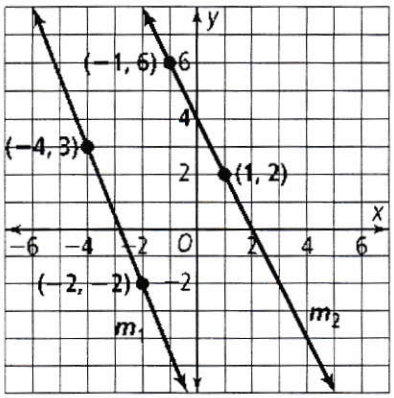
Name Answers Date

# 3.9 - Parallel and Perpendicular Lines in the Coordinate Plane

In #1 and 2, are lines $m_1$ and $m_2$ parallel? Explain and show work.

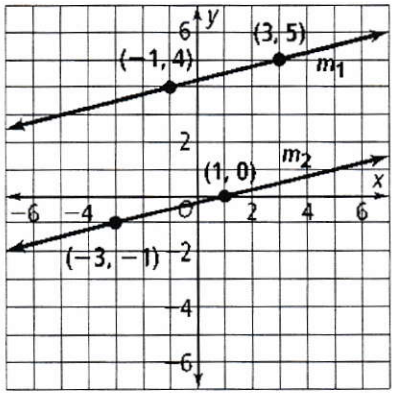
1)




$\text{Slope}_{m_1} = \frac{3-2}{-4-2} = \frac{5}{-2}$ $\text{Slope}_{m_2} = \frac{6-2}{-1-1} = \frac{4}{-2} = -2$

No, they have different slopes.

2)




$\text{Slope}_{m_1} = \frac{5-4}{3-1} = \frac{1}{4}$ $\text{Slope}_{m_2} = \frac{0-1}{1-3} = \frac{1}{4}$

Yes, they have the same slope.

Write an equation of the line parallel to given line and contains point $C$.

3) $y = -5x + 12$; $C(-2, 1)$

$y = -5x + b$

$1 = -5(-2) + b$

$1 = 10 + b$

$-9 = b$

$\boxed{y = -5x - 9}$

4) $y = -\frac{2}{5}x + 5\frac{2}{5}$; $C(5, -2)$

$y = -\frac{2}{5}x + b$

$-2 = -\frac{2}{5}(5) + b$

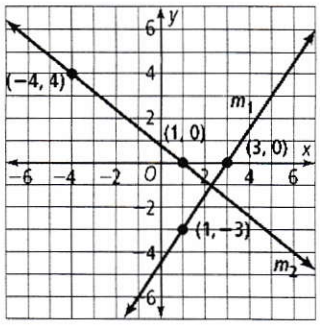
$-2 = -2 + b$

$0 = b$

$\boxed{y = -\frac{2}{5}x}$

In #5 and 6, are lines $m_1$ and $m_2$ perpendicular? Explain and show work.

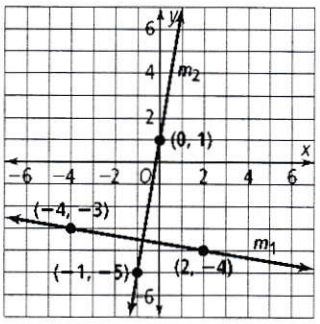
5)




$\text{slope}_{m_1} = \frac{0-3}{3-1} = \frac{3}{2}$ $\text{slope}_{m_2} = \frac{4-(-3)}{-4-1} = \frac{4}{-5}$

No, their slopes are not opposite reciprocals.

6)




$\text{slope}_{m_1} = \frac{-3-(-4)}{-4-2} = \frac{1}{-6}$ $\text{slope}_{m_2} = \frac{1-(-5)}{0-1} = \frac{6}{1}$

Yes, their slopes are indeed opposite reciprocals of each other

Write an equation of the line perpendicular to the given line that contains $P$.

7) $P(-6, 5)$; $y = 2x - 3$

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

$5 = -\frac{1}{2}(-6) + b$

$5 = 3 + b$

$2 = b$

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

8) $P(4, 3)$; $y = -3x - 15$

$y = \frac{1}{3}x + b$

$3 = \frac{4}{3} + b$

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

$\boxed{y = \frac{1}{3}x + \frac{5}{3}}$

Rewrite each equation in slope-intercept form. Then determine whether the lines are parallel. Explain.

