

Two lines can be said to be **parallel** or **perpendicular**.

Two lines are parallel if they have the same slope

Two lines are perpendicular if the product of their slopes is -1

For each of the following:

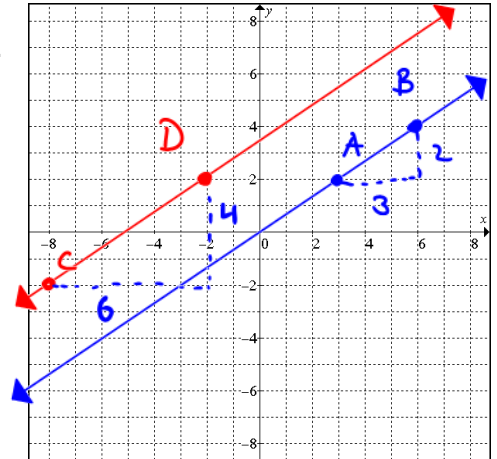
- Plot the given points and draw lines connecting the points as stated. Make sure you extend the lines to the edges of the graph.
- Calculate the slope of each of the lines
- Classify the lines as *parallel*, *perpendicular* (meet at 90°), or *neither*.

- Points: $A(3,2), B(6,4), C(-8,-2), D(-2,2)$.
Lines: AB and CD .

$m_{AB} = \frac{2}{3}$ $m_{CD} = \frac{4}{6} = \frac{2}{3}$ The lines are <u>parallel</u>
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$m_{AB} = m_{CD}$

$\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$

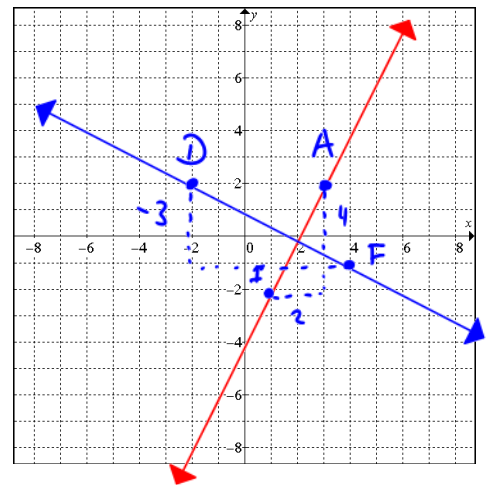


- Points: $A(3,2), D(-2,2), F(4,-1), I(1,-2)$.
Lines: AI and DF .

$m_{AI} = \frac{4}{2} = 2$ $m_{DF} = \frac{-3}{6} = -\frac{1}{2}$ The lines are <u>PERPENDICULAR</u>

$m_{AI} \times m_{DF}$
 $= 2 \times -\frac{1}{2}$
 $= -1$

$\overleftrightarrow{AI} \perp \overleftrightarrow{DF}$

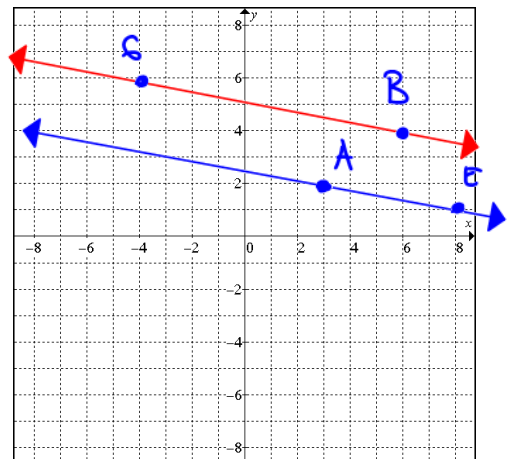


- Points: $A(3,2), B(6,4), E(8,1), G(-4,6)$.
Lines: AE and BG .

