MATHEMATICS · GRADES 10-12

Rational word problems

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you work out shared jobs and trips, like how long it takes two people painting a room together, or when two cars travelling toward each other will meet. Two painters working together finish faster than either one alone, and two cars driving toward each other close the gap from both ends at once. Two hoses filling a pool, or two friends splitting a job, are the same problem in different clothes. Working out how rates combine is what tells you when the job gets done.



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Worked examples

EXAMPLE 1

Q Two workers take 6 hours and 3 hours alone. How long together?

SOLUTION

Write each rate per hour: $\frac{1}{6}$ and $\frac{1}{3}$.

Add the rates: $\frac{1}{6} + \frac{1}{3} = \frac{1}{2}$ per hour, so together they finish 1 job in 2 hours.

So the time together is 2 hours.

EXAMPLE 2

Q A car travels 120 km. Going 20 km/h faster saves 1 hour. Find the slower speed.

SOLUTION

Let the slower speed be x.

$$\frac{120}{x} - \frac{120}{(x + 20)} = 1$$

Multiply out: $120(x + 20) - 120x = x(x + 20)$, giving $x^2 + 20x - 2400 = 0$.

Factor: $(x + 60)(x - 40) = 0$, so the slower speed is 40 km/h.

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Practice questions

1. Two painters each take 4 hours alone. How long do they take together?

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2. Two workers take 2 hours together. One takes 3 hours alone. How long does the other take alone, in hours?

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3. Three painters take 6 hours, 3 hours, and 2 hours alone. How long do they take together, in hours?

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4 A driver travels 150 km to a cottage. Going 25 km/h faster would save 1 hour. What is the slower speed?

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5 A train travels 180 km at 45 km per hour. How much time would it save by going 15 km per hour faster, in hours?

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6 Two hoses fill a pool in 6 hours each. How long do they take together to fill half the pool, in hours?

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7 One hose fills a pool in 10 hours. After 5 hours working alone, a second hose (15 hours alone) joins it. How many more hours until the pool is full?

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8 Two workers take 4 hours each alone. One works alone for 2 hours, then the other finishes the job alone. How long does the other take, in hours?

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9 A truck travels 240 km. Going faster saves 2 hours, and the slower speed is 40 km per hour. What is the faster speed, in km per hour?

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10 Two cars 300 km apart drive toward each other at 60 km per hour and 40 km per hour. In how many hours do they meet?

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ANSWER KEY

1. 2

2. 6

3. 1

4. 50 km/h

5. 1

6. 1.5

7. 3

8. 2

9. 60

10. 3

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