

# 3.4B Piecewise-Defined Functions

## ▼ Definition of a piecewise-defined function

A **piecewise-defined function** is a function that uses more than one equation to define the function. Pieces of each equation are used to develop a rule. The rule consists of the equations and conditions for which to use the equations.

## ▼ Evaluate a piecewise-defined function

### ▼ Example 1:

$$f(x) = \begin{cases} x^2 & x < 2 \\ -3x + 12 & x \geq 2 \end{cases}$$

Find  $f(0)$ ,  $f(2)$ , and  $f(4)$

### ▼ Example 2:

$$f(x) = \begin{cases} -x + 3 & x \neq -3 \\ 1 & x = -3 \end{cases}$$

Evaluate  $f(-5)$ ,  $f(-3)$ , and  $f(0)$

▼ Find the intercepts of a piecewise-defined function

▼ Finding the y-intercept

Let  $x = 0$  and use the conditions to decide which equation to use.

▼ Finding the x-intercepts

Let  $y = 0$  or  $f(x) = 0$ . To do this, set each equation equal to zero and solve. Check each solution to see if the conditions are met before including the solution as an x-intercept.

▼ Example 1:

$$f(x) = \begin{cases} x^2 & x < 2 \\ -3x + 12 & x \geq 2 \end{cases}$$

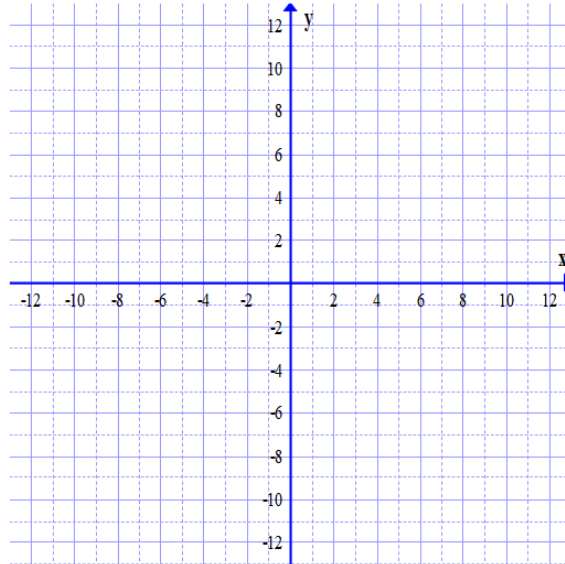
▼ Example 2:

$$f(x) = \begin{cases} -x + 3 & x \neq -3 \\ 1 & x = -3 \end{cases}$$

▼ Sketch a graph of a piecewise-defined function, state the domain and range

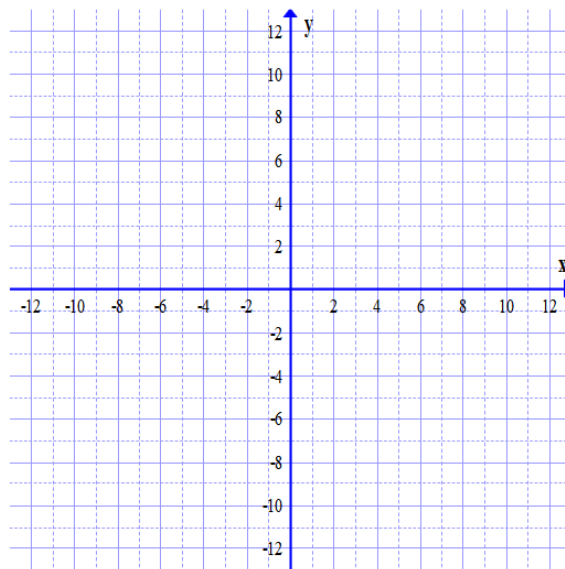
▼ Example 1:

$$f(x) = \begin{cases} x^2 & x < 2 \\ -3x + 12 & x \geq 2 \end{cases}$$



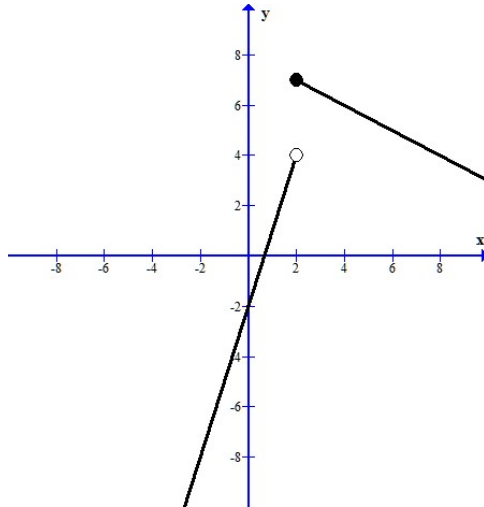
▼ Example 2:

$$f(x) = \begin{cases} -x + 3 & x \neq -3 \\ 1 & x = -3 \end{cases}$$

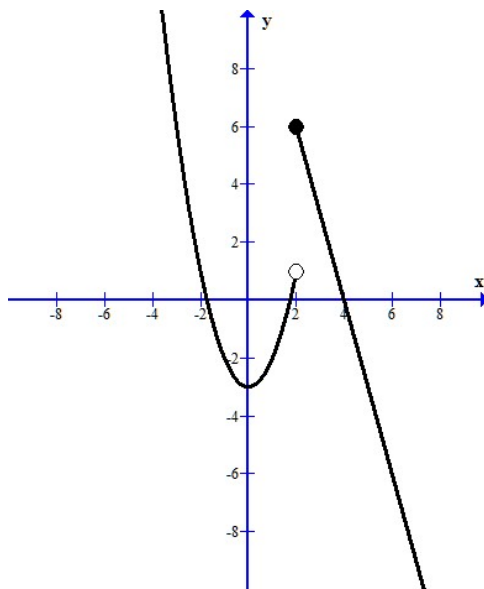


▼ Use a graph to find the rule for a piecewise-defined function

▼ Example 1



▼ Example 2



▼ Solve an application of a piecewise-defined function

▼ Example

On the planet of Sarnun the currency is dollars. On this planet's tax system, a person pays a 5% tax rate on the first \$28,000 earned and a 7% tax rate on everything earned over \$28,000.

- a. How many dollars in taxes are owed if an individual earns \$15,000?
- b. How many dollars in taxes are owed if an individual earns \$30,000?
- c. Find the piecewise-defined function that describes the amount of taxes paid as a function of  $x$  dollars earned.
- d. Sketch a graph of the piecewise-defined function.