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CC GEOMETRY

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LESSON #6: PERPENDICULAR BISECTOR LINES

Perpendicular Lines have opposite reciprocal slopes.

Parallel Lines have equal slopes.

Directions: In 18-21 state in each case whether the lines are parallel, perpendicular, or neither.

18. $y = 3x + 2, y = 3x - 5$

parallel

19. $y = -2x - 6, y = 2x + 6$

neither

20. $y = 4x - 8, 4y + x = 3$

$-x \quad -x$

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

$m = -\frac{1}{4}$

perpendicular

21. $y = \frac{2x}{2}, x = \frac{-2y}{-2}$

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

perpendicular

7. The equation of line k is $y = \frac{1}{3}x - 2$. The equation of line m is $-2x + 6y = 18$. Lines k and m are

1) parallel

2) perpendicular

3) the same line

4) neither parallel nor perpendicular

$+2x \quad +2x$

$\frac{6y}{6} = \frac{2x}{6} + \frac{18}{6}$

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

1. The lines represented by the equations $4x + 6y = 6$ and $y = \frac{2}{3}x - 1$ are

1) Parallel
2) The same line
3) Normal line
4) Intersecting, but *not* perpendicular

$-4x \quad -4x$

$\frac{6y}{6} = \frac{-4x}{6} + \frac{6}{6}$

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

Definition of a normal line: A line segment with one point on a line and a perpendicular to a line

HOW DO WE WRITE THE EQUATION OF A LINE THAT IS PARALLEL OR PERPENDICUALAR TO A GIVEN LINE?!?!?!

2. Write an equation of a line that is parallel to $2y - 4x = 9$ and passes through the point $(-2, 1)$.

$y - y_1 = m(x - x_1)$ $\quad x_1, y_1$

$y - 1 = 2(x - -2)$

$y - 1 = 2(x + 2)$

$y - 1 = 2x + 4 \Rightarrow \boxed{y = 2x + 5}$

same slope

$+4x \quad +4x$

$\frac{2y}{2} = \frac{4x}{2} + \frac{9}{2}$

$y = 2x + \frac{9}{2}$

$m = 2$

3. Write an equation of a line that is perpendicular to $y = -\frac{1}{2}x - 3$ and passes through the point $(1, 5)$.

$y - 5 = 2(x - 1)$ $\quad x_1, y_1$

$y - 5 = 2x - 2$

$+5 \quad +5$

$\boxed{y = 2x + 3}$

opp. recip

$m = -\frac{1}{2} \rightarrow (2)$

4. Find an equation of a line passing through the point $(5, 4)$ and parallel to the line whose equation is $2x + y = 3$.

$-2x \quad -2x$

$y = -2x + 3$

$m = -2$

x_1, y_1 $\quad$ same slope

$y - 4 = -2(x - 5)$

$y - 4 = -2x + 10$

$+4 \quad +4$

$\boxed{y = -2x + 14}$

5. Find an equation of the line passing through the point $(6, 5)$ and normal to the line whose equation is $2y + 3x = 6$.

$-3x \quad -3x$

$\frac{2y}{2} = \frac{-3x}{2} + \frac{6}{2}$

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

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

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

x_1, y_1 $\quad$ normal $\rightarrow$ $\perp$!

$y - 5 = \frac{2}{3}(x - 6)$

$y - 5 = \frac{2}{3}x - 4$

$+5 \quad +5$

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

Directions: The coordinates of the endpoints of a line segment are given. For each segment, find the equation of the line that is the perpendicular bisector of the segment.

6. Write an equation representing the perpendicular bisector of $\overline{AB}$ whose endpoints are $A(8,2)$ and $B(0,6)$.

(A: x_1, y_1; B: x_2, y_2)

① midpoint

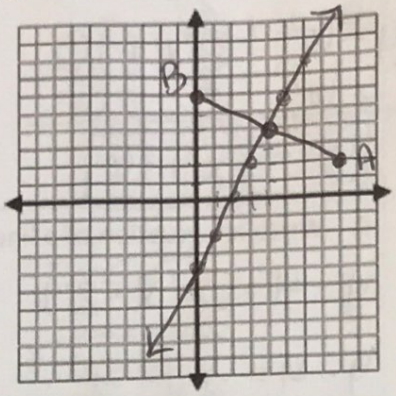
$$m = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$$

$$m = \left(\frac{8+0}{2}, \frac{2+6}{2}\right)$$

$$\boxed{m = (4,4)}$$

bisector → splits in 2 = parts

midpoint!



