3.5 Start Thinking

In a coordinate plane, graph the lines $y = x - 3$ and $y = x + 2$. Do the lines intersect? If so, at what point?

Graph the line $y = -x + 5$ in the same coordinate plane. At what points does this line intersect $y = x - 3$ and $y = x + 2$? How can you describe the angles created by the intersections?

3.5 Warm Up

Graph the line in a coordinate plane.

1. $y = 6x$

2. $y = 4x + 2$

3. $y = x - 3$

4. $y = x + 2$

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

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

3.5 Cumulative Review Warm Up

Name the property of equality the statement illustrates.

1. If $x = y$, then $2x = 2y$.

2. If $BN = NC$, then $BN - 6 = NC - 6$.

3. $z = z$

4. $m\angle A = m\angle A$

5. If $m\angle D = 38°$ and $m\angle E = 38°$, then $m\angle E = m\angle D$.

6. If $FG = JK$, then $JK = FG$.

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3.5 Practice A

In Exercises 1 and 2, find the coordinates of point *P* along the directed line segment *ST* so that *SP* to *PT* is the given ratio.

1. $S(6, 4)$, $T(-4, -8)$; 1 to 3

2. $S(-6, 7)$, $T(9, 25)$; 2 to 3

In Exercises 3 and 4, tell whether the lines through the given points are *parallel*, *perpendicular*, or *neither*. Justify your answer.

3. Line 1: $(2, 3)$, $(4, 12)$
Line 2: $(5, 10)$, $(14, 8)$

4. Line 1: $(-6, -10)$, $(4, -2)$
Line 2: $(-8, -6)$, $(0, 4)$

In Exercises 5 and 6, write an equation of the line passing through point *P* that is parallel to the given line.

5. $P(-1, 3)$, $y = 4x - 7$

6. $P(2, -3)$, $y = -6x + 10$

In Exercises 7 and 8, write an equation of the line passing through point *P* that is perpendicular to the given line.

7. $P(6, 10)$, $y = -3x + 13$

8. $P(0, -8)$, $y = -\frac{1}{3}x - 10$

In Exercises 9 and 10, find the distance from point *Q* to the given line.

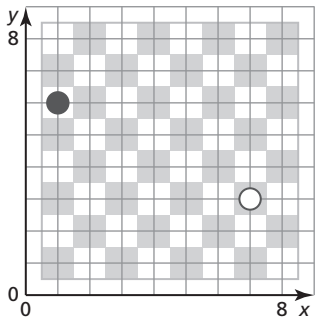
9. $Q(2, 6)$, $y = -x + 4$

10. $Q(-10, -4)$, $5x - y = 6$

11. A line through $(3, 5)$ and $(k, 12)$ is perpendicular to a line through $(0, 7)$ and $(2, 10)$. Find the value of k that makes the above statement true.

12. Your friend claims that if a line has a slope that is less than 1, then any line perpendicular to it must have a positive slope. Is your friend correct? Explain your reasoning.

13. You and your friend are playing a game of checkers. There are only two pieces left on the board. Find the coordinates of point P along the line segment connecting the black and white checkers so that the ratio of the distance between the black checker and P to P and the white checker is 2 to 1.



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3.5 Practice B

In Exercises 1 and 2, find the coordinates of point *Q* along the directed line segment *LM* so that *LQ* to *QM* is the given ratio.

1. $L(-1, -2)$, $M(3, 6)$; 5 to 3

2. $L(2, 7)$, $M(-1, 1)$; 2 to 1

3. Tell whether the lines through the given points are *parallel*, *perpendicular*, or *neither*. Justify your answer.

Line 1: $(2.5, -2)$, $(9.5, 12)$ Line 2: $(-4, -2)$, $(8, -4)$

4. Write an equation of the line passing through point $P(-1, -4)$ that is parallel to $y = -6x + 8$.

5. Write an equation of the line passing through point $P(-1, 3)$ that is perpendicular to $y = 4x - 7$.

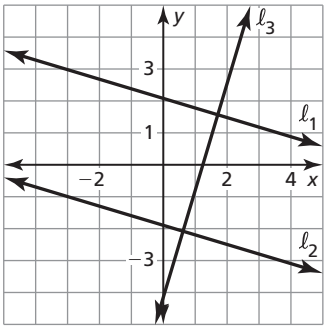
In Exercises 6 and 7, find the distance from point *P* to the given line.

