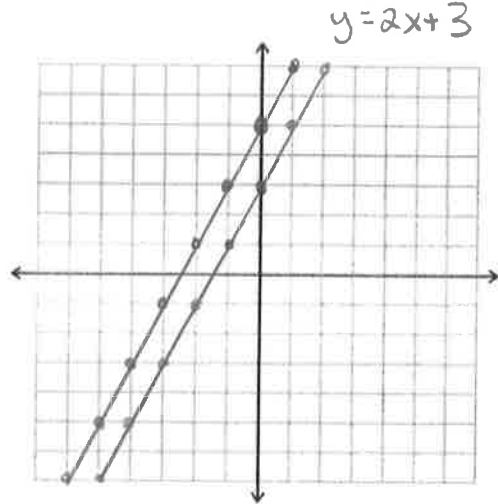1. Graph each pair of lines on the same coordinate grid. Find their slopes and conclude whether the lines are parallel, perpendicular, or neither.

a) $y = \frac{1}{4}x - 2$ $y = \frac{1}{4}x + 3$
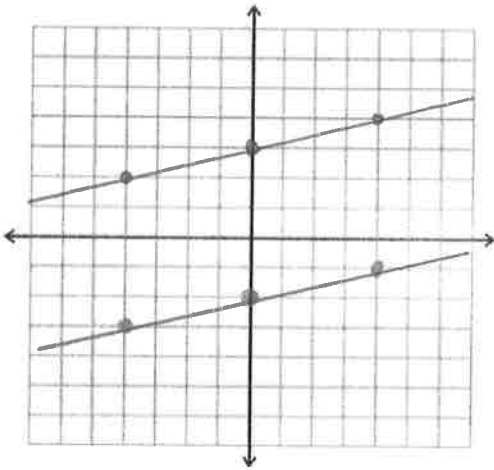
Parallel

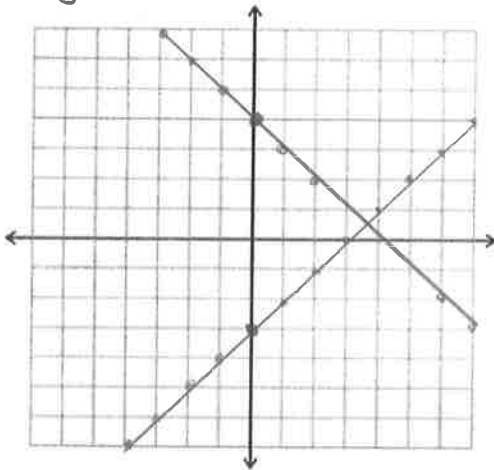**b)** $y = 2x + 5$ $4x - 2y + 6 = 0$
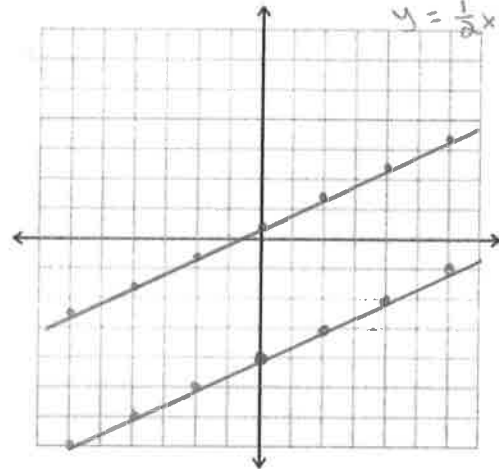
$y = 2x + 3$

Parallel

c) $x + y = 4$ $y = x - 3$

$y = -x + 4$

Perpendicular

d) $y = \frac{1}{2}x - 4$ $x - 2y + 1 = 0$

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

Parallel

3. The slopes of two lines are given. Conclude whether the lines are parallel, perpendicular, or neither. Justify your answers

