Your notes

GCSE Maths: revision notes

Gradients and rates of change

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Gradient as a rate of change

- The **gradient** of a graph shows how fast one quantity changes compared with another.
- On a distance-time graph the **gradient** is the speed. On a velocity-time graph the **gradient** is the **acceleration**.
- A straight line shows a constant **rate of change**. A horizontal line on a velocity-time graph shows a constant velocity.

Average and instantaneous rates of change

- The average **rate of change** between two points is the **gradient** of the **chord** (straight line) joining them. A car that travels 120 m in 8 seconds has an average speed of 15 m/s.
- The **instantaneous rate of change** at one point is the **gradient** of the **tangent** to the curve at that point.
- To find the **gradient** of a **tangent**, pick two points on it that are far apart, then work out change in y ÷ change in x.

Area under a graph

- The area under a velocity-time graph is the distance travelled.
- Split the area into triangles, rectangles and trapeziums. A car accelerating from 0 to 20 m/s in 10 seconds travels ½ × 10 × 20 = 100 m.
- For a curve, split the area into strips (trapeziums) to estimate it.

Key terms

Rate of change	How fast one quantity changes compared with another.
Gradient	Change in y ÷ change in x.
Chord	A straight line joining two points on a curve.

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Tangent	A straight line that touches a curve at one point.
Instantaneous rate of change	The rate of change at one moment: the gradient of the tangent.
Acceleration	The rate of change of velocity: the gradient of a velocity-time graph.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. On a distance-time graph, what does the gradient show?
2. On a velocity-time graph, what does the gradient show?
3. On a velocity-time graph, what does the area under the graph show?
4. How do you estimate the rate of change at one point on a curve?
5. What does the gradient of a chord between two points give?
6. A car travels 120 m in 8 seconds. What is its average speed?
7. A car speeds up steadily from 0 to 20 m/s in 10 seconds. What is its acceleration?
8. A car speeds up steadily from 0 to 20 m/s in 10 seconds. How far does it travel?

Answers

1. Speed
2. Acceleration
3. Distance travelled
4. Draw a tangent and find its gradient
5. The average rate of change
6. 15 m/s
7. 2 m/s²
8. 100 m

What to do next

Practise 12 questions on this topic

Try 4 exam questions, with mark schemes

Read the lesson, one step at a time

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