6. $P(4, 8)$, $6 = y + 2x$

7. $P(-2, 1)$, $y = \frac{1}{4}x - 3$

8. A line through $(-1, b)$ and $(c, 8)$ is parallel to a line through $(-6, 3)$ and $(0, 12)$. Find values of b and c that make the above statement true.

9. The graph shows three lines. The slope of line ℓ_1 is m_1, where $-1 \leq m_1 < 0$.



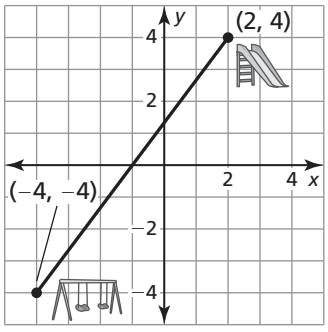
a. Lines ℓ_1 and ℓ_2 are parallel. What do you know about the slope of line ℓ_2?

b. Lines ℓ_1 and ℓ_3 are perpendicular. What do you know about the slope of line ℓ_3?

c. What is the relationship between ℓ_2 and ℓ_3? Justify your answer.

10. Two lines are perpendicular. Is it possible for the lines to have the same y-intercept? Justify your answer.

11. The diagram shows a map of a playground. The water fountain lies directly between the swings and the slide. The distance from the swings to the water fountain is one-third the distance from the water fountain to the slide. What point on the graph represents the water fountain?



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3.5 Enrichment and Extension

Equations of Parallel and Perpendicular Lines

1. Write the equation of the perpendicular bisector for the line segment defined between points $A(2, 5)$ and $B(-6, -1)$.

2. Find the values of a and b in $ax + by = 90$ such that the equation is perpendicular to $-20x + 12y = 36$ and has the same y-intercept.

3. Consider the linear equation $y = 3.62(x - 1.35) + 2.74$.

a. What is the slope of this line?

b. What is the value of y when $x = 1.35$?

c. Find an equation for the line through $(4.23, -2.58)$ that is parallel to this line.

d. Find an equation for the line through $(4.23, -2.58)$ that is perpendicular to this line.

4. What is the slope of the line $ax + by = c$? Find an equation for the line through the origin that is parallel to the line $ax + by = c$. Find an equation for the line through the origin that is perpendicular to the line $ax + by = c$.

5. A line passes through the points $(k + 10, -2k - 1)$ and $(2, 9)$ and has a y-intercept of 10. Find the value of k and the equation of the line.

6. A line passes through the points $(3k, 6k - 5)$ and $(-1, -7)$ and has a y-intercept of -5. Find the value of k and the equation of the line.

7. Consider the two linear equations $ax + by = c$ and $dx + ey = f$.

a. Under what conditions will the graphs of the two equations intersect at one point?

b. Under what conditions will the graphs of the two equations be parallel?

8. Point F is located at $(0, 4)$.

a. Find coordinates of three points that are equidistant from F and the x-axis.

b. If possible, write the equations of the lines that are parallel or perpendicular to the line $x = 0$ and pass through the coordinates from part (a).

c. Consider $G(0, y)$. Find the coordinates of three points that are equidistant from G and the x-axis.

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3.5 Puzzle Time

How Do You Make Seven Even?

Circle the letter of each correct answer in the boxes below. The circled letters will spell out the answer to the riddle.

Complete the sentence.

1. A(n) _____ line segment $\overline{AB}$ is a segment that represents moving from point A to point B.
2. In a coordinate plane, two nonvertical lines are parallel if and only if they have the _____.
3. In a coordinate plane, two nonvertical lines are perpendicular if and only if the product of their _____.

Tell whether the lines through the given points are (1) parallel, (2) perpendicular, (3) neutral, (4) directed, (5) indirective, (6) none of these.

4. Line 1: $(-7, -3), (1, 4)$; Line 2: $(-6, 6), (1, -2)$
5. Line 1: $(-4, -2), (4, 5)$; Line 2: $(-2, 3), (2, -3)$
6. Line 1: $(0, 4), (-6, 0)$; Line 2: $(3, 2), (-3, -2)$

Find the distance from point *A* to the given line. Round to the nearest tenth.

7. $A(-4, 4), y = 0.8x - 0.4$
8. $A(-3, -3), y = 0.5x + 6.5$

R	D	N	R	P	O	M	A
5	2	6.4	slopes is -1	slopes is $-\frac{1}{2}$	5.9	straight	3
P	**T**	**L**	**H**	**L**	**I**	**E**	**S**
7.2	1	6.7	same slope	slopes is 0	4	directed	6

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