



LINES

Pythagorean Theorem

In a right triangle, if a and b are the lengths of the perpendicular sides and c is the length of the hypotenuse, then



Undirected distance between two points

- The distance between two points $P_1(x_1, y_1)$ and $P_2(x_2, y_2)$ is given by

$$|\overline{P_1P_2}| = \boxed{?}$$

Undirected distance between two points

Find the distance of the points $A(-4,7)$ and $B(1,-3)$



Midpoint Formula

- If $M(x, y)$ is the midpoint of the line segment from $P_1(x_1, y_1)$ to $P_2(x_2, y_2)$, then



Midpoint Formula

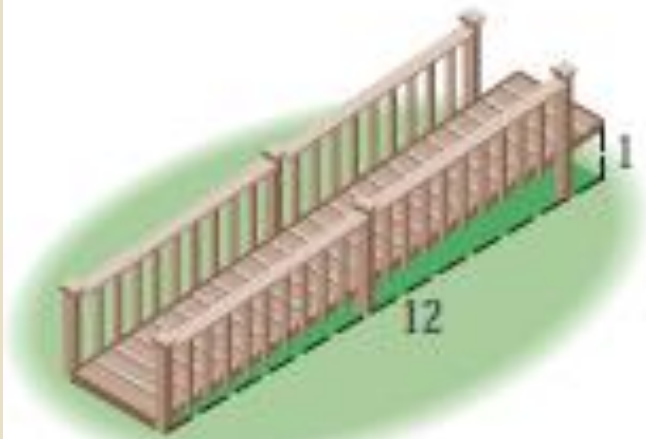
Find the midpoint of the points $A(-4,7)$ and $B(1,-3)$.

Slope of a Line

- “steepness”
- how quickly its rise (or fall)

