Millthorpe School
Mathematics Department

Year 11 Unit 4

Velocity-time graphs and algebraic proof (Higher)

Prior knowledge: Year 10 unit 2 speed, distance, time
Year 10 unit 1 circle theorems and unit 5 further trigonometry

Leads onto: Year 11 exams
Year 12 kinematics and further algebraic proof

What do I need to be able to do?

- Plot and interpret velocity-time graphs to find
  - Velocity (change in y)
  - Time (change in x)
  - Distance (area)
  - Acceleration (gradient)
- Calculate areas by using trapeziums
- Understand and calculate instantaneous rates of change using tangents
- Understand the purpose and nature of algebraic proof for
  - odd and even numbers
  - square and cube numbers
  - Sine and cosine rules
  - Angle facts and circle theorems
- Understand the purpose and limitations of disproof by counterexample

Keywords/formula

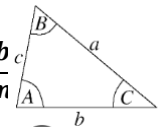
Velocity and **displacement** are the vector quantities for speed and distance

Area of a trapezium is $\frac{(a+b)h}{2}$ where a, b are the lengths of the parallel sides and h is the distance between them

Tangent is a straight line that intersects a curve at just one point

Sine rule

$$\frac{a}{sinA} = \frac{b}{sin}$$



Cosine rule

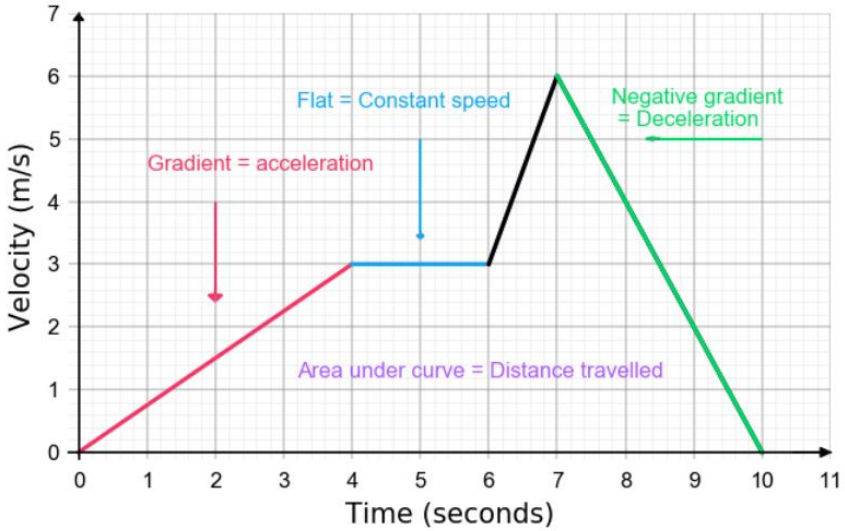
$$a^2 = b^2 + c^2 - 2bc\ cosA$$

Area of a triangle

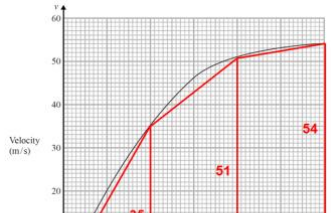
$$Area = \frac{1}{2}ab\ sinC$$

	Look up the seven **circle theorems**

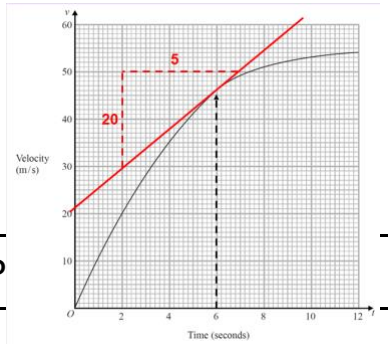
Velocity-time graphs



If the line is curved then the acceleration is constantly changing



To find the area (distance travelled) you can approximate with trapeziums



A tangent to the curve gives the acceleration at that instantaneous moment

P

Integer is any positive or negative whole number
Sum means add the terms together
Product means multiply the terms together

For any given number, n
An **even** number can be represented as $2n$
An **odd** number can be represented as $2n + 1$
A **square** number is n^2
Consecutive numbers can be represented as $n, n + 1, n + 2$, etc
A **multiple** of 5 can be represented by $5n$

You can **disprove** a statement using a **counter example**, as you only need to have one example that doesn't work to show the statement is false.
To **prove** a statement you need to use algebra or geometry to show each step from the start to the conclusion

In general:
Define your variables - say what each letter represents
Show every step - be clear in your workings and take the space that you need!
Give reasons - state clearly any rules you are using eg the angle sum of a triangle is 180o
Re-read your work at the end to make sure you haven't missed any steps, reasons or method marks