MATHEMATICS · GRADES 10-12

Inverse variation

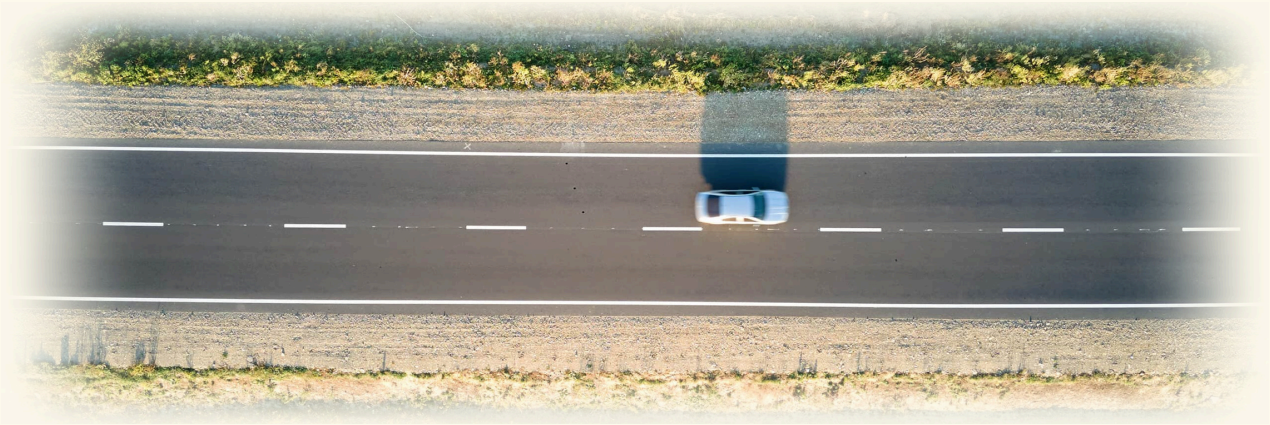
Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you handle a trade off where one thing goes down as another goes up, like driving faster to cut the time a trip takes. When two things vary inversely, doubling one halves the other, and knowing that lets you predict the trade off exactly. You use it to plan a trip, to work out how many workers you need to finish a job by a deadline, or to see how the brightness of a light fades as you move away from it.



Rule

Inverse variation means y equals $\frac{k}{x}$, so x × y always equals the same constant k.

Doubling x halves y, and halving x doubles y.

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Worked examples

EXAMPLE 1

Q **y varies inversely with x. If y = 12 when x = 2, find the equation and y when x = 6.**

SOLUTION

Inverse variation means $y = \frac{k}{x}$. Substitute: $12 = \frac{k}{2}$, so $k = 24$.

The equation is $y = \frac{24}{x}$.

When $x = 6$, $y = \frac{24}{6} = 4$

EXAMPLE 2

Q **y varies inversely with x. If y = 4 when x = 5, find y when x = 10.**

SOLUTION

Find k: $4 = \frac{k}{5}$, so $k = 20$.

The equation is $y = \frac{20}{x}$.

When $x = 10$, $y = \frac{20}{10} = 2$

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Practice questions

1. Brightness y varies inversely with distance x. When x = 4 m, y = 6 units. Find k.

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2. y = 6 when x = 4. What is the brightness when x = 8 m?

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3. The time y to finish a job varies inversely with the number of workers x. If y = 10 days when x = 3 workers, find k.

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4 The job takes 10 days with 3 workers. How long does it take with 5 workers?

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5 The pressure y of a gas varies inversely with its volume x. If y = 2 when x = 9, write the equation.

A $y = \frac{18}{x}$

B $y = \frac{9}{x}$

C $y = \frac{36}{x}$

D $y = 18x$

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6 $y = 2$ when $x = 9$. What is the pressure when $x = 6$?

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7 The time to mow a lawn varies inversely with the number of mowers. With 2 mowers it takes 6 hours. How long would it take with 4 mowers?

A 12 hours

B 3 hours

C 2 hours

D 6 hours

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8 The wavelength y of a wave varies inversely with its frequency x. If $y = 15$ when $x = 2$, find y when $x = 10$.

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9 The current y in a circuit varies inversely with resistance x. If $y = 8$ when $x = 5$, find k.

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10 $y = 8$ when $x = 5$. What resistance gives a current of $y = 2$?

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ANSWER KEY

1. 24

2. 3

3. 30

4. 6

5. $y = \frac{18}{x}$

6. 3

7. 3 hours

8. 3

9. 40

10. 20

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