

Identifying Intercepts of a Line

by Sophia



WHAT'S COVERED

This tutorial covers identifying intercepts of a line, through the exploration of:

1. Defining x- and y-Intercepts
2. Identifying Intercepts from a Graph
3. Identifying Intercepts from an Equation

1. Defining x- and y-Intercepts

The **x-intercept** is the location on a graph where a line or a curve intersects the x-axis. The coordinate pair of any x-intercept is $(x, 0)$ because the value of y is always 0 on the x-axis.

The **y-intercept** is the location on the graph where a line or curve intersects the y-axis. The coordinate pair of any y-intercept is $(0, y)$ because the value of x is always 0 on the y-axis.



TERMS TO KNOW

x-Intercept

The location on a graph where a line or curve intersects the x-axis: $(x, 0)$

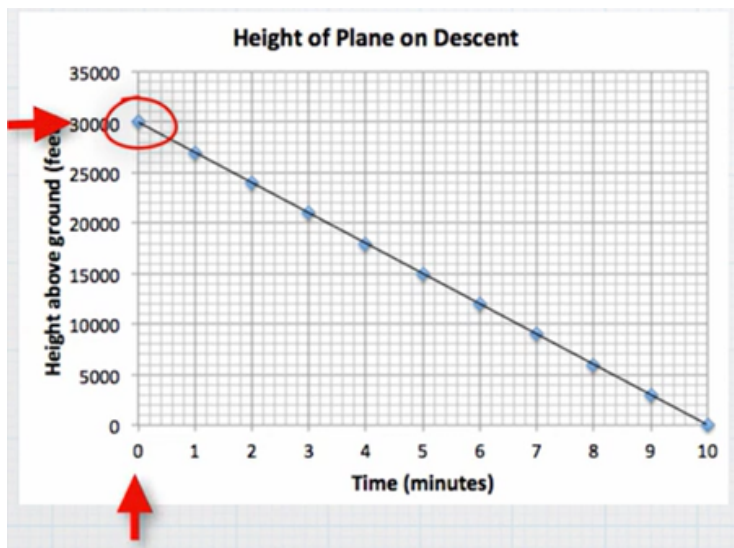
y-Intercept

The location on a graph where a line or curve intersects the y-axis: $(0, y)$

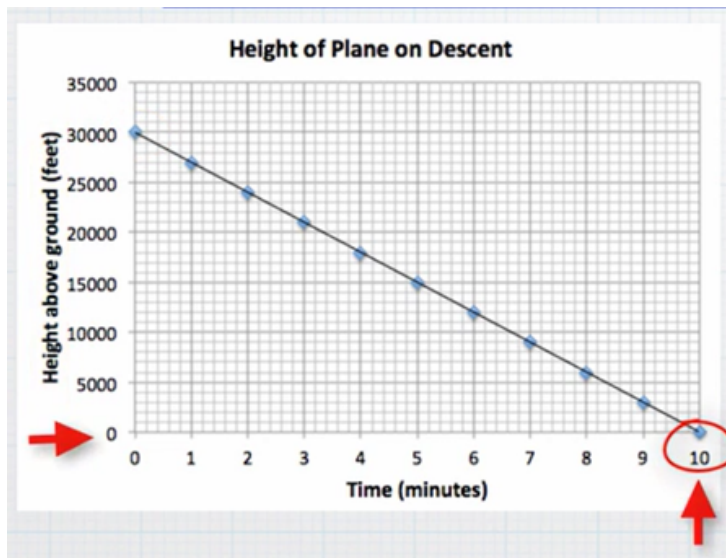
2. Identifying Intercepts from a Graph

You can visually identify the x- and y-intercepts on a graph. For example, the graph below shows the height above ground of a plane during its descent in relation to time in minutes.

The y-intercept is represented by the pair $(0, 30,000)$. This means that after 0 minutes of descent, the plane is 30,000 feet above the ground.



The x-intercept of the graph is represented by the order paired (10, 0). This means that after 10 minutes, the height of the plane is 0 feet above ground.



3. Identifying Intercepts from an Equation

You can also find the x- and y-intercepts from an equation. An **equation in two variables** is an equation with terms involving two distinct variables. Most commonly, these variables are x and y.

⇒ **EXAMPLE** The equation below represents the balance of debt during a 24-month repayment period, with the corresponding graph representation.

$$y = -45x + 1080$$



You can find the x-intercept by substituting 0 for y in the equation and then solving the equation for x.



