Lesson 3: Speed-time graphs

# P3: FORCES FOR TRANSPORT

# OBJECTIVES

- Know how to describe and explain graphs of speed against time
- Be able to draw a simple speed-time graphs
- Know how to calculate distance travelled and acceleration from speed-time graphs

<u>Success Criteria</u>

- Correctly describe and explain graphs **(Grade C)**
- Correctly draw a speed-time graph and label correctly **(Grade B)**
- Calculate distance travelled and acceleration accurately **(Grade A)**

# STARTER – 5 MINUTES

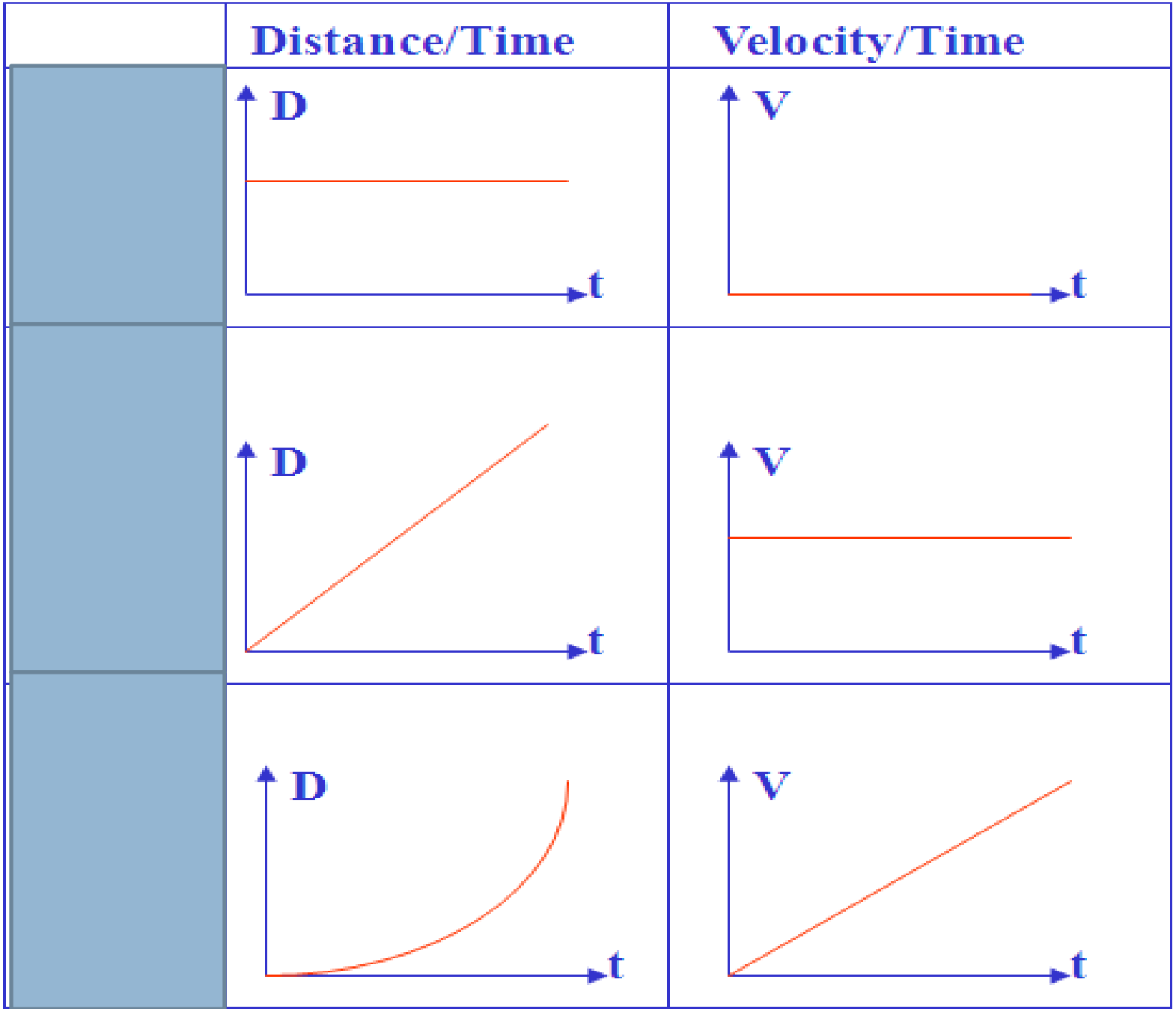
- Write down and link up the 5 words in column 1 with the 5 words in column 2 – relating to **distance-time graphs**

| | |
|---|---|
| distance | changing speed |
| time | gradient |
| speed | X axis |
| straight diagonal line | constant speed |
| curved line | Y axis |

- **Homework handout – for next Monday**

# 2 different types of graph

Don't confuse these in the exam!