$$\text{slope} = \frac{\text{rise}}{\text{?}}$$

Slope of a Line



Slope of a ramp

$$\text{Slope} = \frac{1}{12}$$



Pitch of a roof

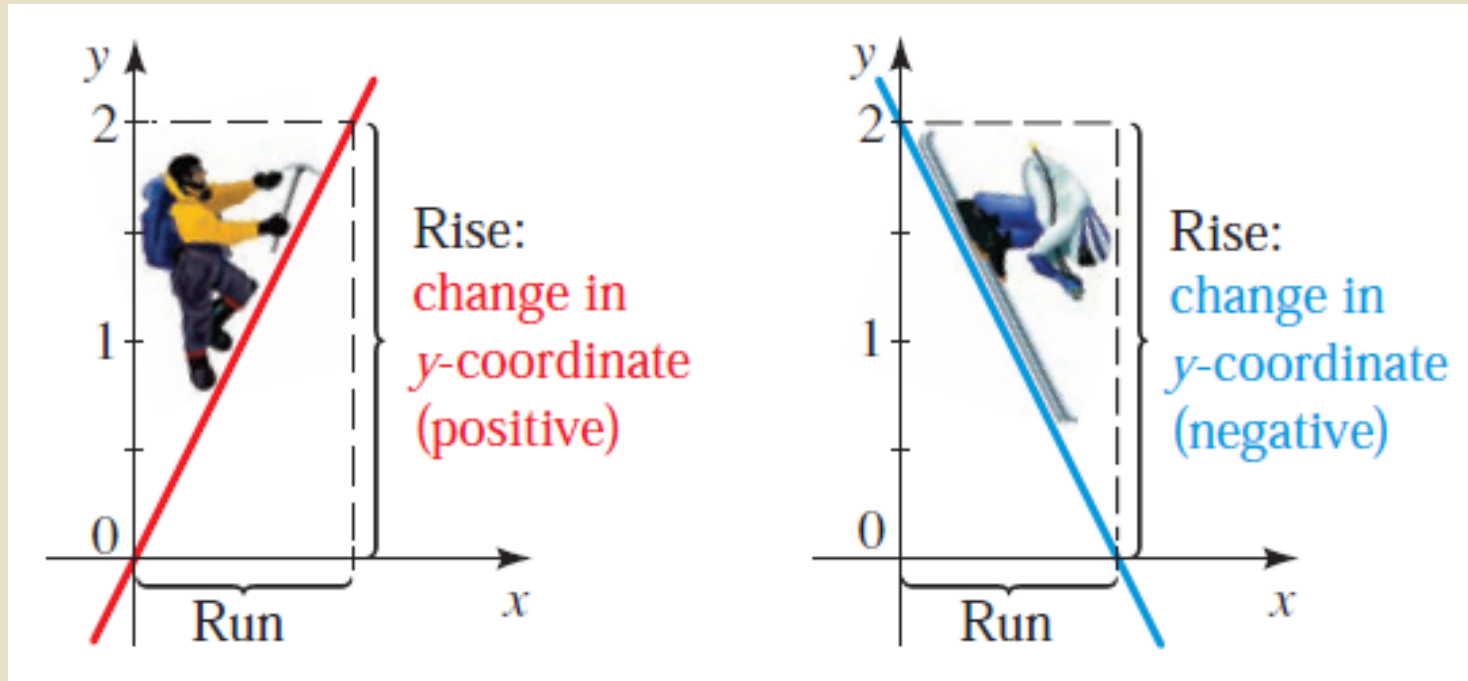
$$\text{Slope} = \frac{1}{3}$$



Grade of a road

$$\text{Slope} = \frac{8}{100}$$

Slope of a Line



- Run: change in the x -coordinate
- Rise: change in the



Slope of a Line

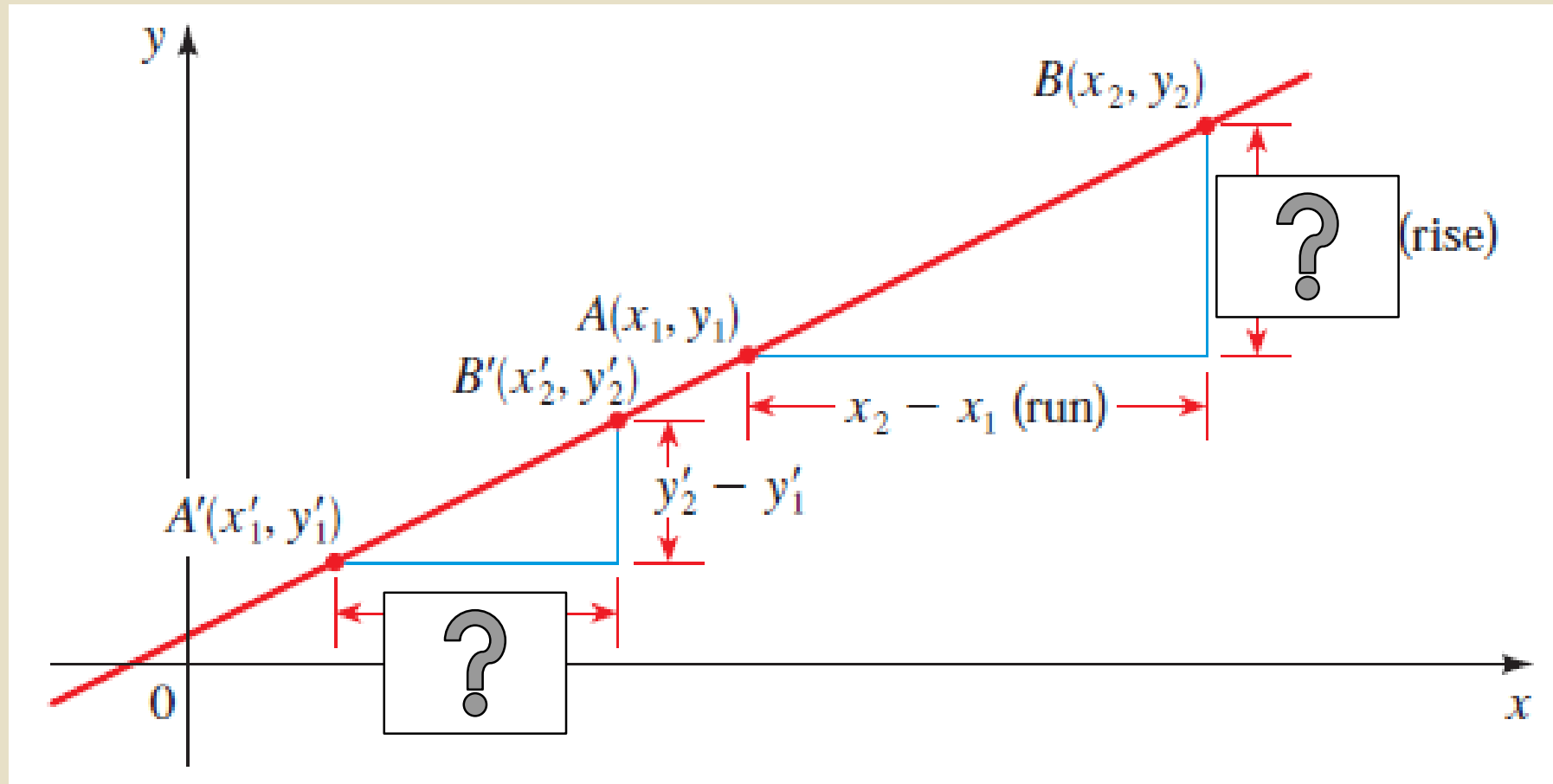
The slope m of a nonvertical line that passes through the points $A(x_1, y_1)$ and $B(x_2, y_2)$ is

