SCIENCE FOUNDATIONS

Calculating slopes on motion graphs

Difficulty level: Intermediate

Science Foundations

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Overview of the concept

This is how you read speed and acceleration straight off a graph, like finding how fast a cyclist is going from the slope of a distance-time graph. A steep slope means the cyclist is moving fast, a flat slope means they have stopped, and a slope that gets steeper means they are speeding up. A coach reading a race graph can see exactly when a runner sped up and when they slowed down, without timing every step. The slope of the line is the speed, written right there in the shape of the graph.



Rule

Calculating slopes on motion graphs: slope = $\frac{\text{rise}}{\text{run}}$.

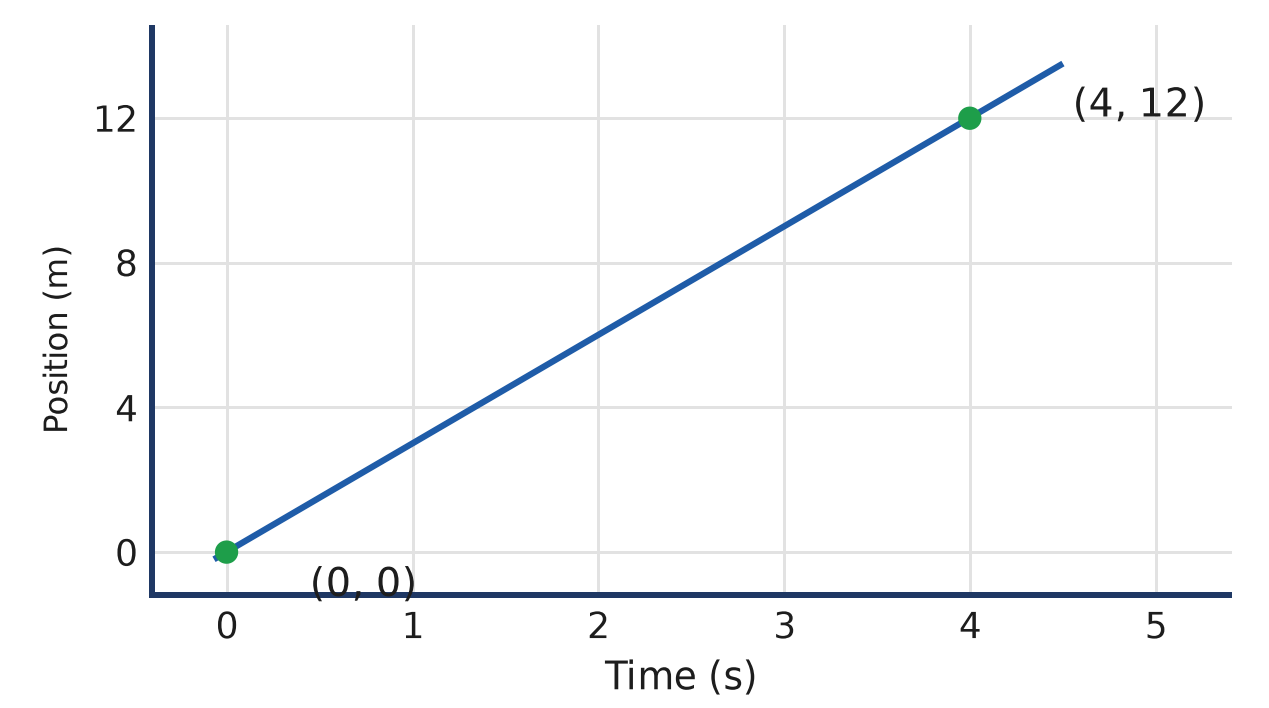
On a position-time graph the slope is the velocity, and on a velocity-time graph the slope is the acceleration.

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Worked examples

EXAMPLE 1

Q Position-time: points (0 s, 0 m) and (4 s, 12 m). Slope?



