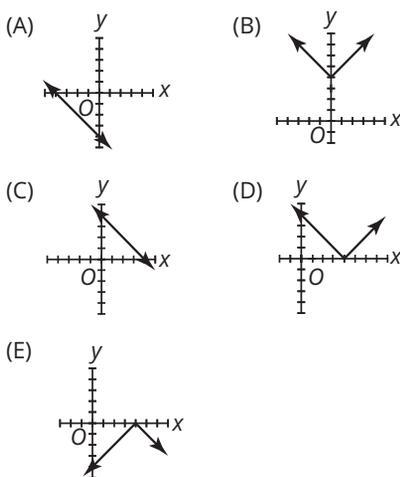
Talking Points

It can be helpful to understand different kinds of functions for college admissions tests.

Here is an example of a sample question:

Which of the following is the graph of

$$f(x) = |x - 4|?$$



To solve this problem, you need to know about absolute value functions. Choice D is the correct graph of the function.

Key Terms

absolute value

The absolute value of a number is its distance from zero on the number line.

line of reflection

A line of reflection is the line that the graph is reflected across.

piecewise function

A piecewise function is a function that can be represented by more than one function, each of which corresponds to a part of the domain.

step function

A step function is a piecewise function on a given interval whose pieces are discontinuous constant functions.

inverse function

The inverse function takes the output value, performs some operation(s) on this value, and arrives back at the original function's input value.