$$m = \frac{\text{rise}}{\text{run}} = \boxed{?}$$

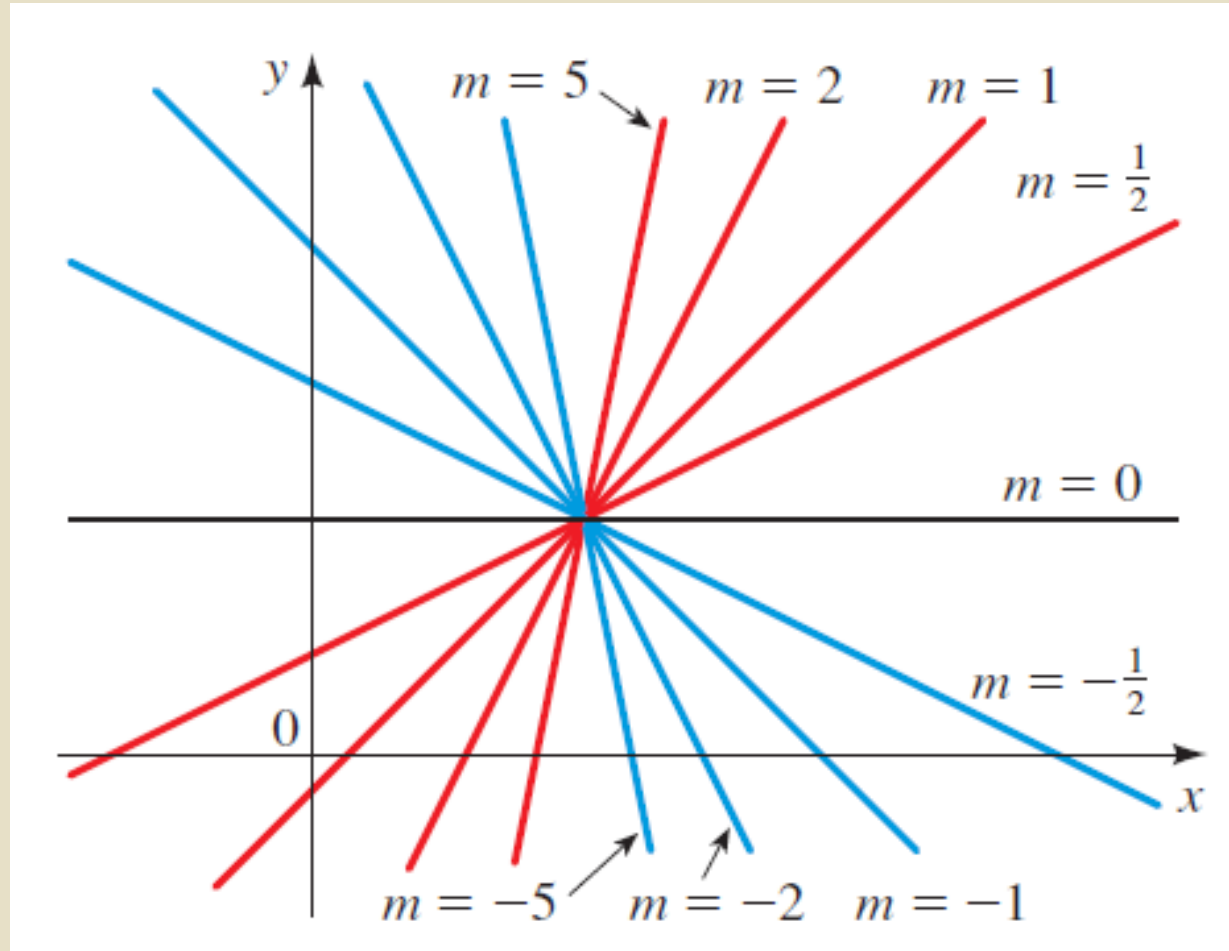
The slope of a vertical line is

$$\boxed{?}$$

Slope of a Line



Slope of a Line



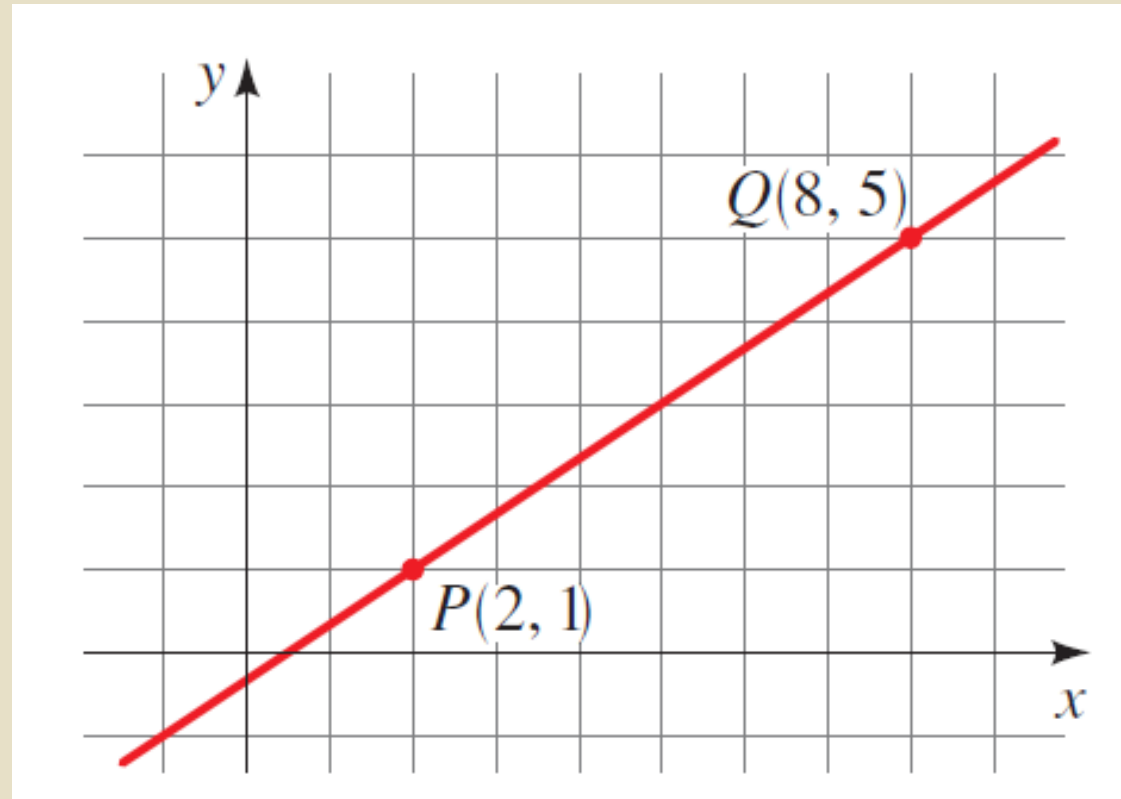
Slope of a Line

Find the slope of the lines that passes through points $P(2,1)$ and $Q(8,5)$.