SOLUTION

Find the rise: 12 - 0 = 12 m

Find the run: 4 - 0 = 4 s

12 ÷ 4 = 3

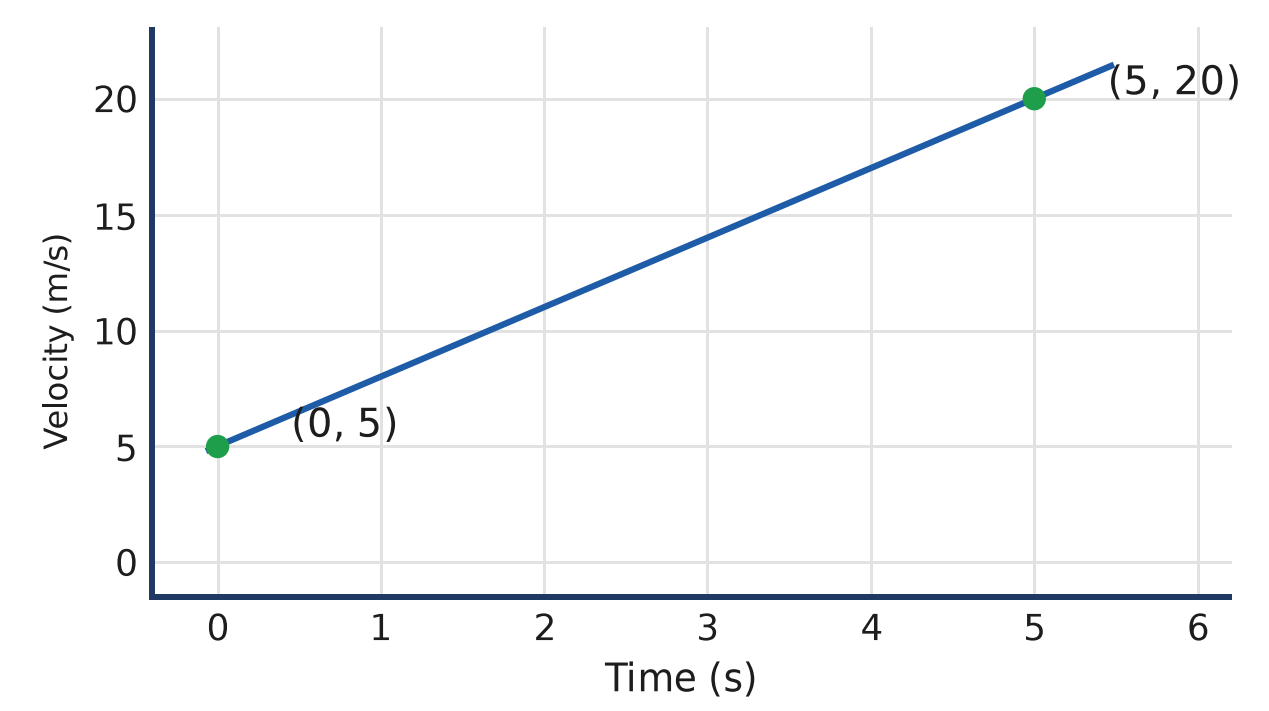
Slope = 3 m/s

The result is slope 3 m/s, so velocity 3 m/s.

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EXAMPLE 2

Q Velocity-time: points (0 s, 5 m/s) and (5 s, 20 m/s). Slope?



SOLUTION

Find the rise: 20 - 5 = 15 m/s

Find the run: 5 - 0 = 5 s

15 ÷ 5 = 3

Slope = 3 m/s^2

The result is slope 3 $\frac{m}{s^2}$, so acceleration 3 $\frac{m}{s^2}$.

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Practice questions

1

What is the slope formula?

