Objectives

Graph lines and write their equations in slope-intercept and point-slope form.

Classify lines as parallel, intersecting, or coinciding.

3-6 Lines in the Coordinate Plane

Forms of the Equation of a Line

FORM	EXAMPLE
The **point-slope form** of a line is $y - y_1 = m(x - x_1)$, where m is the slope and (x_1, y_1) is a given point on the line.	$y - 3 = 2(x - 4)$ $m = 2$, $(x_1, y_1) = (3, 4)$
The **slope-intercept form** of a line is $y = mx + b$, where m is the slope and b is the y-intercept.	$y = 3x + 6$ $m = 3$, $b = 6$
The equation of a vertical line is $x = a$, where a is the x-intercept.	$x = 5$
The equation of a horizontal line is $y = b$, where b is the y-intercept.	$y = 2$

Remember!

A line with y-intercept b contains the point $(0, b)$.
A line with x-intercept a contains the point $(a, 0)$.

Example 1:

Write the equation of each line in the given form.

the line with slope 6 through (3, –4) in point-slope form

$y - y_1 = m(x - x_1)$ *Point-slope form*

$y - (-4) = 6(x - 3)$ *Substitute 6 for m, 3 for x_1, and -4 for y_1.*

Example 1B: Writing Equations In Lines

Write the equation of each line in the given form.

the line through (–1, 0) and (1, 2) in slope-intercept form

$$m = \frac{2-0}{1-(-1)} = \frac{2}{2} = 1$$ *Find the slope.*

$y = mx + b$ *Slope-intercept form*

$0 = 1(-1) + b$ *Substitute 1 for m, -1 for x, and 0 for y.*

$1 = b$

$y = x + 1$ *Write in slope-intercept form using m = 1 and b = 1.*

Example 1C

Write the equation of each line in the given form.

the line through (–3, 2) and (1, 2) in point-slope form

$$m = \frac{2-2}{1-(-3)} = \frac{0}{4} = 0$$ *Find the slope.*

$y - y_1 = m(x - x_1)$ *Point-slope form*

$y - 2 = 0(x - 1)$ *Substitute 0 for m, 1 for x_1, and 2 for y_1.*

$y - 2 = 0$ *Simplify.*

3-6 Lines in the Coordinate Plane

Pairs of Lines

PARALLEL LINES	INTERSECTING LINES	COINCIDING LINES
$y = 5x + 8$ $y = 5x - 4$	$y = 2x - 5$ $y = 4x + 3$	$y = 2x - 4$ $y = 2x - 4$
Same slope different *y*-intercept	Different slopes	Same slope, same *y*-intercept

Example 3:

Determine whether the lines are parallel, intersect, or coincide.

$y = 3x + 7$, $y = -3x - 4$

The lines have different slopes, so they intersect.

Example 3B: Classifying Pairs of Lines

Determine whether the lines are parallel, intersect, or coincide.

$y = -\frac{1}{3}x + 5,\ 6y = -2x + 12$

Solve the second equation for y to find the slope-intercept form.

$$6y = -2x + 12$$

$$y = -\frac{1}{3}x + 2$$

Both lines have a slope of $-\frac{1}{3}$, and the *y*-intercepts are different. So the lines are parallel.

Example 3C: Classifying Pairs of Lines

Determine whether the lines are parallel, intersect, or coincide.

$2y - 4x = 16$, $y - 10 = 2(x - 1)$

Solve both equations for y to find the slope-intercept form.

$$2y - 4x = 16$$
$$2y = 4x + 16$$
$$y = 2x + 8$$

$$y - 10 = 2(x - 1)$$
$$y - 10 = 2x - 2$$
$$y = 2x + 8$$

Both lines have a slope of 2 and a y-intercept of 8, so they coincide.