$m_{AE} = -\frac{1}{5}$ $m_{BG} = \frac{-2}{10} = -\frac{1}{5}$ The lines are <u>PARALLEL</u>
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$m_{AE} = m_{BG}$

$\overleftrightarrow{AE} \parallel \overleftrightarrow{BG}$

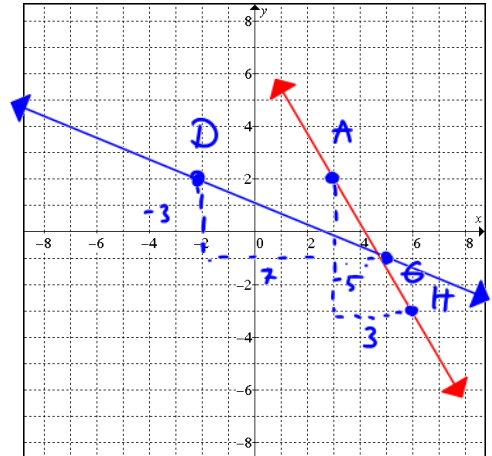


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4. Points: $A(3,2), D(-2,2), G(5,-1), H(6,-3)$.
Lines: AH and DG .

$$m_{AH} = -\frac{5}{3} \quad m_{DG} = -\frac{3}{2}$$

The lines are neither



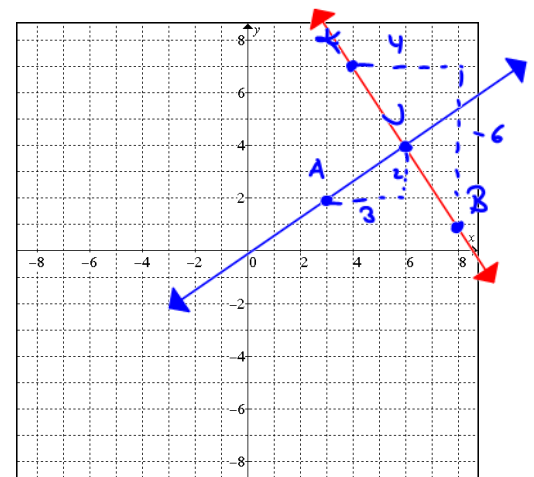
5. Points: $A(3,2), E(8,1), J(6,4), K(4,7)$.
Lines: AJ and EK .

$$m_{AJ} = \frac{2}{3} \quad m_{EK} = \frac{-6}{4} = -\frac{3}{2}$$

The lines are PERPENDICULAR

$\overleftrightarrow{AJ} \perp \overleftrightarrow{EK}$

$$m_{AJ} \times m_{EK} = \frac{2}{3} \times -\frac{3}{2} = -1$$



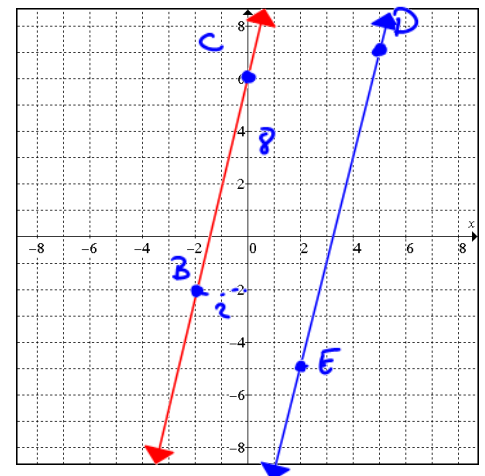
6. Points: $B(-2,-2), C(0,6), D(5,7), E(2,-5)$.
Lines: BC and DE .

$$m_{BC} = \frac{8}{2} = 4 \quad m_{DE} = \frac{8}{2} = 4$$

The lines are PARALLEL

$\overleftrightarrow{BC} \parallel \overleftrightarrow{DE}$

$$m_{BC} = m_{DE}$$



By comparing the slopes of the pairs of lines that were parallel, develop a rule for the slopes of parallel lines.