A Rise divided by run

B Run divided by rise

C Rise plus run

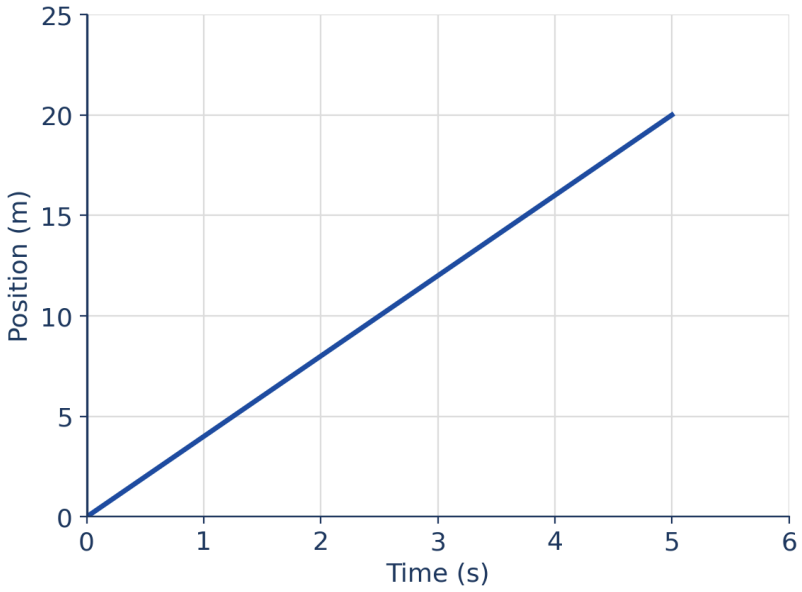
D Rise times run

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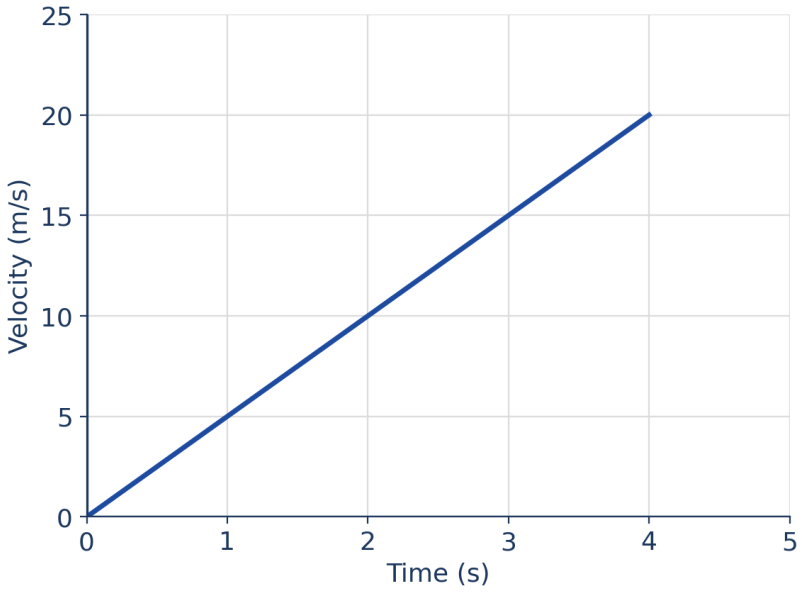
2 Look at the position-time graph. What is the slope?



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3 Look at the velocity-time graph. What is the slope?



A $4\ \frac{m}{s^2}$

B $5\ \frac{m}{s^2}$

C $2.5\ \frac{m}{s^2}$

D $10\ \frac{m}{s^2}$

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4 What does the slope of a position-time graph give?

- A Velocity
- B Acceleration
- C Distance
- D Time

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5 What does the slope of a velocity-time graph give?

