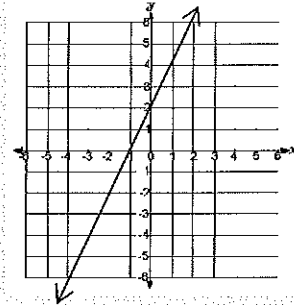


3.3 and 3.4 Slopes and Equations of Lines

G.PL.4 Know that parallel lines have the same slope and perpendicular lines have opposite reciprocal slopes. Determine if a pair of lines are parallel, perpendicular, or neither by comparing the slopes in coordinate graphs and in equations. Find the equation of the line, passing through a given point, that is parallel or perpendicular to a given line.

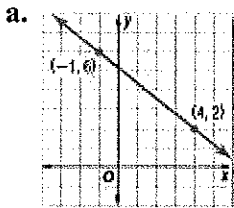
Slope of a Line

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1} \quad \text{or} \quad \frac{\text{RISE}}{\text{RUN}}$$



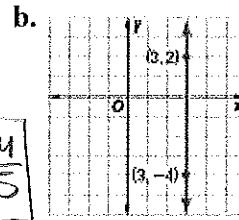
Ex 1:

Find the slope of the following lines.



$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{6 - 2}{-1 - 4} = \frac{4}{-5} = \boxed{\frac{-4}{5}}$$



$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - (-4)}{3 - 3} = \frac{6}{0} = \boxed{\text{undefined}}$$

Slope Postulates

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

*All vertical lines are parallel.

same slope

Two nonvertical lines are perpendicular if and only if the product of their slopes is -1.

*All vertical and horizontal lines are perpendicular.

opposite reciprocal

Ex 2:

Determine whether \overline{XY} and \overline{WZ} are parallel, perpendicular, or neither using the slope formula.

a. X(9, 5), Y(-1, 6), W(-8, 2), Z(12, 4)

$$m_{\overline{XY}} = \frac{6 - 5}{-1 - 9} = \frac{1}{-10} = \frac{-1}{10}$$

$$m_{\overline{WZ}} = \frac{4 - 2}{12 - (-8)} = \frac{2}{20} = \frac{1}{10}$$

Neither

b. X(9, -4), Y(-2, 7), W(14, 8), Z(19, 13)

$$m_{\overline{XY}} = \frac{7 - (-4)}{-2 - 9} = \frac{11}{-11} = -1$$

$$m_{\overline{WZ}} = \frac{13 - 8}{19 - 14} = \frac{5}{5} = 1$$

$$\frac{-1}{10} \neq \frac{1}{10}$$

Not parallel

$$\frac{-1}{10} \left(\frac{1}{10} \right) = \frac{-1}{100}$$

Not perpendicular

$$-1 \neq 1$$

Not parallel

$$-1(1) = -1$$

perpendicular

Slope Intercept Form

$$y = mx + b$$

m : slope
 b : y-intercept

Ex 3: Write an equation in slope-intercept form of the line with slope of 5 and y-intercept of -9.

$$m = 5$$

$$b = -9$$

$$y = 5x - 9$$

Ex 4: Write an equation in slope-intercept form for line that passes through (-4, 1) with a slope of 3.

$$m = 3$$

$$y = 3x + b$$

$$1 = 3(-4) + b$$

$$1 = -12 + b$$

$$b = 13$$

$$y = 3x + 13$$

Ex 5: Write an equation in slope-intercept form for a line containing (3, 2) that is perpendicular to the line $y = \frac{3}{2}x - 1$.

opposite reciprocal

perp slope = $-\frac{2}{3}$

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

$$2 = -\frac{2}{3}(3) + b$$

$$2 = -2 + b$$

$$4 = b$$

$$y = -\frac{2}{3}x + 4$$

Ex 6: Write an equation in slope-intercept form for a line containing (-2, 5) that is parallel to the line $y = 3x + 9$.

same

parallel slope = 3

$$y = 3x + b$$

$$5 = 3(-2) + b$$

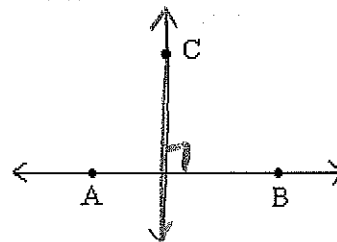
$$5 = -6 + b$$

$$11 = b$$

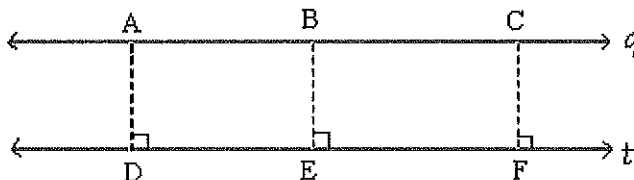
$$y = 3x + 11$$

Perpendicular Postulate

Given a line and a point not on the line, then there exists exactly one line through the point that is perpendicular to the given line.



Distance between Parallel Lines



→ Two lines in a plane are parallel if they are everywhere equidistant.

→ The distance between two parallel lines is the perpendicular distance between one of the lines & any point on the other line.