Interpreting graphs

What you should know

A graph of the form $y = mx + c$ represents a straight line where m is the gradient of the line and c is the value of the y-intercept.
How to draw and interpret velocity–time graphs.

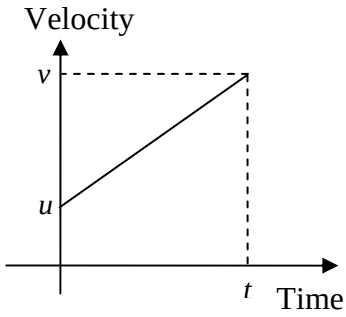
New ideas

A simple equation for an object travelling with constant acceleration is $v = u + at$, where u is its initial velocity (speed in a given direction), v is its final velocity, a is its acceleration and t is the time from the beginning to the end of its motion.
The area under a velocity–time graph represents the displacement (distance travelled in a given direction).

Task: Velocity–time graphs

A car accelerates from 10 ms^{-1} at a constant rate when leaving a built-up area.
It takes 6 seconds to reach a velocity of 22 ms^{-1} (about 50 miles per hour).

- Draw a velocity–time graph to represent this motion.
- The graph should be a straight line. You already know the equation $y = mx + c$ to describe a straight line. If you use $v = u + at$ to describe the motion, what properties would v, t, u and a represent on the graph?
- Use the equation $v = u + at$ to find the car's acceleration.
  What is the gradient of the line you have drawn?
- The area under a velocity–time graph represents displacement.
  The letter s is used for displacement.
  Find the displacement, s, of the car for this journey.
- The diagram shows the general graph for motion with constant velocity. Find a formula for the displacement, s, in terms of u, v and t.
  Check that this formula works for the example above.



Take it further

- Try substituting $v = u + at$ into your formula for s and simplifying it.
  This should give you a formula for s, in terms of u, a and t.
  Check that this formula works for the example above, too.
- A dropped object falls to Earth with an acceleration of approximately 10 ms^{-2} and has initial velocity, u, of 0.
  Use the formulae you found to work out how far it would fall and what its velocity would be after 1 second, 2 seconds, 5 seconds, 10 seconds, etc.
  What is the problem with this model?

Where this goes next

At A level constant acceleration formulae are studied in Mechanics.