MATHEMATICS · GRADES 7-9

Direct variation

Difficulty level: Intermediate

Mathematics: Grades 7-9

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Overview of the concept

This is how you work out a total that grows in step with how much you buy. Apples by the kilogram cost twice as much when you buy twice as many, and pay by the hour doubles when you work twice the hours. Once you know the rate for one unit, you can work out any amount. It is the simplest kind of pattern in everyday money, and it is everywhere once you start looking.



Rule

Direct variation: $y = kx$, where k is a constant.

When x doubles, y doubles too, because y is always the same multiple of x. The graph is a straight line through (0, 0), and k is $\frac{y}{x}$.

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Worked examples

EXAMPLE 1

Q If y varies directly with x and y = 20 when x = 4, find y when x = 7.

SOLUTION

This is direct variation, so y = kx, and the one thing to find first is k, the constant.

20 = k × 4, so k = 20 ÷ 4 = 5, and the equation is y = 5x

When x = 7, y = 5 × 7 = 35

EXAMPLE 2

Q Do these values show direct variation? x: 2, 5, 8; y: 6, 15, 24.

SOLUTION

For direct variation the ratio y over x has to be the same for every pair, because y = kx with one k.

6 ÷ 2 = 3, 15 ÷ 5 = 3, and 24 ÷ 8 = 3

The ratio is always 3, so yes, it is direct variation, with y = 3x

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Practice questions

1 If y varies directly with x and y = 18 when x = 3, find the equation.

- **A** y = 7x
- **B** y = 6x
- **C** y = 5x
- **D** y = -6x

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2 If y varies directly with x and y = 10 when x = 2, find y when x = 9

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3 If y varies directly with x and y = 24 when x = 8, find x when y = 15

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4 A car travels 150 km in 3 hours at a steady speed. How far does it travel in 7 hours at the same speed?

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5 4 kg of apples cost $12. How much do 9 kg cost at the same rate?

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6

Do these values show direct variation?
x: 3, 6, 9
y: 5, 10, 15.
Answer yes or no.

A Yes

B No

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7

Do these values show direct variation?
x: 2, 4, 6
y: 5, 9, 13.
Answer yes or no.

A Yes

B No

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8 Which equation shows direct variation?

A $y = 3x + 1$

B $y = 3x$

C $y = \frac{3}{x}$

D $y = x + 3$

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9 A worker earns $96 for 8 hours. How many hours does she work to earn $180?

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10 **The distance a spring stretches varies directly with the weight on it. It stretches 4 cm under 10 kg. How far does it stretch under 25 kg?**

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ANSWER KEY

1. y = 6x

2. 45

3. 5

4. 350 km

5. $27

6. Yes

7. No

8. y = 3x

9. 15 hours

10. 10 cm

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