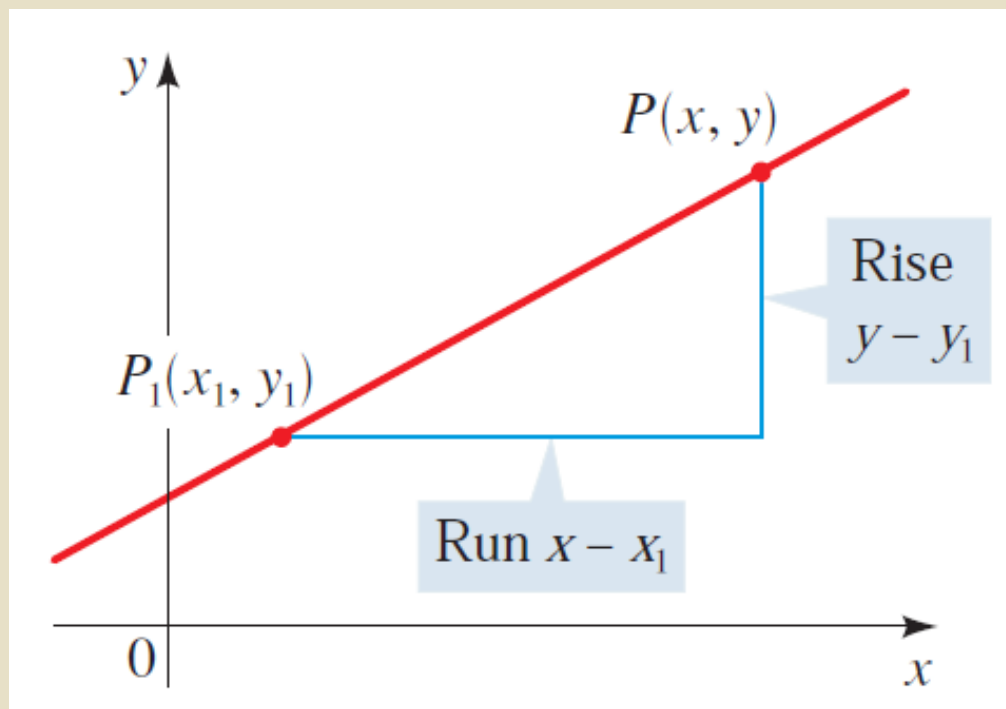


Slope of a Line

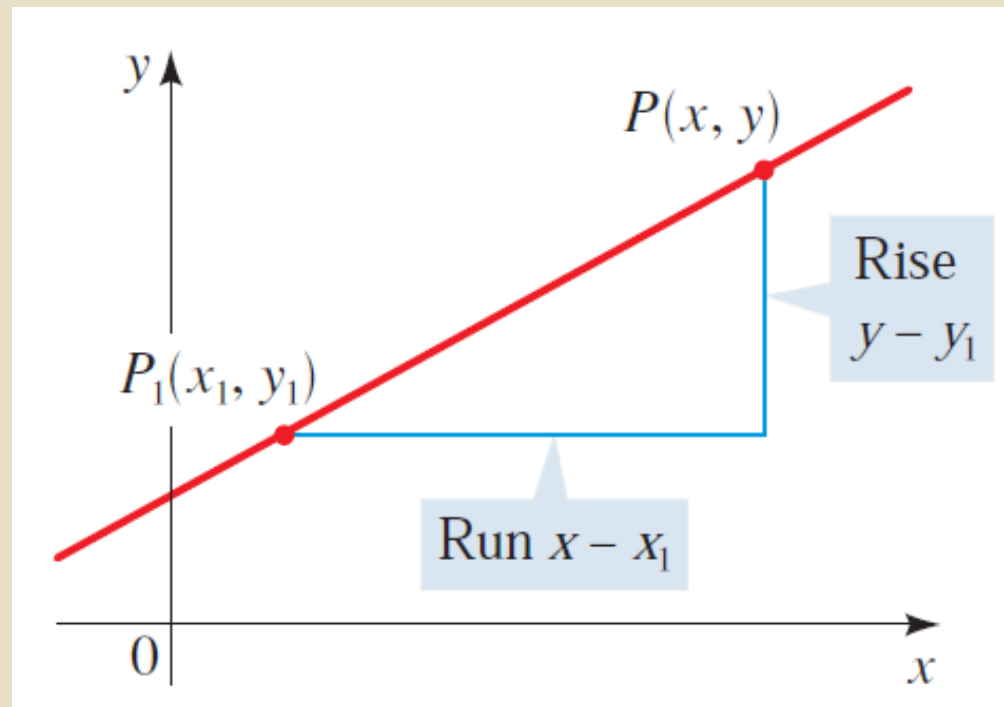
Find the slope of the lines that passes through points $P(2,1)$ and $Q(8,5)$.



Point-Slope form



Point-Slope form



An equation of the line that passes through the point (x_1, y_1) and has slope m is

?

