

Writing Equations of Lines Video Lecture

Section 3.5

Course Learning Objective:

- 1) Identify and use connections between linear equations, their slope, their intercepts, and their graphs. (Review from Math 840)
- 2) Graph linear equations and model applications based on these equations and their graphs.

Weekly Learning Objectives:

- 1) Use the slope-intercept form to write an equation of a line.
- 2) Use the point-slope form to find an equation of a line given its slope and a point of the line.
- 3) Use the point-slope form to find an equation of a line given two points of the line.
- 4) Write the equation of line in standard form.
- 5) Find equations of vertical and horizontal lines.
- 6) Find the equation of a line from its graph.
- 7) Find the equation of a line parallel or perpendicular to a line and passing through a given point.
- 8) Use the point-slope form to solve linear application problems.
- 9) Interpret the meaning of the slope and intercepts in linear applications.

Writing Equations of Lines

Slope-Intercept Form: $y = mx + b$

Point-Slope Form: $y - y_1 = m(x - x_1)$

Standard Form: $Ax + By = C$, A, B, and C must be integers (not fractions or decimals), and $A > 0$ (A must be positive)

How to find the equation of a line given two points:

- 1) Find the slope between the 2 points using: $m = \frac{y_2 - y_1}{x_2 - x_1}$**
- 2) Use point-slope form, $y - y_1 = m(x - x_1)$, using either point and m**
- 3) Simplify and put into slope-intercept or standard form**

Examples:

Find the equation of the line between $(-4, -3)$ and $(2, 1)$. Put into slope-intercept form.

Find the equation of the line between $(2, 5)$ and $(-1, 0)$. Put into standard form.

How to find the equation of a line given the slope m and y -intercept b :

1) Substitute m and b into slope-intercept form: $y = mx + b$

Example:

Find the equation of the line with slope $2/3$ and passing through the point $(0, -1)$

How to find the equation of a line given the slope m and any point (x_1, y_1) :

1) Substitute given info into point-slope form: $y - y_1 = m(x - x_1)$

2) Simplify and put equation into slope-intercept or standard form

Example:

Find the equation of the line through $(-3, 0)$ with slope = $-1/2$.

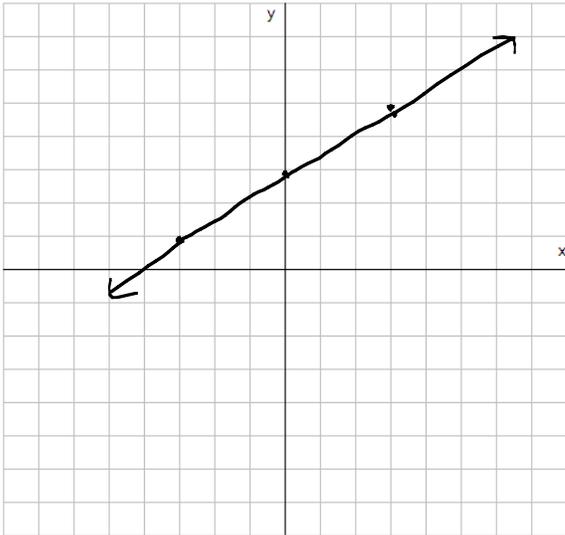
Put the line into standard form.

How to find the equation of a line from a graph:

- 1) Find the slope m by locating two "good" points and counting rise/run
- 2) Find the y -intercept by locating the point that intersects the y -axis
- 3) Substitute the slope and y -intercept into slope-intercept form

Example:

Find the equation of the line graphed below:



How to find the equation of a line parallel or perpendicular to a given line and passing through a given point:

- 1) Find the slope of the given line by solving for y and finding the coefficient of x
- 2) For a parallel line, keep the slope the same
For a perpendicular line, take the opposite reciprocal slope
- 3) Substitute the given point and the new slope into point-slope form
- 4) Simplify and put equation into slope-intercept or standard form

Examples:

Find the equation of the line passing through $(2, -1)$ and parallel to the line having equation $5x = 2y + 10$

Find the equation of the line passing through $(-1, 4)$ and perpendicular to the line having equation $2x + 3y = 8$.

How to find equations of Vertical Lines through any point (a, b) :

1) The equation will be $x = a$

How to find equations of Horizontal Lines through any point (a, b) :

1) The equation will be $y = b$

Examples:

Find the equation of the horizontal line through $(-3, 1)$

Find the equation of the vertical line through $(2, -1)$

Find the equation of the line through $(1, 5)$ with undefined slope

Find the equation of the line through $(1, 4)$ with zero slope

Application Problems:

A company has learned that by pricing a newly released frisbee at \$6, sales will reach 2000 per day. Raising the price to \$8 will cause the sales to fall to 1500 per day.

Assume that the ratio of change in sales to change in daily price is constant, and let x be the price of the frisbee and y be the number of sales.

a) List two ordered pairs:

b) Find the slope and interpret its meaning

c) Find the linear equation which models the prices sales relationship for this frisbee.

d) Find the y -intercept and interpret its meaning

e) Find the x -intercept and interpret its meaning

f) Predict the daily sales of frisbess if the price is set at \$7.50

The value of a building bought in 1990 appreciates or increases as time passes. Four years after the building was bought it was worth \$165,000. Seven years after it was bought it was worth \$180,000. If this relationship between the number of years (x) past 1990 and the value of the building (y) is linear, write an equation describing this relationship.

Interpret the meaning of the slope.

Find and interpret the meaning of the y -intercept.

Use the equation to estimate the value of the building in the year 2000.