

# Test the Whole Relationship

## Learn one multiplier for the whole relationship

Call the input  $x$  and the output  $y$ . A proportional relationship uses one constant  $k$  so that  $y = k \times x$  for every allowed input. For  $x$  greater than zero,  $y \div x$  must be the same  $k$ , with units. If zero is an allowed input, the pair must be  $(0, 0)$ . Never calculate  $0 \div 0$ .

### A supplied water model

For 0 to 4 minutes, Tank A begins empty and gains 3 liters each minute. Tank B begins with 5 liters and also gains 3 liters each minute. Time is the input; total water, including any starting water, is the output.

| Time (minutes) | Tank A total (liters) | Tank B total (liters) |
|----------------|-----------------------|-----------------------|
| 0              | 0                     | 5                     |
| 1              | 3                     | 8                     |
| 2              | 6                     | 11                    |
| 4              | 12                    | 17                    |

For A,  $3 \div 1 = 3$ ,  $6 \div 2 = 3$  and  $12 \div 4 = 3$  liters per minute. The rule is  $y = 3 \times x$  and zero time gives zero water. For B,  $8 \div 1 = 8$  but  $11 \div 2 = 5.5$  liters per minute. Its total is  $y = 3 \times x + 5$ . Equal increases do not make those totals proportional.

Explain the difference between water added and total water

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## Guided practice state the constant and its units

Each complete cord piece has length 12 centimeters. Total length includes only these identical pieces. The model allows whole-number counts from 0 to 5 pieces.

| Number of pieces | Total cord length (centimeters) |
|------------------|---------------------------------|
| 0                | 0                               |
| 1                | 12                              |
| 3                | 36                              |
| 5                | 60                              |

Compare the quotients for 1, 3 and 5 pieces. Is total length proportional to piece count? Name  $k$  and its units, write a rule, and explain the zero-input pair. What total does the rule give for 4 pieces?

Your ratios, rule and explanation

An answer for a fractional piece count is outside this stated whole-piece model. A rule's allowed inputs matter.

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## Independent practice test the claim

### A A tank with a starting amount

For 0 to 5 minutes, a tank begins with 4 liters and gains 2 liters each minute. Use total water, including the starting water.

| Time (minutes) | Total water (liters) |
|----------------|----------------------|
| 0              | 4                    |
| 1              | 6                    |
| 3              | 10                   |
| 5              | 14                   |

Is total water proportional to time? Use two positive-time quotients and the starting pair. Write a rule matching the supplied model.

#### A: evidence, rule and conclusion

### B Two matching pairs are not the whole table

| Input x | Output y |
|---------|----------|
| 1       | 2        |
| 2       | 4        |
| 3       | 7        |

A fictional learner checked only the first two pairs and said  $y = 2 \times x$  fits the whole table. Test that claim against every displayed pair. Which pair resolves the question? No rule for unseen inputs is supplied.

#### B: evidence and qualified conclusion