

Boost Free Lessons - Year 10 Maths

Lesson 13: Parallel and Perpendicular Lines

Name: _____ Grade: _____ Date: _____

Worked Example 1

Are the lines $y = 3x + 1$ and $y = 3x - 4$ parallel?

1. Parallel lines have exactly the **same** gradient.
2. Both equations are in the form $y = mx + b$, so read off the number in front of x .
3. The first has $m = 3$ and the second has $m = 3$.
4. The gradients match, and the y -intercepts differ, so the lines are parallel and never meet.

Yes, they are parallel

Worked Example 2

Find the gradient of a line perpendicular to $y = 2x + 5$.

1. Perpendicular gradients always multiply to give -1 .
2. The given gradient is $m_1 = 2$.
3. So $2 \times m_2 = -1$, giving $m_2 = -\frac{1}{2}$.
4. In short: flip the fraction upside down and change the sign. This is called the negative reciprocal.

$$m = -\frac{1}{2}$$

Remember: Parallel lines have the same gradient. Perpendicular gradients multiply to -1 , so flip the fraction and change the sign.



Question 1: State the gradient of a line **parallel** to each line below.

1. $y = 4x + 3$

2. $y = -2x + 1$

3. $y = x - 7$

4. $y = \frac{1}{2}x + 5$

5. $y = -5x$

6. $y = 3 - x$

7. $y = \frac{2}{3}x + 1$

8. $y = -0.5x + 4$



Question 2: State the gradient of a line **perpendicular** to each line below.

1. $y = 2x + 1$

2. $y = -3x$

3. $y = x + 4$

4. $y = \frac{1}{4}x$

5. $y = -x + 2$

6. $y = 5x - 3$

7. $y = \frac{2}{3}x + 1$

8. $y = -\frac{1}{2}x$



Question 3: Answer the following questions.

1. Are $y = 2x + 1$ and $y = -\frac{1}{2}x + 3$ perpendicular? Show your working.
2. Find the equation of the line parallel to $y = 3x - 2$ with a y-intercept of $(0, 5)$.
3. Find the equation of the line perpendicular to $y = 4x + 1$ that passes through $(0, -3)$.
4. Are $y = 2x + 5$ and $y = 2x - 5$ the same line? Explain your answer.
5. A line has a gradient of $\frac{3}{5}$. Find the gradient of a line perpendicular to it.





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Answers: Parallel and Perpendicular Lines**Question 1**

- | | |
|------------------|------------------|
| 1. 4 | 5. -5 |
| 2. -2 | 6. -1 |
| 3. 1 | 7. $\frac{2}{3}$ |
| 4. $\frac{1}{2}$ | 8. -0.5 |

Question 2

- | | |
|-------------------|-------------------|
| 1. $-\frac{1}{2}$ | 5. 1 |
| 2. $\frac{1}{3}$ | 6. $-\frac{1}{5}$ |
| 3. -1 | 7. $-\frac{3}{2}$ |
| 4. -4 | 8. 2 |

Question 3

1. Yes, because $2 \times -\frac{1}{2} = -1$
2. $y = 3x + 5$
3. $y = -\frac{1}{4}x - 3$
4. No. They have the same gradient so they are parallel, but different y-intercepts, so they never meet.
5. $-\frac{5}{3}$