Doing this, your expression becomes:

$$0 = -45x + 1080$$

You can start to solve this equation for x by subtracting 1,080 from both sides. Next, divide by -45 on both sides, which provides x equals 24. Therefore, the x-coordinate of the x-intercept is 24, and the ordered pair of the x-intercept is (24, 0). This means that after 24 months, the balance of debt is \$0.

$$0 = -45x + 1080$$

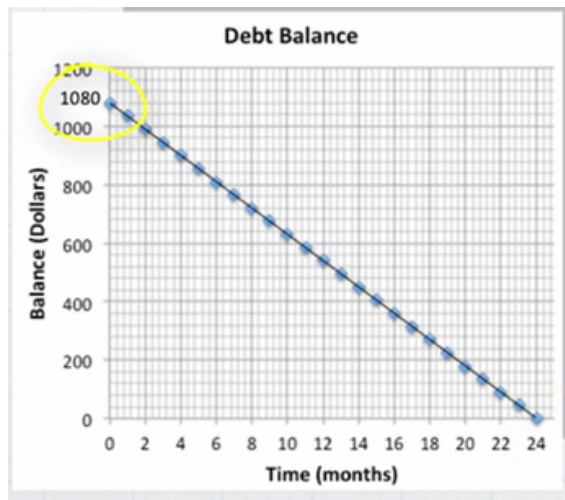
$$0 - 1080 = -45x + 1080 - 1080$$

$$-1080 = -45x$$

$$\frac{-1080}{-45} = \frac{-45x}{-45}$$

$$24 = x$$

Similarly, you can find the y-intercept by substituting 0 for x in the equation and then solving the equation for y.



Substituting 0 for x, your equation is:

$$y = -45(0) + 1080$$

Solve the equation by multiplying -45 times 0, which equals 0. Next, add 0 and 1,080, which equals 1,080. Therefore, y equals 1,080. The y-coordinate of the y-intercept is 1,080, and the ordered pair of the y-intercept is (0, 1080). This means that after 0 months, the balance of debt is \$1,080.

$$y = -45(0) + 1080$$

$$y = 0 + 1080$$

$$y = 1080$$



BIG IDEA

Note that for equations written as $y = ax + b$ (slope intercept form), as in the preceding example, the y-intercept can easily be defined by b, or the constant value at the end of the equation, since a times x will always be 0 when x is 0 for any value of a.



FORMULA TO KNOW

Slope-Intercept Form of a Line

$$y = mx + b$$

⇒ **EXAMPLE** Try finding the x- and y-intercepts for the following equation in slope-intercept form.

$$y = 5x - 30$$

To find the x-intercept, you know that the value of y will be 0, so you can substitute 0 for y into the equation and solve for x. This provides 0 equals 5x minus 30. To solve for x, start by adding 30 to both sides of the

equation. Divide by 5 on both sides, which simplifies to 6 is equal to x. The x-intercept can be written as the ordered pair (6,0).

$$\begin{aligned}0 &= 5x - 30 \\0 + 30 &= 5x - 30 + 30 \\30 &= 5x \\\frac{30}{5} &= \frac{5x}{5} \\6 &= x \\(6,0)\end{aligned}$$



HINT

Notice that the y value of the ordered pair is 0, because the value of y is always 0 at the x-intercept.

Next, to find the y-intercept, substitute 0 for x in the equation and solve for y. You know that the y-intercept will always be the value of b in our equation, because when x is 0, a times x will always equal 0 for any value of a. However, you can complete the steps to solve the equation for y to show that this is true. Substitute 0 for x, then simplify the right side of the equation, arriving at the expression y equals -30. The y-intercept can be written as the ordered pair (0, -30).

$$\begin{aligned}y &= 5(0) - 30 \\y &= 0 - 30 \\y &= -30 \\(0, -30)\end{aligned}$$



HINT

Notice that the x value of the ordered pair is 0, because the value of x is always 0 at the y-intercept.



TERM TO KNOW

Equation in Two Variables

An equation with terms involving two distinct variables



SUMMARY

Today you learned the **definition of the x- and y-intercepts** on a graph, which is where a line or curve intersects each respective axis. You also learned how to **identify the x- and y-intercepts from a graph**, as well as how to identify the **x- and y-intercepts from an equation**.

Source: This work is adapted from Sophia author Colleen Atakpu.



TERMS TO KNOW

Equation in Two Variables

An equation with terms involving two distinct variables.

X-Intercept

The location on a graph where a line or curve intersects the x-axis: $(x, 0)$.

Y-Intercept

The location on a graph where a line or curve intersects the y-axis: $(0, y)$.



FORMULAS TO KNOW

Slope-Intercept Form of a Line

$$y = mx + b$$