Lesson 7.4: Parallel and Perpendicular Lines

Practice – IV

1. Decide if each pair of lines is parallel, perpendicular, or neither. Explain your choice.

   a. $y = 9x + 4$ and $18x - 2y + 13 = 0$

   Find the slopes to determine if the lines are parallel, perpendicular, or neither.

   The slope of $y = 9x + 4$ is 9.

   $$\begin{aligned} 18x - 2y + 13 &= 0 \\ 18x + 13 &= 2y \\ \frac{18x + 13}{2} &= y \\ 9x + \frac{13}{2} &= y \end{aligned}$$

   The slope of $18x - 2y + 13 = 0$ is also 9, so the two lines are parallel.

   b. $y - 7 = \frac{3}{2}(x + 5)$ and $y = \frac{2}{3}x$

   Find the slopes to determine if the lines are parallel, perpendicular, or neither.

   The slope of $y - 7 = \frac{3}{2}(x + 5)$ is $\frac{3}{2}$ and the slope of $y = \frac{2}{3}x$ is $\frac{2}{3}$. Although the two slopes are reciprocals, they are not negative reciprocals. The two lines are neither parallel nor perpendicular.

   c. $y = 2.5x + 1$ and $y = -0.4x - 1$

   The slope of $y = 2.5x + 1$ is 2.5 and the slope of $y = -0.4x - 1$ is –0.4. Multiply the two slopes to determine whether the product is –1.

   $2.5 \times (-0.4) = -1$

   The product is –1, so the slopes are negative reciprocals and the two lines are perpendicular.

2. Line A passes through the points $(-1,-1)$ and $(5,3)$. Line B passes through the points $(7,-5)$ and $(1,r)$. Determine a value of r such that the two lines are

   a. parallel

$$\begin{aligned} m_A &= \frac{y_2 - y_1}{x_2 - x_1} \\ m_A &= \frac{3-(-1)}{5-(-1)} \\ &= \frac{4}{6} \\ &= \frac{2}{3} \end{aligned}$$

The slope of line A is $\frac{2}{3}$. For lines A and B to be parallel, line B must also have a slope of $\frac{2}{3}$. The slope formula can be used to determine the value of r.

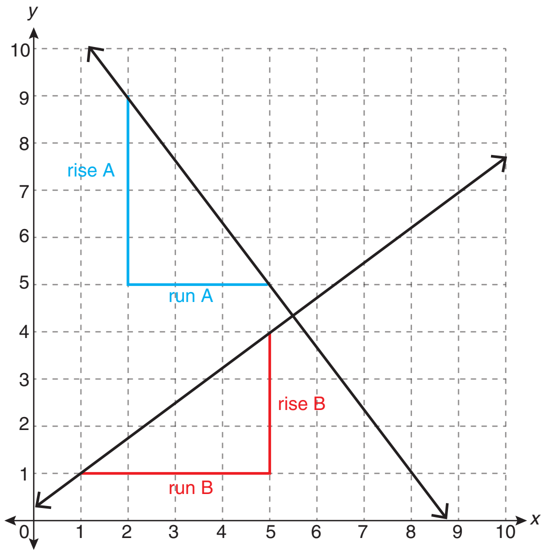
$$\begin{aligned} m_B &= \frac{y_2 - y_1}{x_2 - x_1} \\ \frac{2}{3} &= \frac{r-(-5)}{1-7} \\ \frac{2}{3} &= \frac{r+5}{-6} \\ \frac{2}{3}(-6) &= \frac{r+5}{\cancel{-6}}(\cancel{-6}) \\ -4 &= r+5 \\ -4-5 &= r\cancel{+5}\cancel{-5} \\ -9 &= r \end{aligned}$$

   b. perpendicular

The slope of line A is $\frac{2}{3}$. The slope of line B must be the negative reciprocal of $\frac{2}{3}$ for the lines to be perpendicular, so the slope of line B must be $-\frac{3}{2}$. Again, use the slope formula to determine the value of r.

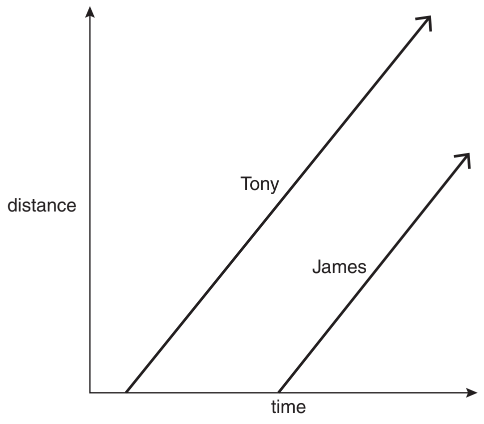
$$\begin{aligned} m_B &= \frac{y_2 - y_1}{x_2 - x_1} \\ -\frac{3}{2} &= \frac{r-(-5)}{1-7} \\ -\frac{3}{2} &= \frac{r+5}{-6} \\ -\frac{3}{2}(-6) &= \frac{r+5}{\cancel{-6}}(\cancel{-6}) \\ 9 &= r+5 \\ 9-5 &= r\cancel{+5}\cancel{-5} \\ 4 &= r \end{aligned}$$

3. The grid shows two perpendicular lines. Use the information provided on the grid to show that the slopes of the lines have a product of –1.



$$\frac{\text{rise A}}{\text{run A}} \times \frac{\text{rise B}}{\text{run B}} = \frac{-4}{3} \times \frac{3}{4}$$
$$= -\frac{12}{12}$$
$$= -1$$

4. Tony and James both walked home from school, as shown in the graph provided.



a. Describe a scenario that would lead to this graph.

Situations may vary. A sample is shown.

Tony started to walk home from school before James did.

b. The two lines in the graph are parallel. Explain what this means in the given context.

The parallel lines have the same slope, or rate of change. In this case, the rate of change is a speed. The two boys walked home from school at the same speed.

c. Suppose the two lines were not parallel. Would this guarantee that James and Tony will meet? Explain.

No. If the both lines extended in both directions, this would be true because non-parallel lines must intersect in exactly one place. However, they both start walking from a distance of 0. In this case, the two lines will only intersect if James walks faster than Tony (the slope of James' line would have to be steeper) and reaches Tony while they are both still walking.

Please complete *Lesson 7.4 Explore Your Understanding Assignment*, located in *Workbook 7.4*.