Writing Equations of Parallel and Perpendicular Lines

Key

$2x - 3y = 6$

$-3y = -2x + 6$

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

**To begin!**

Write the equation of the line through the given points.

Slope $= \frac{3+1}{-3-5} = \frac{4}{-4}$

$m = -1$

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

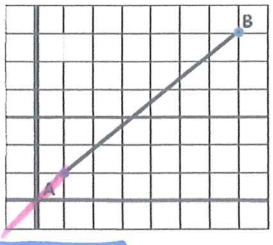
$3 = 3 + b$

$0 = b$

A. (5,-1), (-3,3)

$Y = -x$

B.




$Y = x$

C. Circle the equation(s) parallel to $2x - 3y = 6$.

$y = \frac{2}{3}x + 7$ $\quad y = 2x + 7$ $\quad y = 2x - 1$ $\quad 4x - 6y = 9$

D. Circle the equation(s) perpendicular to $2x - 3y = 6$.

$y = \frac{2}{3}x + 7$ $\quad y = 2x + 7$ $\quad y = -\frac{3}{2}x - 1$ $\quad 6x - 4y = 9$

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**PARALLEL and PERPENDICULAR LINES**

The slope of parallel lines are EQUAL. The slope of perpendicular lines are OPPOSITE RECIPROCALS.

If line *a* is perpendicular to line *b*, then (slope of *a*)(slope of *b*) = -1

EX: *Given* $y = 2x + 3$ *and* $y = -\frac{1}{2}x - 2$ $\quad 2(-\frac{1}{2}) = -1$, *so the two lines are perpendicular.*

**To find the equation of a line that passes through a given point,** (x,y), and is parallel or perpendicular to a given line, we must know the Slope of the given line and can use the point to find the equation of the line that passes through the given point.

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

Ex1) Find the equation of the line that passes through (3,1) and is PARALLEL to the line $y = \frac{2}{3}x + 4$.

**STEP 1:** We know that *parallel* lines have EQUAL slopes, so m =2/3.

**STEP 2:** We can use the Point Slope Formula and the coordinates of the given point to complete the equation. Use the values given for 'x' and 'y' and the slope equal to that of the given equation.

$(y - y_1) = m(x - x_1)$

$(y - 1) = \frac{2}{3}(x - 3)$ Do the algebra to place into slope-intercept form.

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

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

Ex2) Find the equation of the line that passes through the point (-5,5) and is *parallel* to the line $y = \frac{3}{5}x + 4$.

Slope: $\frac{3}{5}$ $(-5, 5)$

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

$5 = -3 + b$

$8 = b$

$y = \frac{3}{5}x + 8$

***You Try***

Ex3) Find the equation of the line that passes through the point (-2, 3) and is ***parallel*** to the line $y = 2x - 3$.

$m = 2$ $(-2, 3)$

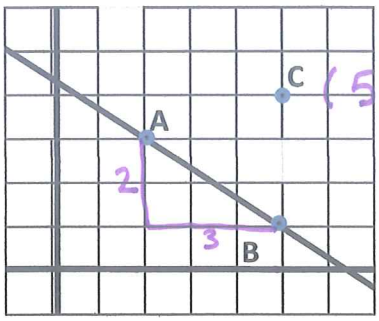
$3 = 2(-2) + b$

$3 = -4 + b$

$7 = b$

$y = 2x + 7$

Ex4) Find the equation of the line that passes through point 'C' and is *parallel* to $\overline{AB}$.




$m = -\frac{2}{3}$ $(5, 4)$

$4 = -\frac{2}{3}(5) + b$

$4 = \frac{12}{3}$

$4 = -\frac{10}{3} + b$

$\frac{22}{3} = b$

$y = -\frac{2}{3}x + \frac{22}{3}$

Ex5) Find the equation of the line that passes through (3,1) and is **PERPENDICULAR** to the line $y = \frac{2}{3}x + 4$.

**STEP 1:** We know that *perpendicular* lines have op. recip. slopes, so m = $-\frac{3}{2}$.

**STEP 2:** We can use the Point Slope Formula and the coordinates of the given point to complete the equation. Use the values given for 'x' and 'y' and the negative inverse of the slope from the given equation.

$$(y - y_1) = m(x - x_1)$$

$$(y - 1) = -\frac{3}{2}(x - 3)$$ Do the algebra to complete!

$y - 1 = -\frac{3}{2}x + \frac{9}{2}$

$y = -\frac{3}{2}x + \frac{11}{2}$

Ex6) Find the equation of the line that passes through (-1.4) and is *perpendicular* to y = 3x – 2.

$m_\perp = -\frac{1}{3}$ (-1, 4)

$y = mx + b$

$4 = -\frac{1}{3}(-1) + b$

$4 = \frac{1}{3} + b$

$\frac{11}{3} = b$

$y = -\frac{1}{3}x + \frac{11}{3}$

*You Try*

Ex7) Find the equation of the line that passes through (3,2) and is *perpendicular* to $y = \frac{1}{4}x + 1$.

$m_\perp = -4$

(3, 2)

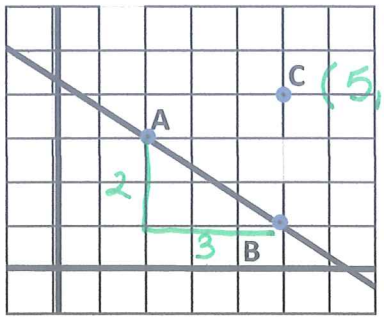
$2 = -4(3) + b$

$2 = -12 + b$

$14 = b$ ✓

$y = -4x + 14$

Ex8) Find the equation of the line that passes through point 'C' and is *perpendicular* to $\overline{AB}$.




$m_\perp = \frac{3}{2}$

(5,4)

$4 = \frac{3}{2}(5) + b$

$4 = \frac{15}{2} + b$

$\frac{8}{2} = \frac{15}{2} + b$

$-\frac{7}{2} = b$

$y = \frac{3}{2}x - \frac{7}{2}$

Ex9) Write an equation of a line *parallel* to $\overline{AB}$. A(2,1) and B(3,5).

Step 1: Find Slope of line

$m = \frac{5-1}{3-2} = \frac{4}{1}$

Step 2: Find // Slope

$m_{//} = 4$

Step 3 find EQ

$1 = 4(2) + b$

$1 = 8 + b$

$-7 = b$

$y = 4x - 7$

Ex10) Write an equation of a line *perpendicular* to $\overline{AB}$. A(2,1) and B(3,5).

$m = 4$

$m_\perp = -\frac{1}{4}$

$1 = -\frac{1}{4}(2) + b$

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

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

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

*You Try* Ex 11) Write an equation of a line *parallel* to $\overline{AB}$. A(2,3) and B(8,6).

$\frac{6-3}{8-2} = \frac{3}{6} = \frac{1}{2}$

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

$3 = \frac{1}{2}(2) + b$

$2 = b$

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

*You Try* Ex 12) Write an equation of a line *perpendicular* to $\overline{AB}$. A(2,3) and B(8,6).

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

$m_\perp = -2$

$3 = -2(2) + b$

$7 = b$

$y = -2x + 7$