

Slope and Perpendicular Lines

Practice and Problem Solving: A/B

Line A contains the points $(-1, 5)$ and $(1, -3)$. Line B contains the points $(2, 3)$ and $(-2, 2)$.

1. Are the lines A & B perpendicular? Explain your reasoning.

$$\left. \begin{aligned} \text{slope } A &= \frac{5 - (-3)}{-1 - 1} = \frac{8}{-2} = -4 \\ \text{slope } B &= \frac{3 - 2}{2 - (-2)} = \frac{1}{4} \end{aligned} \right\} \text{neg. recip.}$$

Figure WXYZ has as its vertices the points $W(2, 7)$, $X(5, 6)$, $Y(5, -4)$, and $Z(-1, -2)$.

Find each slope.

2. \overline{WX}

$$\frac{7-6}{2-5} = -\frac{1}{3}$$

3. \overline{XY}

$$\frac{6 - (-4)}{5 - 5} = \text{undef.}$$

4. \overline{YZ}

$$\frac{-2 - (-4)}{-1 - 5} = \frac{2}{-6} = -\frac{1}{3}$$

5. \overline{ZW}

$$\frac{7 - (-2)}{2 - (-1)} = \frac{9}{3} = 3$$

6. Is Figure WXYZ a rectangle? Explain your reasoning.

no, not a parallelogram

For Problems 7–10, use the graph at the right.

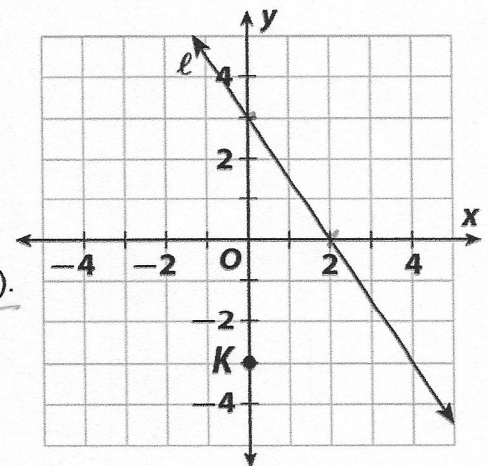
7. Find the slope of line l .

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

8. Line t is perpendicular to line l and passes through point $K(0, -3)$.

Find the slope of line t .

$$\frac{2}{3}$$



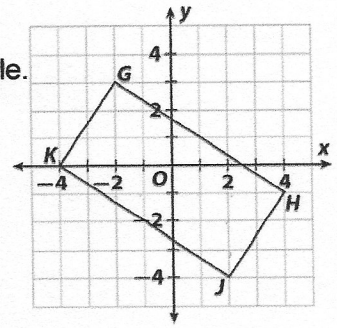
9. Find the equation of line t .

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

For Problems 10–15, use the graph.

10. Describe a method you can use to show that Figure $GHJK$ is a rectangle.

show sides are perp. by
finding slopes



Find each slope.

11. \overline{GH}

$$\frac{-4}{6} = -\frac{2}{3}$$

12. \overline{HJ}

$$\frac{3}{2}$$

perp.

13. \overline{JK}

$$\frac{-4}{6} = -\frac{2}{3}$$

perp.

14. \overline{KG}

$$\frac{3}{2}$$

15. Is Figure $GHJK$ a rectangle? Explain your reasoning.

slopes are perp., so it's a rect.

In Exercises 16 – 19, determine which of the lines, if any, are parallel or perpendicular. Explain.

16 Line a passes through $(-2, 1)$ and $(0, 3)$. slope = $\frac{3-1}{0-(-2)} = \frac{2}{2} = 1$

Line b passes through $(4, 1)$ and $(6, 4)$. slope = $\frac{4-1}{6-4} = \frac{3}{2}$

Line c passes through $(1, 3)$ and $(4, 1)$. slope = $\frac{3-1}{1-4} = \frac{2}{-3} = -\frac{2}{3}$ } perp.