② Determine slope

$$m = \frac{y_2-y_1}{x_2-x_1} = \frac{6-2}{0-8} = \frac{4}{-8} = \frac{1}{-2} = m$$

$$2 = \perp m$$

③ Find equation

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

$$y - 4 = 2(x-4)$$

$$y - 4 = 2x - 8 \Rightarrow \boxed{y = 2x - 4}$$

$+4 \quad +4$

7. Write an equation of the perpendicular bisector of the line segment whose endpoint are $(-1,1)$ and $(7,-5)$.

($-1,1$: x_1, y_1; $7,-5$: x_2, y_2)

① midpoint

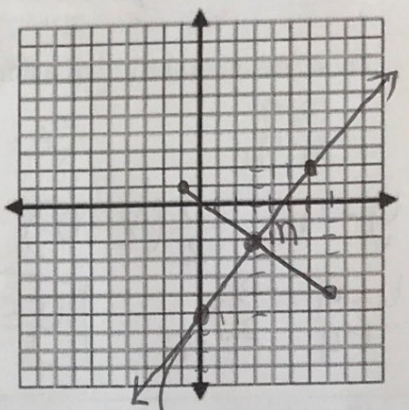
$$\left(\frac{-1+7}{2}, \frac{1+-5}{2}\right) = \left(\frac{6}{2}, \frac{-4}{2}\right) = (3,-2)$$

② slope

$$\frac{-5-1}{7-1} = \frac{-6}{8} = \frac{-3}{4} \Rightarrow \perp m = \frac{4}{3}$$

③ equation:

$$\boxed{y = \frac{4}{3}x - 6}$$



→ y-int = -6 !

PRACTICE PROBLEMS

8. Write an equation of a line that is normal to the line $y = \frac{2}{5}x + 3$ and passes through the point $(4, 6)$.

x_1, y_1

$\perp$

↳ $\perp$ slope $= -\frac{5}{2}$

$y - 6 = -\frac{5}{2}(x - 4)$

$y - 6 = -\frac{5}{2}x + 10$

$+6 \quad +6$

$\boxed{y = -\frac{5}{2}x + 16}$

9. Write an equation of a line that is perpendicular to $y = -\frac{2}{3}x + 2$ and passes through the point $(2, 4)$.

x_1, y_1

↳ $\perp$ slope $= \frac{3}{2}$

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

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

$+4 \quad +4$

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

10. Write an equation of a line that is parallel to $y - 3x = 5$ and passes through the point $(1, 6)$.

x_1, y_1

$+3x \quad +3x$

$y = 3x + 5$

↳ $\parallel$ slope $= 3$

$y - 6 = 3(x - 1)$

$y - 6 = 3x - 3$

$+6 \quad +6$

$\boxed{y = 3x + 3}$

11. Write an equation of a line that is perpendicular to the line $y = \frac{2}{3}x + 5$ and passes through the point $(0, 4)$.

x_1, y_1

↳ $\perp$ slope $= -\frac{3}{2}$

$y - 4 = -\frac{3}{2}(x - 0)$

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

$+4 \quad +4$

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

12. Write an equation of the line that passes through the point $(6, -5)$ and is parallel to the line whose equation is $2x - 3y = 11$.

x_1, y_1

$-2x \quad -2x$

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

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

↳ $m \parallel = \frac{2}{3}$

$y - -5 = \frac{2}{3}(x - 6)$

$y + 5 = \frac{2}{3}x - 4$

$-5 \quad -5$

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

MORE PRACTICE!!!!!

1. The two lines represented by the equations below are graphed on a coordinate plane.

$y = 3x - 6 + 4$

$y = -3x$

$x + 6y = 12$

$-x \quad -x$

$3(x-2) = -y - 4$

$+4 \quad +4$

$\frac{6y}{6} = \frac{-x}{6} + \frac{12}{6}$

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

Which statement best describes the two lines?

1) The lines are parallel.

2) The lines are the same line.

3) The lines are perpendicular.

4) The lines intersect at an angle other than 90°.

2. Given two lines whose equations are $3x + y - 8 = 0$ and $-2x + by + 9 = 0$, determine the value of b such that the two lines will be perpendicular.

$3x + y - 8 = 0$

$-3x \quad +8$

$y = -3x + 8$

$\perp m = \frac{1}{3}$

$-2x + by + 9 = 0$

$+2x \quad -9$

$\frac{by}{b} = \frac{-2x}{b} - \frac{9}{b}$

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

$-6 = b$

3. Are the following lines parallel, perpendicular or neither & explain. $y = 4x - 8$ and $4y + x = 3$

perpendicular b/c they have opposite reciprocal slopes.

$-x \quad -x$

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

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

4. Are the following lines parallel, perpendicular or neither and explain. $5x - 7y = -35$ and $y = \frac{7}{5}x + 3$

$-5x \quad -5x$

$\frac{-7y}{-7} = \frac{-5x}{-7} - \frac{35}{-7}$

$y = \frac{5x}{7} + 5$

Neither - not = or opp. reciprocal

1. What is an equation of the line that passes through the point $(-2, 5)$ and is normal to the line whose equation is $y = \frac{1}{2}x + 5$?

(x_1, y_1)

$\perp$

$\perp m = -2$

$y - 5 = -2(x - -2)$

$y - 5 = -2x - 4$

$+5 \quad +5$

$y = -2x + 1$

1) $y = 2x + 1$

2) ~~$y = -2x + 1$~~

3) $y = 2x + 9$

4) $y = -2x - 9$

2. What is an equation of the line that contains the point $(3, -1)$ and is perpendicular to the line whose equation is $y = -3x + 2$?

$\perp m = \frac{1}{3}$

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

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

$-1 \quad -1$

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

1) $y = -3x + 8$

2) $y = -3x$

3) $y = \frac{1}{3}x$

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