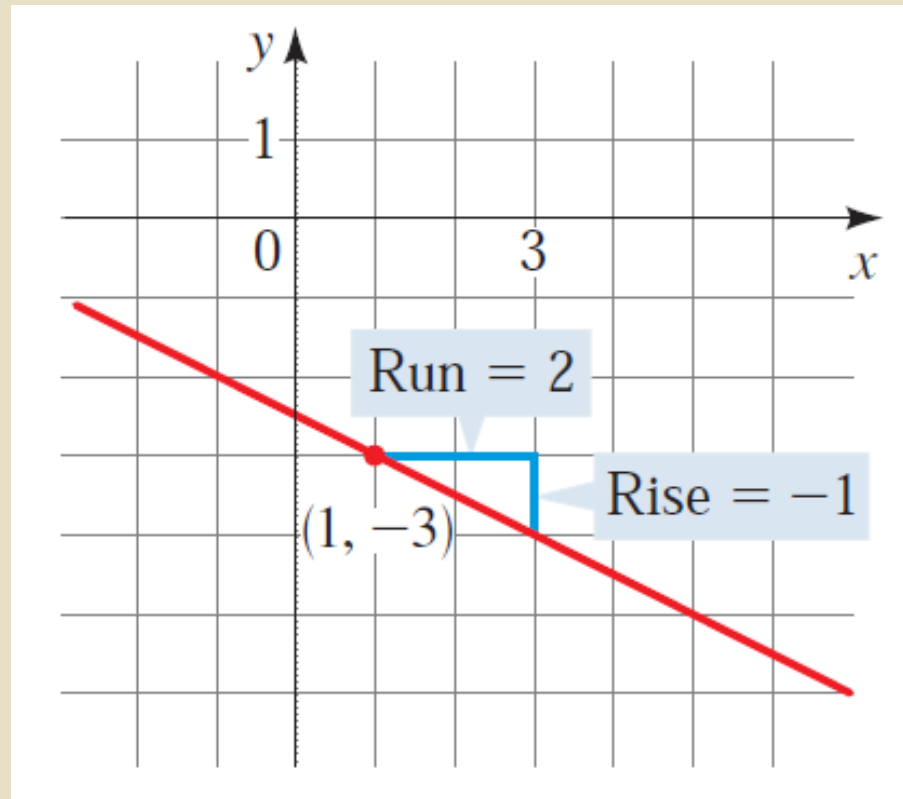
Point-Slope form

Find an equation of the line through $(1, -3)$ with slope $-\frac{1}{2}$



Point-Slope form

Find an equation of the line through $(1, -3)$ with slope $-\frac{1}{2}$

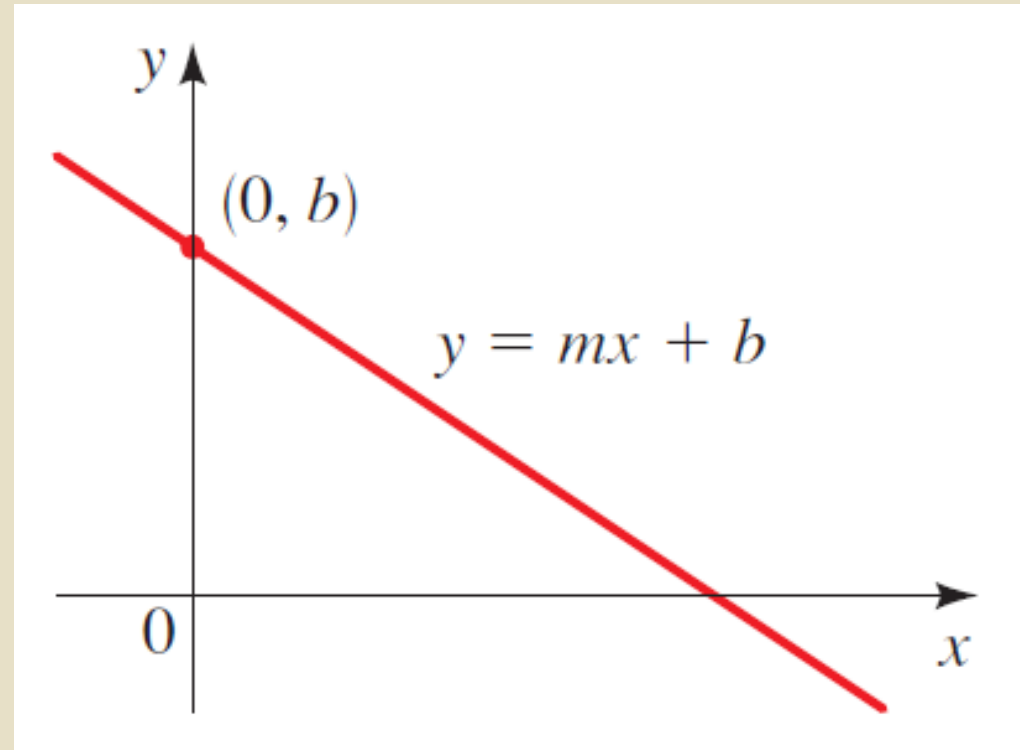


Point-Slope form

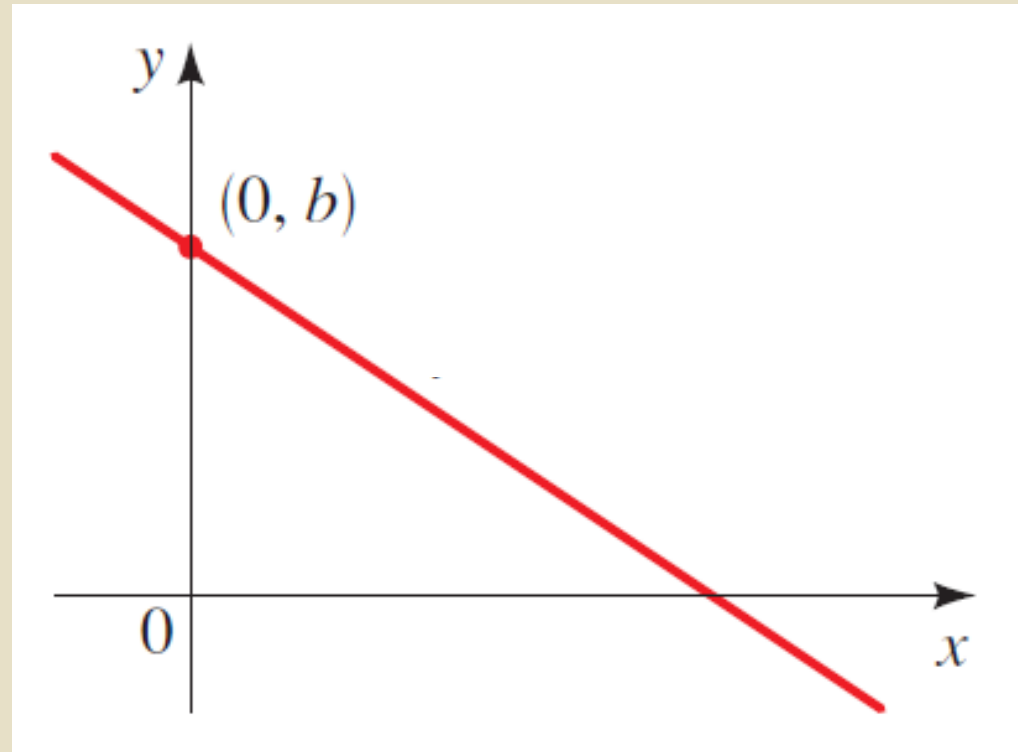
Find an equation of the line through $(-1, 2)$ and $(3, -4)$



Slope-Intercept form



Slope-Intercept form



An equation of the line that has slope m and y -intercept b is

?

