Section 3.2 – Writing Equations of Lines

This booklet belongs to: _____ **Block:** _____

Equations of Parallel and Perpendicular Lines

- To write the **equation of a line**, two points are needed or a **point** and **slope**
- Sometimes this information is **not given directly**
- We have to **problem solve** to find the information we need
- Remember that **parallel lines** have **equal slopes** and **perpendicular lines** have **slopes** that are **negative reciprocals** to one another

Example 1:   Write the General Form equation of a line **parallel** to $3x - 2y = 6$, and which goes through the point $A(4, -2)$.

Solution 1:

- First, we need the Slope of the given line

$$3x - 2y = 6 \quad \rightarrow \quad -2y = -3x + 6 \quad \rightarrow \quad y = \frac{3}{2}x - 3, \qquad \mathbf{m = \frac{3}{2}}$$

- So, the **slope of the line parallel** to $3x - 2y = 6$ **also** has a slope: $\mathbf{m = \frac{3}{2}}$

- **Substituting** in the **given point** and **slope** to the **Point-slope equation** of a line gives us:

So, $y - y_1 = m(x - x_1) \qquad \rightarrow \qquad y - (-2) = \frac{3}{2}(x - 4) \quad \rightarrow$

$y + 2 = \frac{3}{2}x - \frac{12}{2} \qquad \rightarrow \qquad y + 2 = \frac{3}{2}x - 6 \qquad \rightarrow$

$$y = \frac{3}{2}x - 8 \qquad \textbf{(Slope-intercept Form)}$$

And, $y = \frac{3}{2}x - 8 \quad \rightarrow \quad 2y = 3x - 16 \rightarrow \quad 3x - 2y - 16 = 0 \qquad \textbf{(General Form)}$

Example 2:   Write the General Form equation of a line **perpendicular** to $4x + 2y = 7$, and which goes through the point A$(-2, 5)$.

Solution 2:

- First, we need to find the **slope** of the given line

$$4x + 2y = 7 \quad \rightarrow \quad 2y = -4x + 7 \quad \rightarrow \quad y = \frac{-4}{2}x + \frac{7}{2} \qquad \mathbf{m = -2}$$

- So, the **slope of the line perpendicular** to $4x + 2y = 7$ has slope: $\mathbf{m = \dfrac{1}{2}}$

- **Substituting** in the **given point** and **slope** to the **Point-slope equation** of a line gives us:

So, $y - y_1 = m(x - x_1) \qquad \rightarrow \qquad y - 5 = \frac{1}{2}(x - (-2)) \quad \rightarrow$

$y - 5 = \frac{1}{2}x + \frac{2}{2} \qquad \rightarrow \qquad y - 5 = \frac{1}{2}x + 1 \qquad \rightarrow$

$$y = \frac{1}{2}x + 6 \qquad \textbf{(Slope-intercept Form)}$$

And, $y = \frac{1}{2}x + 6 \quad \rightarrow \quad 2y = x + 12 \qquad \rightarrow \quad x - 2y + 12 = 0 \qquad \textbf{(General Form)}$

Section 3.2 – Practice Problems

Find the equation of the line in **General Form**, that passes through the given point and is **parallel** to the given line.

EMERGING LEVEL QUESTIONS

1. $P(0,0); y = 2x - 5$

2. $P(0,0); x = 2y + 5$

3. $P(1,3); 3x - y = 6$

4. $P(-2,0); 2x + 5y = 3$

5. $P(-6,3); y + 4x = -8$

6. $P(5,-2); 3y + 1 = -4x$

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

8. $P(-5,2); y = -4$

Find the equation of the line in **General Form**, that passes through the given point and is **perpendicular** to the given line.

PROFICIENT LEVEL QUESTIONS

9. $P(0,0); y = 2x - 5$

10. $P(0,0); x = 2y + 5$

11. $P(1,3); 3x - y = 6$

12. $P(-2,0); 2x + 5y = 3$

13. $P(-6, 3); y + 4x = -8$

14. $P(5, -2); 3y + 1 = -4x$

15. $P(-5, 2); x = 3$

16. $P(-5, 2); y = -4$

EXTENDING LEVEL QUESTIONS

17. Find the equation of a line **parallel** to $3x + 4y = 8$ with the same $y - intercept$ as $5x - 3y = 10$

18. Find the equation of a line **perpendicular** to $x - 3y = 8$ with the same $y - intercept$ as $3x + 2y = 6$

19. Find the equation of a line **parallel** to $2x + 7y = 10$ with the same $x - intercept$ as $3x - 4y = 5$

Section 3.2 – Answer Key

1. $2x - y = 0$
2. $x - 2y = 0$
3. $3x - y = 0$
4. $2x + 5y + 4 = 0$
5. $4x + y + 21 = 0$
6. $4x + 3y - 14 = 0$
7. $x = -5$
8. $y = 2$
9. $x + 2y = 0$
10. $2x + y = 0$
11. $x + 3y - 10 = 0$
12. $5x - 2y + 10 = 0$
13. $x - 4y + 18 = 0$
14. $3x - 4y - 23 = 0$
15. $y = 2$
16. $x = -5$
17. $y = -\dfrac{3}{4}x - \dfrac{10}{3}$

    or

    $9x + 12y = -40$

18. $y = -3x + 3$

    or

    $3x + y = 3$

19. $y = -\dfrac{2}{7}x + \dfrac{10}{21}$

    or

    $6x + 21y = 10$

Extra Work Space