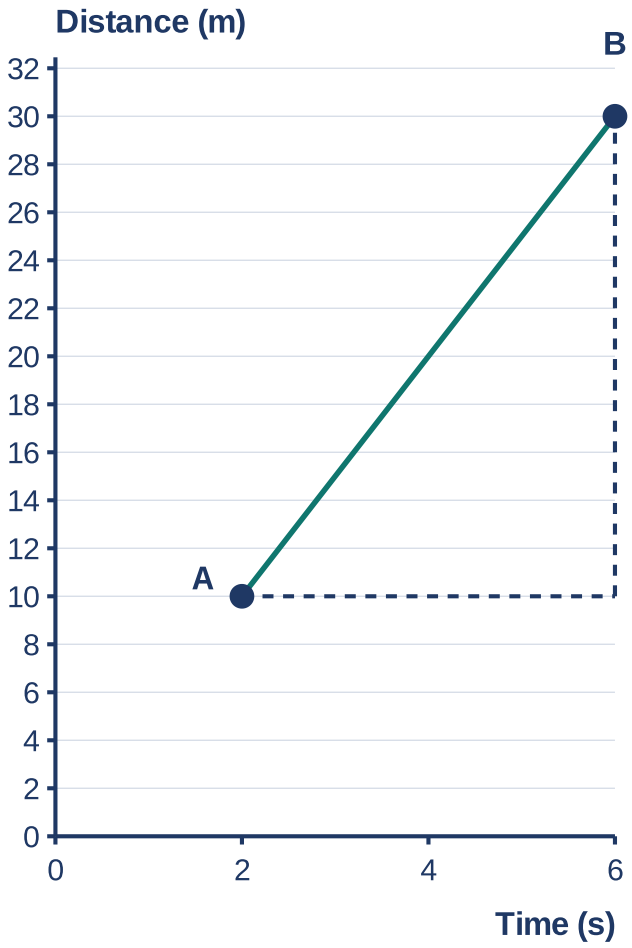
- A Acceleration
- B Velocity
- C Distance
- D Time

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6

The position-time graph shows points A and B. Read their coordinates from the graph, then find the slope.

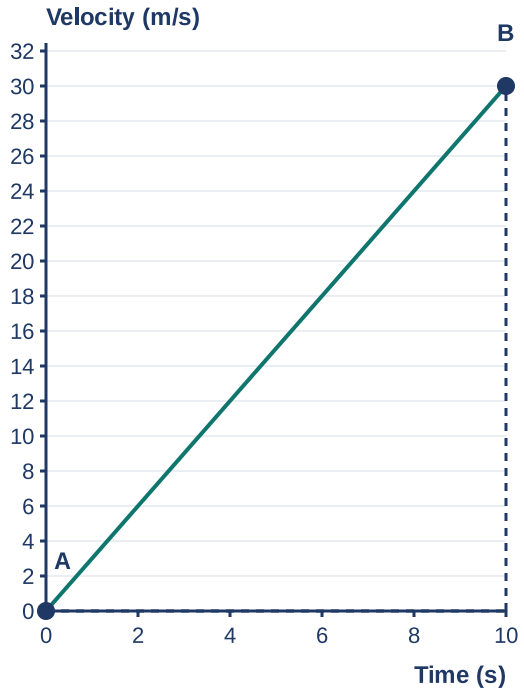


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7 The velocity-time graph shows points A and B. Read their coordinates from the graph, then find the slope.



A $2\frac{m}{s^2}$

B $5\frac{m}{s^2}$

C $3\frac{m}{s^2}$

D $6\frac{m}{s^2}$

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8

What is rise?

A Vertical change

B Horizontal change

C Change in time

D Change in speed

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9

What is run?

A Horizontal change

B Vertical change

C Change in time

D Change in speed

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10

Why do you use two points to find the slope?

A One point alone gives no change

B One point gives the slope directly

C Two points make the line longer

D One point gives the speed directly

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ANSWER KEY

1. Rise divided by run

2. 4 m/s

3. 5 $\frac{m}{s^2}$

4. Velocity

5. Acceleration

6. 5 m/s

7. 3 $\frac{m}{s^2}$

8. Vertical change

9. Horizontal change

10. One point alone gives no change

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