Slope-Intercept form

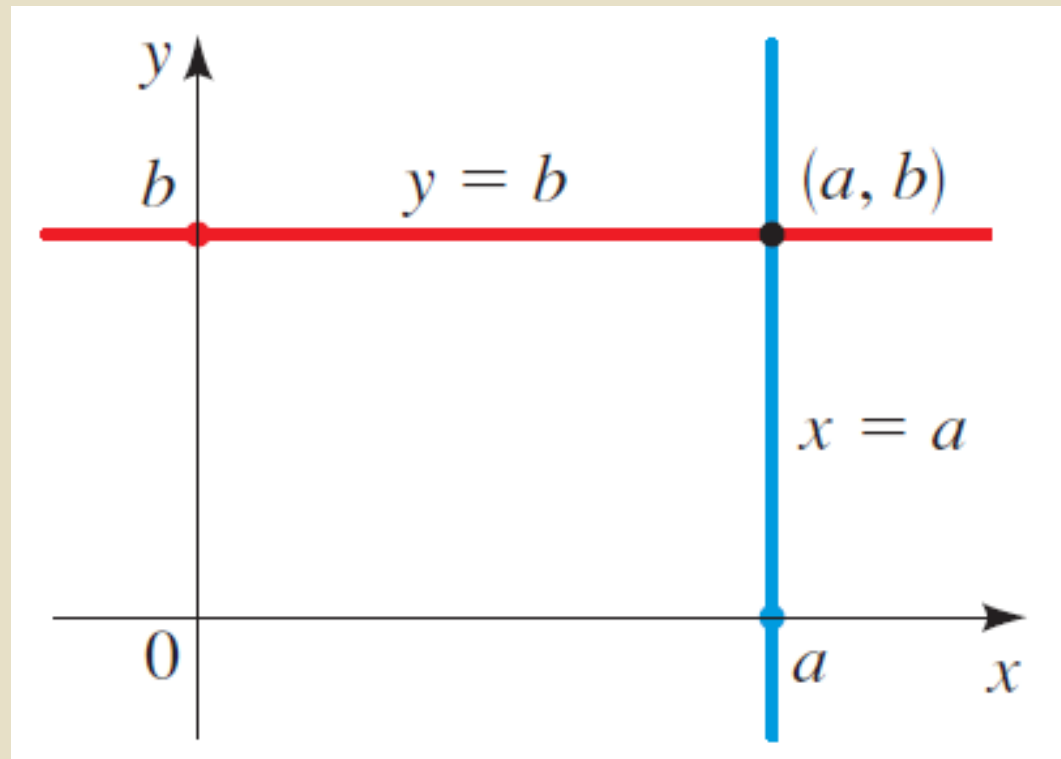
Find the equation of the line with slope 3 and y -intercept -2



Find the slope and y -intercept of the line $3y - 2x = 1$



Vertical and Horizontal Lines



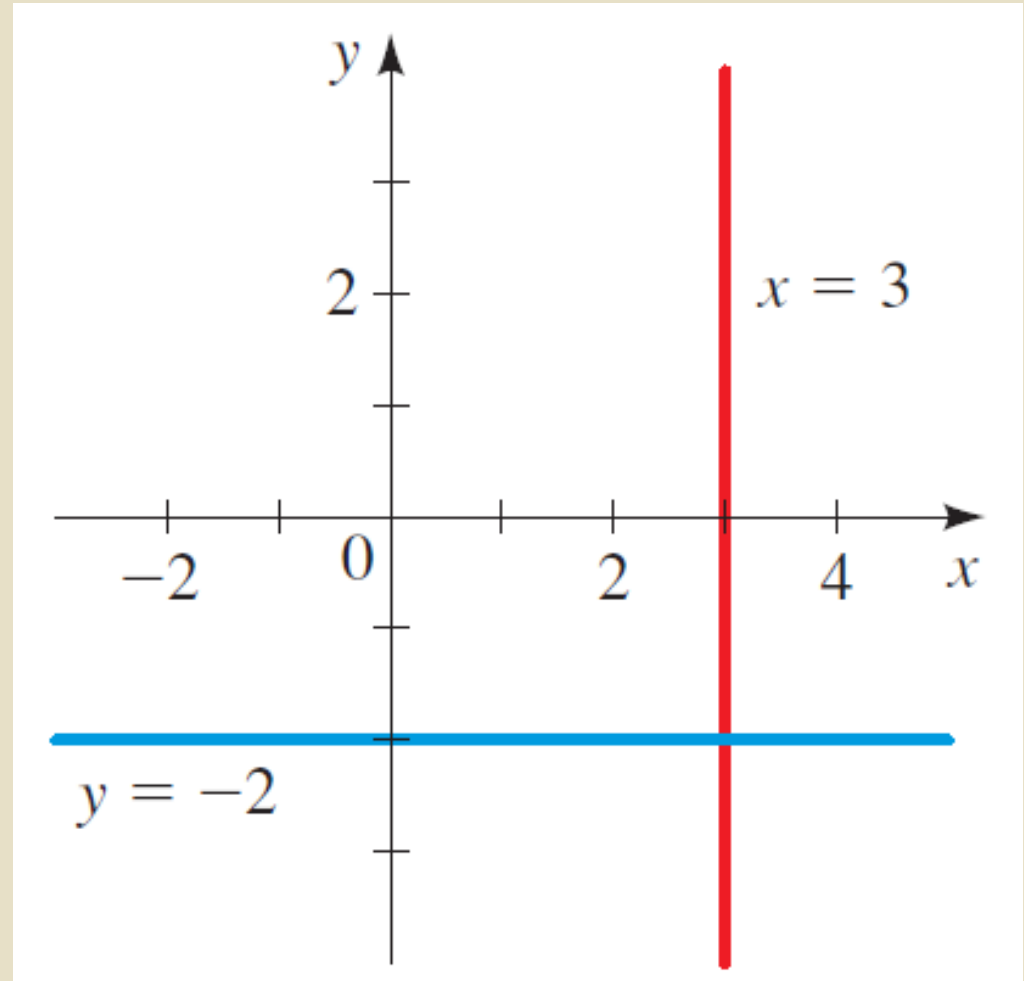
An equation of the vertical line through (a, b) is $x = a$.