a) $m = \frac{2}{3}, m = \frac{4}{6} = \frac{2}{3}$

parallel

b) $m = \frac{3}{4}, m = -\frac{4}{3}$

perpendicular

c) $m = 2, m = -2$

neither

d) $m = 1, m = -1$

perpendicular

e) $m = \frac{1}{5}, m = 0.2$

parallel

f) $m = 2\frac{1}{4}, m = -\frac{4}{9}$

$= \frac{9}{4}$

Perpendicular

4. What is the slope of a line that is parallel to each line?

a) $y = \frac{3}{5}x - 2$

$m = \frac{3}{5}$

b) $y = -x + 7$

$m = -1$

c) $2x - y + 3 = 0$

$y = 2x + 3$

$m = 2$

d) $4x + 3y = 12$

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

$m = -\frac{4}{3}$

e) $y = 2$

$m = 0$

f) $x = -5$

undefined

5. For each line in question 4, give the slope of a perpendicular line.

a) $\perp m = -\frac{5}{3}$

b) $\perp m = 1$

c) $\perp m = -\frac{1}{2}$

d) $\perp m = \frac{3}{4}$

e) $\perp m = $ undefined

f) $\perp m = 0$

6. Write the equations of two lines that are parallel to the line $3x - 6y - 5 = 0$

$-6y = -3x + 5$

$y = \frac{1}{2}x - \frac{5}{6}$

Parallel lines: ① $y = \frac{1}{2}x + 99$

② $y = \frac{1}{2}x + 87$

7. Write the equations of two lines that are perpendicular to the line $4x + y - 2 = 0$
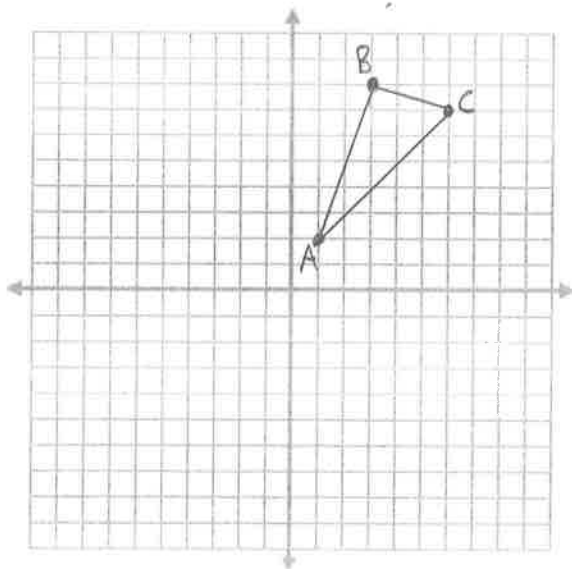
$$y = -4x + 2$$

Perpendicular Lines: ① $y = \frac{1}{4}x + 71$

② $y = \frac{1}{4}x + 87$

8. A triangle has vertices $A(1, 2)$, $B(3, 8)$, and $C(6, 7)$.

a) Plot these points and draw the triangle.

b) Does this appear to be a right triangle? Explain.

It appears that at vertex B their might be a $90°$ angle.

c) Find the slopes of the line segments that form this triangle.

$mAB = \frac{8-2}{3-1}$ $mBC = \frac{7-8}{6-3}$ $mAC = \frac{7-2}{6-1}$

$\quad = \frac{6}{2}$ $\quad = \frac{-1}{3}$ $\quad = \frac{5}{5}$

$\quad = 3$ $\quad = 1$

d) Explain how the slopes can be used to conclude whether or not this is a right triangle. Is it?

The product of perpendicular slopes $= -1$. $mAB \times mBC = 3\left(\frac{-1}{3}\right)$

$\qquad = \frac{-3}{3} = -1$

so AB and BC are perpendicular.

9. Determine whether or not the following sets of points form right triangles. Justify your answers with mathematical reasoning.

a) A(1, 1), B(-2, 5), C(3, -2)

$$mAB = \frac{5-1}{-2-1}$$

$$mBC = \frac{-2-5}{3-(-2)}$$

$$mAC = \frac{-2-1}{3-1}$$

$$= \frac{4}{-3}$$

$$= \frac{-7}{5}$$

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

$$= \frac{-4}{3}$$

No slopes are negative reciprocals of each other, therefore the points do not form a right triangle.

b) P(2, 4), Q(-2, 2), R(5, -2)

$$mPQ = \frac{2-4}{-2-2}$$

$$mQR = \frac{-2-2}{5-(-2)}$$

$$mPR = \frac{-2-4}{5-2}$$

$$= \frac{-2}{-4}$$

$$= \frac{-4}{7}$$

$$= \frac{-6}{3}$$

$$= \frac{1}{2}$$

$$= -2$$

$$mPQ \times mPR = \left(\frac{1}{2}\right)(-2)$$

$$= \frac{-2}{2}$$

$$= -1$$

∴ PQ and PR form a right angle.