18. Line a : $4x - 3y = 2 \rightarrow -3y = -4x + 2 \rightarrow y = \frac{4}{3}x - \frac{2}{3} \rightarrow \text{slope} = \frac{4}{3}$

Line b : $y = \frac{4}{3}x + 2 \rightarrow \text{slope} = \frac{4}{3}$

Line c : $4y + 3x = 4 \rightarrow 4y = -3x + 4 \rightarrow y = -\frac{3}{4}x + 1 \rightarrow \text{slope} = -\frac{3}{4}$

a & b are parallel, both perp. to c

In Exercises 20 - 23, write an equation of the line that passes through the given point and is perpendicular to the given line.

20. $(7, 10); y = \frac{1}{2}x - 9$

slope = -2
 $y - 10 = -2(x - 7)$

21. $(-4, -1); y = \frac{4}{3}x + 6$

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

22. $(-3, 3); 2y = 8x - 6$

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

23. $(8, 1); 2y + 4x = 12$

$2y = -4x + 12$
 $y = -2x + 6$
 slope = $\frac{1}{2}$
 $y - 1 = \frac{1}{2}(x - 8)$

25. The vertices of a quadrilateral are $A(2, 2)$, $B(6, 4)$, $C(8, 10)$, and $D(4, 8)$.

a. Is quadrilateral $ABCD$ a parallelogram? Explain.

slope $\overline{AB} = \frac{4-2}{6-2} = \frac{2}{4} = \frac{1}{2}$
 slope $\overline{CD} = \frac{10-8}{8-4} = \frac{2}{4} = \frac{1}{2}$ } parallel

parallelogram

slope $\overline{BC} = \frac{10-4}{8-6} = \frac{6}{2} = 3$
 slope $\overline{AD} = \frac{8-2}{4-2} = \frac{6}{2} = 3$
 parallel

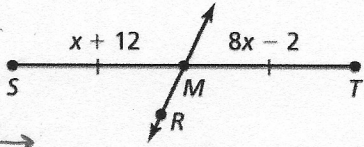
b. Is quadrilateral $ABCD$ a rectangle? Explain.

no, slopes are not perp.

Review:

In Exercises 30 and 31, identify the segment bisector of \overline{ST} . Then find ST .

30.



\overline{RM} is seg. bis.

$$x + 12 = 8x - 2$$

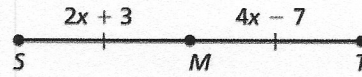
$$14 = 7x$$

$$x = 2$$

$$SM = 2 + 12 = 14$$

$$\boxed{ST = 28}$$

31.



M is seg. bis.

$$2x + 3 = 4x - 7$$

$$10 = 2x$$

$$x = 5$$

$$SM = 2(5) + 3 = 13$$

$$\boxed{ST = 26}$$

In Exercises 32 and 33, the endpoints of \overline{JK} are given. Find the coordinates of the midpoint M .

32. $J(-3, 2)$ and $K(9, 2)$

$$\left(\frac{-3+9}{2}, \frac{2+2}{2} \right) = \left(\frac{6}{2}, \frac{4}{2} \right)$$

$$= (3, 2)$$

33. $J(1, 3)$ and $K(7, 5)$

$$\left(\frac{1+7}{2}, \frac{3+5}{2} \right) = \left(\frac{8}{2}, \frac{8}{2} \right)$$

$$= (4, 4)$$

In Exercises 34 and 35, find the measure of each angle.

34. $\angle ABC$ and $\angle CBD$ are supplementary angles, $m\angle ABC = 7x^\circ$ and $m\angle CBD = 8x^\circ$.

$$7x + 8x = 180$$

$$15x = 180$$

$$x = 12$$

$$= 7(12)$$

$$= 84$$

$$= 8(12)$$

$$= 96$$

35. $\angle WXY$ and $\angle YXZ$ are complementary angles, $m\angle WXY = (2x + 5)^\circ$, and $m\angle YXZ = (8x - 5)^\circ$.

$$2x + 5 + 8x - 5 = 90$$

$$10x = 90$$

$$x = 9$$

$$= 2(9) + 5$$

$$= 23$$

$$= 8(9) - 5$$

$$= 67$$