An equation of the horizontal line through (a, b) is $y = b$.

Vertical and Horizontal Lines

An equation for the vertical line through $(3,5)$ is $x = 3$

An equation for the horizontal line through $(8, -2)$ is $y = -2$



General Equation of a Line

A linear equation is an equation of the form

$$\boxed{}?$$

where A , B , and C are constants and A and B are not both 0.

General Equation of a Line

An equation

$$Ax + By + C = 0$$

with $B \neq 0$ has slope-intercept form



and if $B = 0$, the equation becomes

$$Ax + C = 0$$

or

$$x = -\frac{C}{A}$$

General Equation of a Line

Sketch the graph of the equation

$$2x - 3y - 12 = 0$$

using intercepts and using the slope-intercept form

Parallel and Perpendicular Lines

Two nonvertical lines are parallel if and only if they have the same

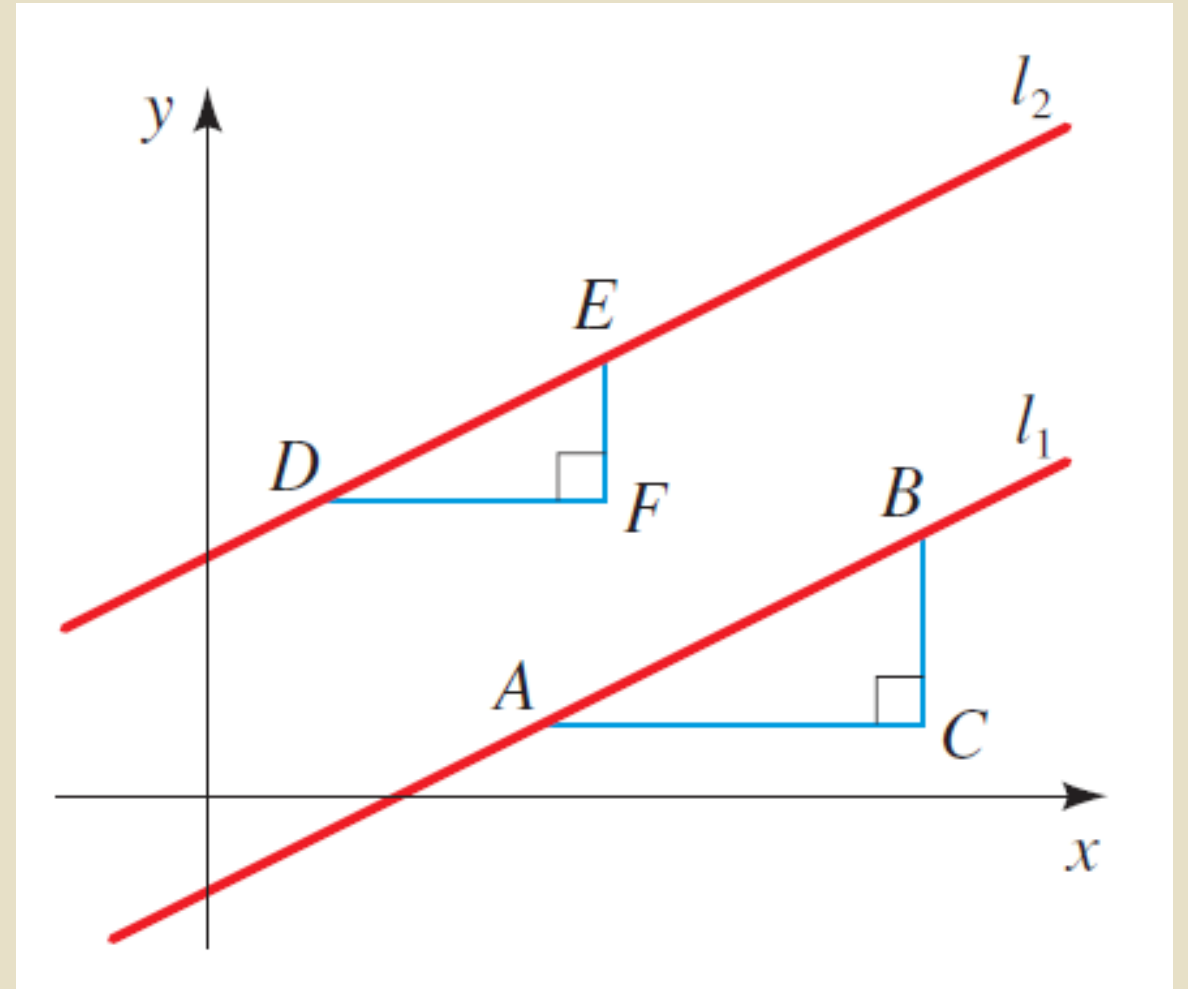
?

Parallel and Perpendicular Lines

Proof: Let lines l_1 and l_2 have slopes m_1 and m_2 .

If the lines are parallel then the right triangles ABC and DEF are similar, so

$$m_1 = \frac{d(B, C)}{d(A, C)} = \frac{d(E, F)}{d(D, F)} = m_2$$



Parallel and Perpendicular Lines

Find an equation of the line through the point $(5,2)$ that is parallel to the line $4x + 6y + 5 = 0$



Parallel and Perpendicular Lines

Two lines with slopes m_1 and m_2 are perpendicular if and only if $m_1 m_2 = -1$, that is, their slopes are negative reciprocals:

