MATHEMATICS · GRADES 10-12

Equations of lines

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you turn a steady pattern into one rule. A phone plan that charges the same amount for every extra gigabyte follows one rule, and once you have it you can work out the cost for any amount of data. The same idea works for pay by the hour, taxi fares, or any cost that grows steadily. One equation replaces a whole table of numbers.



Rule

Equation of a line: $y = mx + b$, where m is the slope and b is the y-intercept.

The slope tells you how steep the line is, and the y-intercept tells you where it crosses the y-axis.

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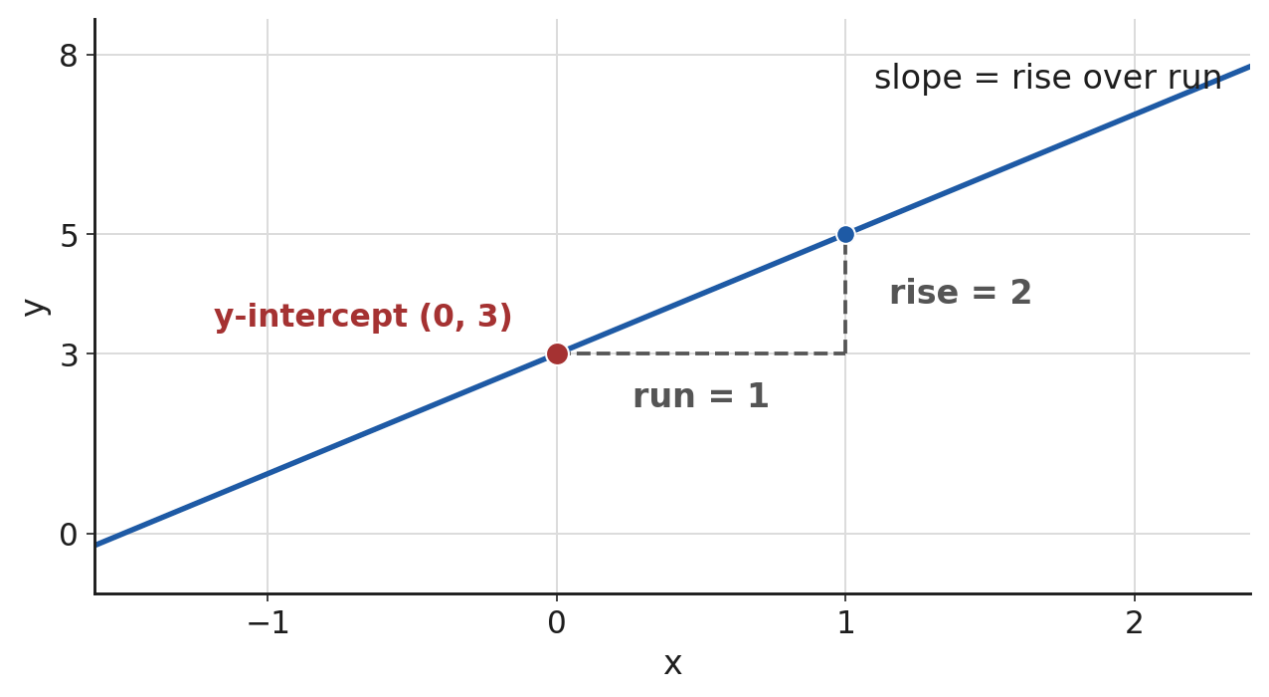
Worked examples

EXAMPLE 1

Q Find the equation of the line with slope 2 passing through (0, 3).



SOLUTION

Slope-intercept form is $y = m x + b$, with m the slope and b the intercept.

Here $m = 2$ and $b = 3$.