If lines are parallel, then slopes are equal

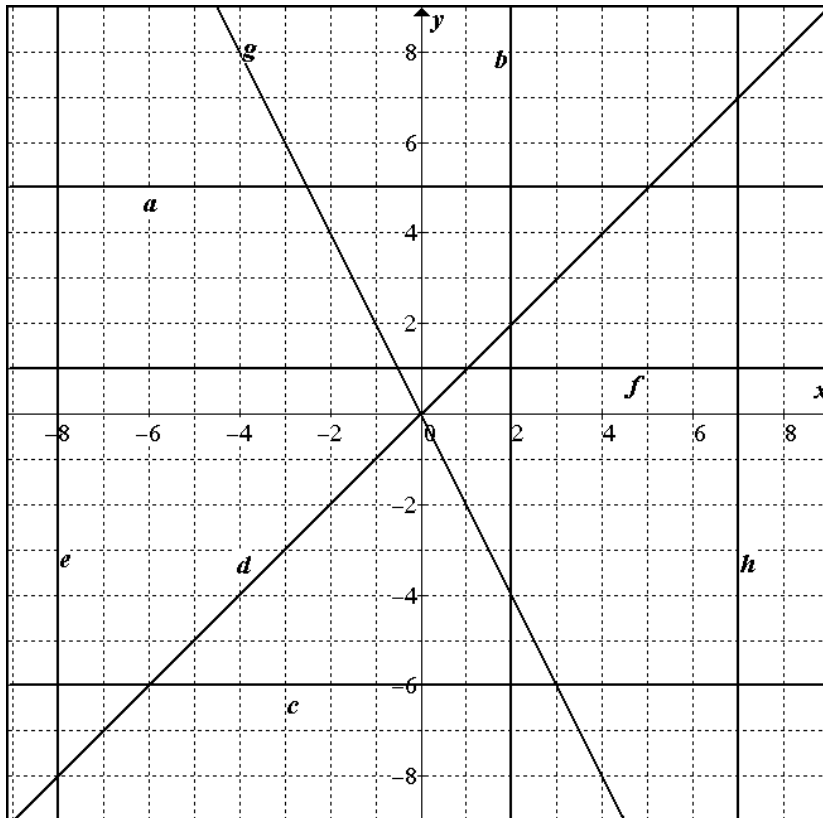
By comparing the slopes of the pairs of lines that were perpendicular, develop a rule for the slopes of perpendicular lines.

If lines are perpendicular, then the product of their slopes is -1

7. Determine if the following lines are parallel, perpendicular, or neither by placing the symbols \parallel , \perp , or N beside each pair of equations.

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|---|-----------------------------------|--|-----------------------------------|
| a) $y = 5x, y = 5x + 3$ | <u> \parallel </u> | b) $y = -\frac{3}{5}x, y = \frac{5}{3}x + 3$ | <u> \perp </u> |
| c) $y = \frac{2}{3}x - 2, y = \frac{3}{2}x - 2$ | <u> N </u> | d) $y = \frac{4}{3}x - 5, y = \frac{4}{3}x + \frac{1}{5}$ | <u> \parallel </u> |
| e) $y = -\frac{2}{5}x + \frac{5}{2}, y = -\frac{5}{2}x - \frac{2}{5}$ | <u> N </u> | f) $y = -\frac{4}{7}x - \frac{4}{7}, y = \frac{7}{4}x - \frac{4}{7}$ | <u> \perp </u> |
| g) $y = x + 2, y = 2x - \frac{1}{2}$ | <u> N </u> | h) $y = \frac{5}{4}x, y = x + \frac{5}{4}$ | <u> N </u> |
| i) $y = -\frac{6}{5}x + 4, y = \frac{5}{6}x + 4$ | <u> \perp </u> | j) $y = \frac{5}{2}x, y = -\frac{2}{5}x + \frac{5}{2}$ | <u> \perp </u> |
| k) $y = 3x - \frac{1}{3}, y = 3x + 3$ | <u> \parallel </u> | l) $y = -x, y = x - 1$ | <u> \perp </u> |

8. State the equation of the labelled lines in the graph.



- | | | | |
|-----------------------------------|----------------------------------|------------------------------------|----------------------------------|
| a) <u> $y = 5$ </u> | b) <u> $x = 2$ </u> | c) <u> $y = -6$ </u> | d) <u> $y = x$ </u> |
| e) <u> $y = -8$ </u> | f) <u> $y = 1$ </u> | g) <u> $y = -2x$ </u> | h) <u> $x = 7$ </u> |
| | | $m = \frac{-2}{1} = -2$ | |