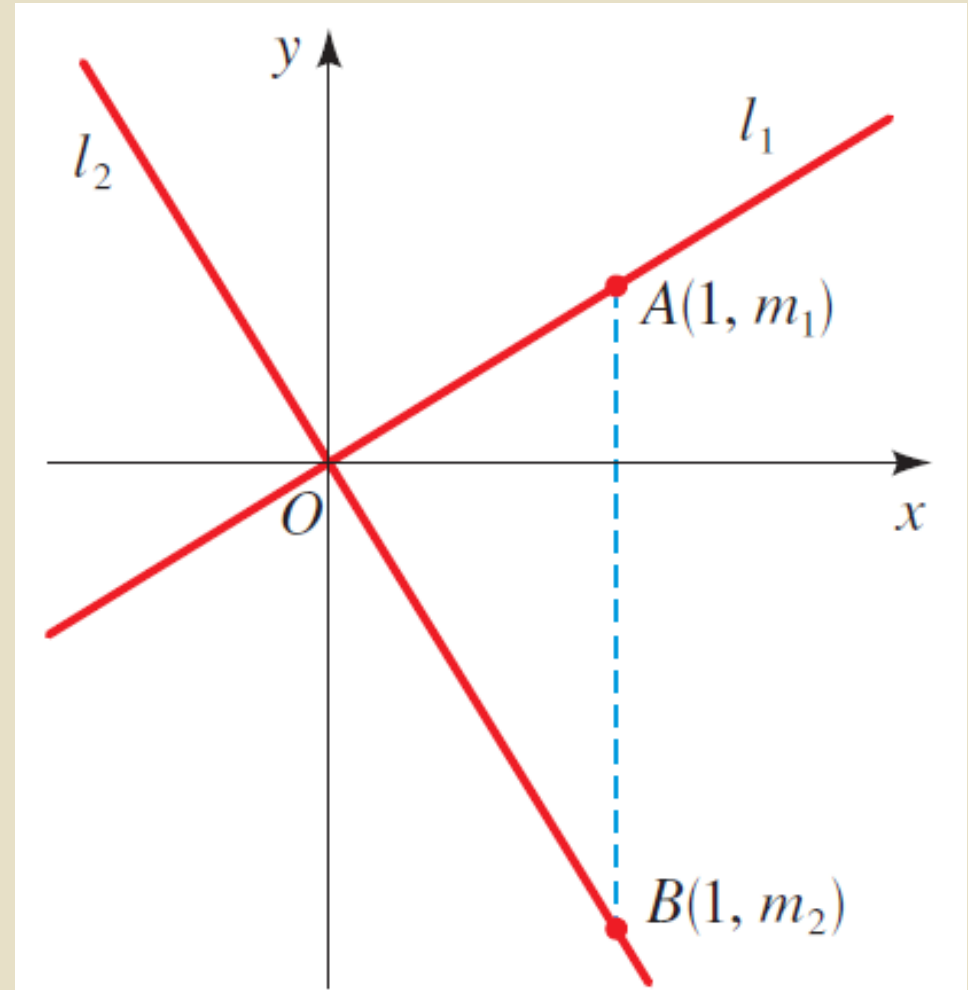
$$m_2 = -\frac{1}{m_1}$$

Also, a horizontal line (slope 0) is perpendicular to a vertical line (no slope).

Parallel and Perpendicular Lines

Proof:

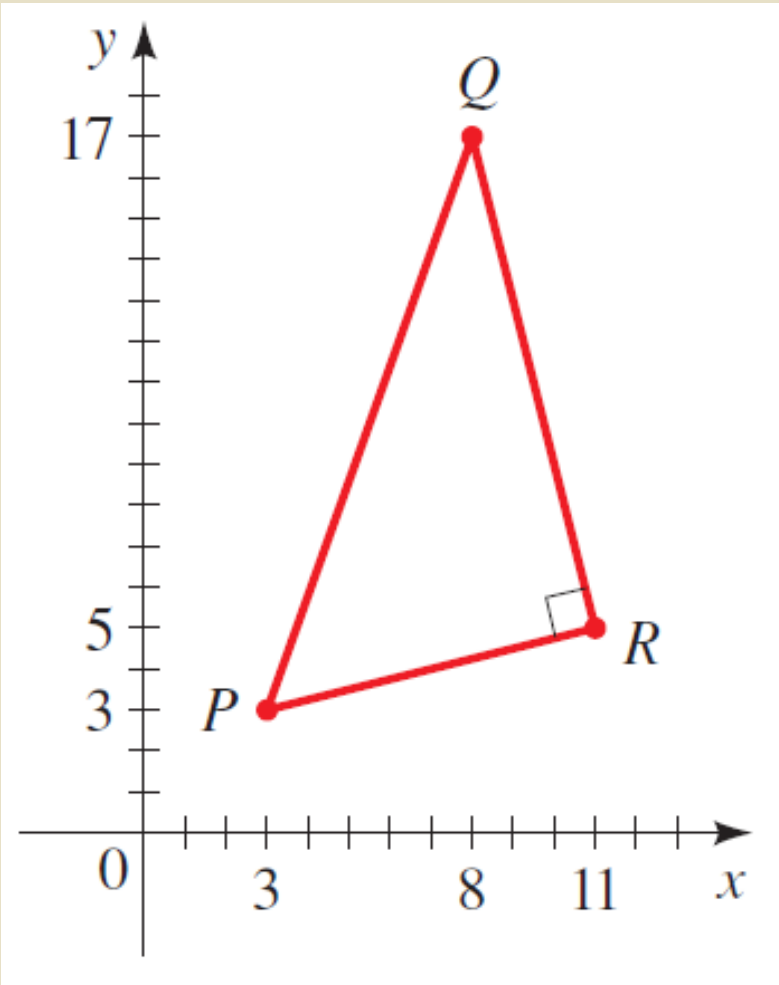
If the lines l_1 and l_2 have slopes m_1 and m_2 , then the equations are $y = m_1x$ and $y = m_2x$.



Parallel and Perpendicular Lines

Show that the points $P(3,3)$, $Q(8,17)$, and $R(11,5)$ are the vertices of a right triangle.

Parallel and Perpendicular Lines



Show that the points $P(3,3)$, $Q(8,17)$, and $R(11,5)$ are the vertices of a right triangle.

Parallel and Perpendicular Lines

Find an equation of the line that is perpendicular to the line $4x + 6y + 5 = 0$ and passes through the origin