Equation: $y = 2x + 3$

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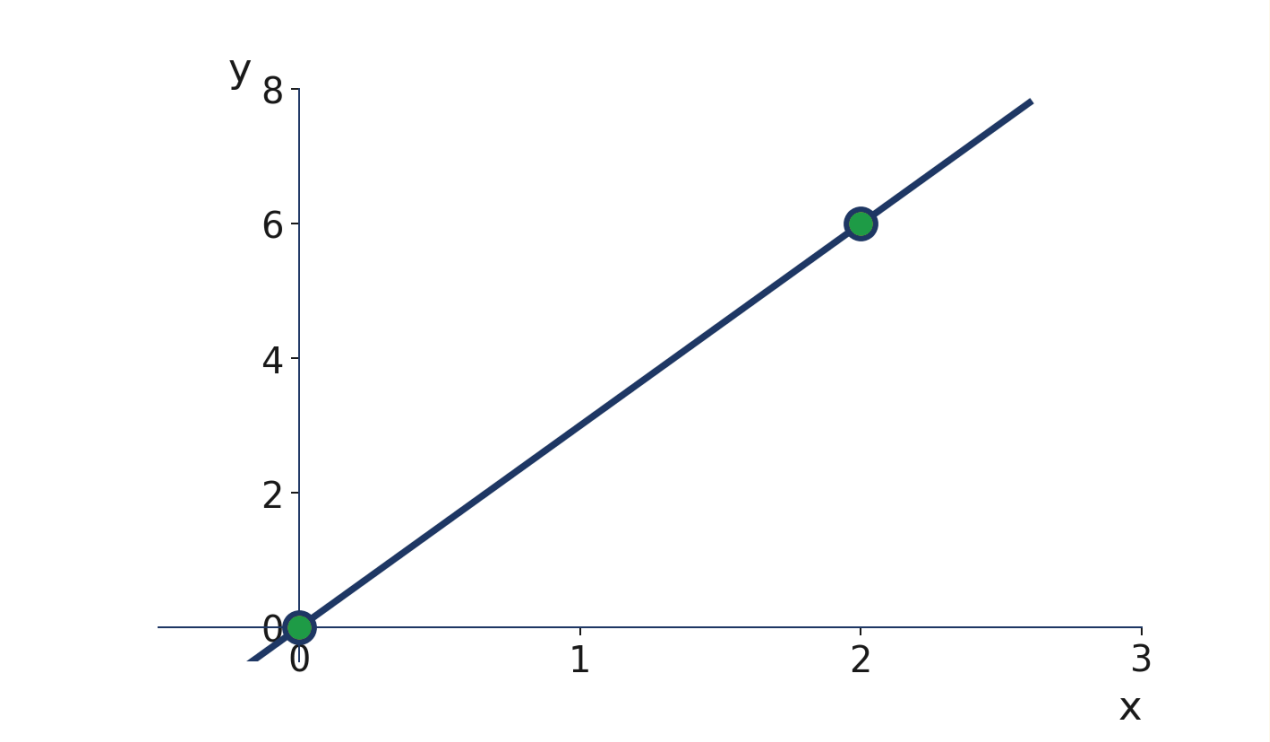
EXAMPLE 2

Q Find the equation of the line through (0, 0) and (2, 6).



SOLUTION

Slope = $\frac{(6 - 0)}{(2 - 0)} = 3$

It passes through (0, 0), the origin, so the intercept is 0.

Equation: y = 3x

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Practice questions

1 A phone plan charges $2 a month plus $3 per gigabyte. Write the equation of the line for the monthly cost y after x gigabytes.

- **A** y = 3x - 2
- **B** y = 4x + 2
- **C** y = 3x + 2
- **D** y = 2x + 2

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2 A delivery driver starts 2 km from the depot and drives 4 km per hour. Find the equation of the line through (0, 2) and (2, 10).

- **A** y = 4x - 2
- **B** y = 5x + 2
- **C** y = 3x + 2
- **D** y = 4x + 2

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3 A line has slope 3 and passes through (1, 7). What is its equation?

- **A** y = 3x + 4
- **B** y = 3x + 7
- **C** y = 3x + 1
- **D** y = 7x + 3

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4 A taxi meter starts at $5 and never moves. What is the line's equation?

- **A** y = 6
- **B** y = 5
- **C** y = 4
- **D** y = -5

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5 A train passes (2, 3) and (4, 11). Find the equation of its line.

- **A** y = 4x + 5
- **B** y = 5x - 5
- **C** y = 4x - 5
- **D** y = 3x - 5

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6 A horizontal line crosses the y-axis at 7. Write its equation.

- **A** y = 8
- **B** y = 6
- **C** y = -7
- **D** y = 7

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7 A cyclist rides at a steady speed, covering 12 km in 3 hours from the start. What is the equation of the line?

- **A** y = 4x
- **B** y = 5x
- **C** y = 3x
- **D** y = -4x

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8 A line has slope -3 and intercept 2. Write its equation.

- **A** $y = -3x - 2$
- **B** $y = -3x + 2$
- **C** $y = -2x + 2$
- **D** $y = -4x + 2$

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9 A ramp rises 1 metre for every 2 metres it runs, starting 4 metres below ground level. What is the equation of the ramp's line?

- **A** $y = (\frac{1}{2})x + 4$
- **B** $y = (\frac{3}{2})x - 4$
- **C** $y = (\frac{1}{2})x - 4$
- **D** $y = (\frac{-1}{2})x - 4$

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10 A line has equation $y = 5x + 2$. What is its slope?

A 2

B 5

C 7

D -5

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ANSWER KEY

1. $y = 3x + 2$

2. $y = 4x + 2$

3. $y = 3x + 4$

4. $y = 5$

5. $y = 4x - 5$

6. $y = 7$

7. $y = 4x$

8. $y = -3x + 2$

9. $y = \left(\frac{1}{2}\right)x - 4$

10. 5

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