9) $2y = 15 + 4x$
$6y - 30 = 12x$

$y = 2x + \frac{15}{2}$

$y = 2x + 5$

Yes, parallel same slope

10) $10y + 130 = 50x$
$-5y = 2x + 11$

$y = 5x - 13$

$y = -\frac{2}{5}x - \frac{11}{5}$

No, not parallel different slopes

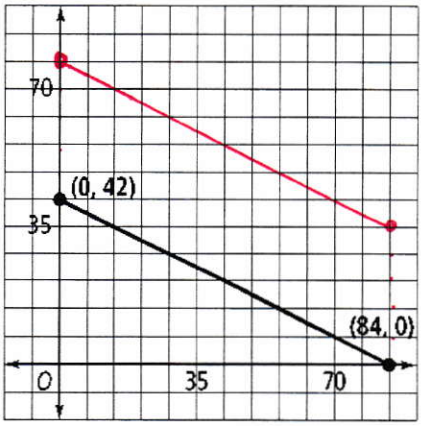
11) $y-1=-x-6$
$y-3=-\frac{5}{6}(x-5)$

$y=-x+5$

$y=-\frac{5}{6}x+\frac{43}{6}$

No, not parallel different slopes

12) A town's building code states that stairs and ramps must have a handrail. The sketch at the right has a scale of 7 in. to each grid space.




a. The handrail needs to be at least 35 in. above the ramp. Mark the point 35 in. above the top of the ramp. What are its coordinates?

(0, 77)

b. What is the equation of the line for the handrail?

$m=\frac{0-42}{84-0}=\frac{-42}{84}=-\frac{1}{2}$

$y=-\frac{1}{2}x+77$

13) Find the equation of the line with slope -3, passing through the midpoint of a segment with endpoints (3, 4) and (11, 6).

midpoint = (7, 5)

$y=-3x+b$

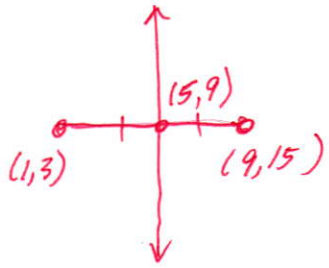
$5=-3(7)+b$

$5=-21+b$

$26=b$

$y=-3x+26$

14) Find the equation of the perpendicular bisector of the segment with endpoints (1,3) and (9,15).




$m=\frac{15-3}{9-1}=\frac{12}{8}=\frac{3}{2}$

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

$9=-\frac{2}{3}(5)+b$

$9=\frac{-10}{3}+b$

$\frac{37}{3}=b$

$y=-\frac{2}{3}x+\frac{37}{3}$

15) Line $\ell_1$ contains (–2, 1) and (4, 3) and line $\ell_2$ contains (5, 3) and (3, $g$). What value of $g$ makes $\ell_1$ and $\ell_2$ perpendicular?

Clue: For $\ell_1$ and $\ell_2$ to be perpendicular, what must be true of their slopes?

$\text{Slope}_{\ell_1} = \frac{3-1}{4-2} = \frac{2}{6} = \frac{1}{3}$ Perpendicular slope $= -3$

$\text{Slope}_{\ell_2} = \frac{g-3}{3-5} = \frac{-3}{1}$

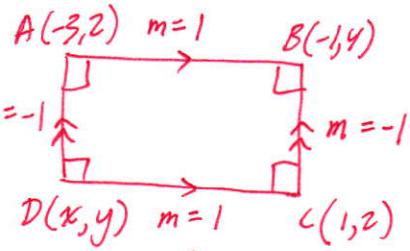
$= \frac{g-3}{-2} = \frac{-3}{1}$ cross-multiply

$\Rightarrow g-3 = 6$

$\boxed{g = 9}$

**Bonus**

A classmate plotted the following points: $A(-3, 2)$, $B(-1, 4)$, and $C(1, 2)$. Where should the classmate plot point $D$ so that the quadrilateral formed has perpendicular sides?




Opposite sides must be parallel due to the Perpendicular to the Same Line theorem

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

cross multiply $x+3 = -y+2$

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

$x-1 = y-2$ cross multiply

$\begin{cases} x+3 = -y+2 \\ x-1 = y-2 \end{cases}$

Change to standard form $\Rightarrow \begin{cases} x+y = -1 \\ x-y = -1 \end{cases}$

Elimination method

$2x = -2$

$x = -1$

$y = 0$

$\boxed{(-1, 0)}$