9. Determine if the following lines are horizontal, vertical, or neither.

- | | | | | | |
|----------------------|----------|-----------------------|----------|---------------------------|----------|
| a) $y = 1$ | <u>H</u> | b) $x = 1$ | <u>V</u> | c) $y = -4$ | <u>H</u> |
| d) $y = \frac{5}{3}$ | <u>H</u> | e) $x = -\frac{3}{2}$ | <u>V</u> | f) $y = \frac{2}{3}x + 2$ | <u>N</u> |
| g) $x = -8$ | <u>V</u> | h) $y = x$ | <u>N</u> | i) $y = 3x$ | <u>N</u> |

10. Determine if the following lines are parallel, perpendicular, or neither.

- | | | | | | |
|--|-----------|--|-----------|--|-----------|
| a) $y = 5, y = 2$ | <u> </u> | b) $y = 3, y = -\frac{1}{3}$ | <u> </u> | c) $y = 5, x = 1$ | <u>⊥</u> |
| d) $x = 3, y = 3$ | <u>⊥</u> | e) $y = 5, x = 9$ | <u>⊥</u> | f) $x = \frac{3}{2}, x = -\frac{2}{3}$ | <u> </u> |
| g) $x = \frac{1}{2}, x = -\frac{1}{2}$ | <u> </u> | h) $y = \frac{4}{3}, x = -\frac{3}{4}$ | <u>⊥</u> | i) $y = \frac{5}{3}, y = -\frac{3}{5}$ | <u> </u> |
| j) $y = \frac{7}{3}, x = \frac{7}{3}$ | <u>⊥</u> | k) $x = \frac{3}{4}, y = -\frac{3}{4}$ | <u>⊥</u> | l) $x = 5, y = 7$ | <u>⊥</u> |
- * answer is correct*

11. Determine if the following lines are parallel, perpendicular, or neither.

- | | | | | | |
|--|----------|---------------------------------------|-----------|--|-----------|
| a) $y = 2x, y = 3x$ | <u>N</u> | b) $y = \frac{1}{3}x, y = -3x$ | <u>⊥</u> | c) $x = \frac{3}{10}, x = -\frac{10}{3}$ | <u> </u> |
| d) $y = x, y = -x$ | <u>⊥</u> | e) $y = 2, y = 3$ | <u> </u> | f) $x = 2, y = 2$ | <u>⊥</u> |
| g) $y = 2x, y = 2$ | <u>N</u> | h) $y = \frac{1}{2}, x = \frac{1}{2}$ | <u>⊥</u> | i) $y = \frac{2}{3}x, y = -\frac{3}{2}$ | <u>N</u> |
| j) $y = -\frac{2}{3}x, y = \frac{3}{2}x$ | <u>⊥</u> | k) $y = x, y = 2x$ | <u>N</u> | l) $y = 2x, y = -2x$ | <u>N</u> |

Selected Answers:

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|---|--|---|
| 1. $m_{AB} = \frac{2}{3}, m_{CD} = \frac{2}{3}$ | 2. $m_{AI} = 2, m_{DF} = -\frac{1}{2}$ | 3. $m_{AE} = -\frac{1}{5}, m_{BG} = -\frac{1}{5}$ |
| 4. $m_{AH} = -\frac{5}{3}, m_{DG} = -\frac{3}{7}$ | 5. $m_{AJ} = \frac{2}{3}, m_{EK} = -\frac{3}{2}$ | 6. $m_{BC} = 4, m_{DE} = 4$ |
| 7. a) b) ⊥ c) N d) e) N f) ⊥ | g) N h) N i) ⊥ j) ⊥ k) l) ⊥ | |
| 8. a) $y = 5$ b) $x = 2$ c) $y = -6$ d) $y = x$ | e) $x = -8$ f) $y = 1$ g) $y = -2x$ h) $x = 7$ | |
| 9. a) H b) V c) H d) H e) V f) N g) V h) N i) N | | |
| 10. a) b) c) ⊥ d) ⊥ e) ⊥ f) | g) h) ⊥ i) j) ⊥ k) ⊥ l) ⊥ | |
| 11. a) N b) ⊥ c) d) ⊥ e) f) ⊥ | g) N h) ⊥ i) N j) ⊥ k) N l) N | |