# DISTANCE TIME GRAPHS: SUMMARY

- The gradient of a distance time graph gives the velocity

- *Increasing* gradient means object is accelerating
- *Decreasing* gradient means object is decelerating
- *zero* gradient means object is stationary

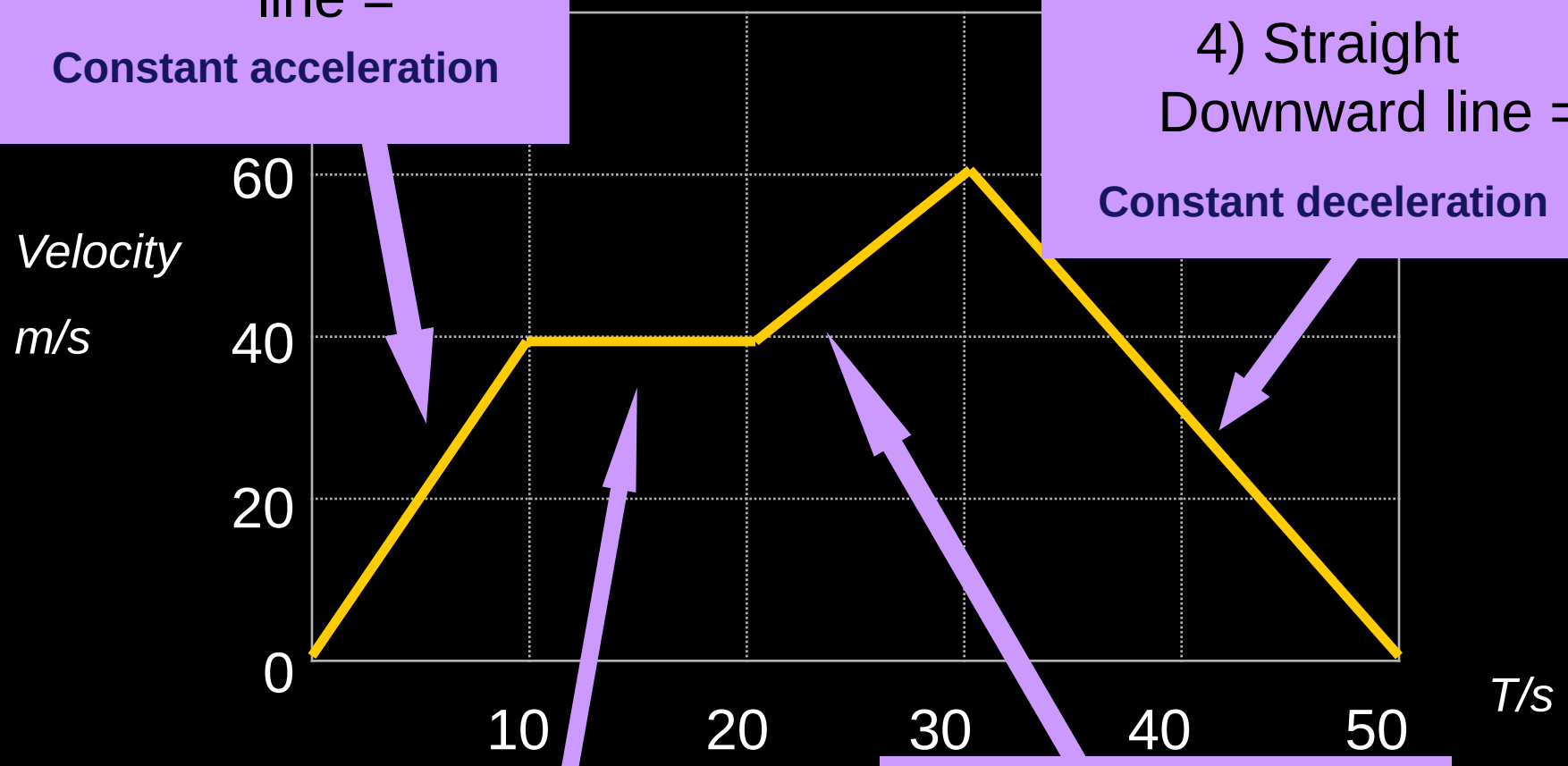
# Velocity-time graphs

1) Straight Upwards line =

**Constant acceleration**

4) Straight Downward line =

**Constant deceleration**




2) Horizontal line =

**Constant speed**

3) Straight Upwards line =

**Constant acceleration**

# CONSTANT ACCELERATION

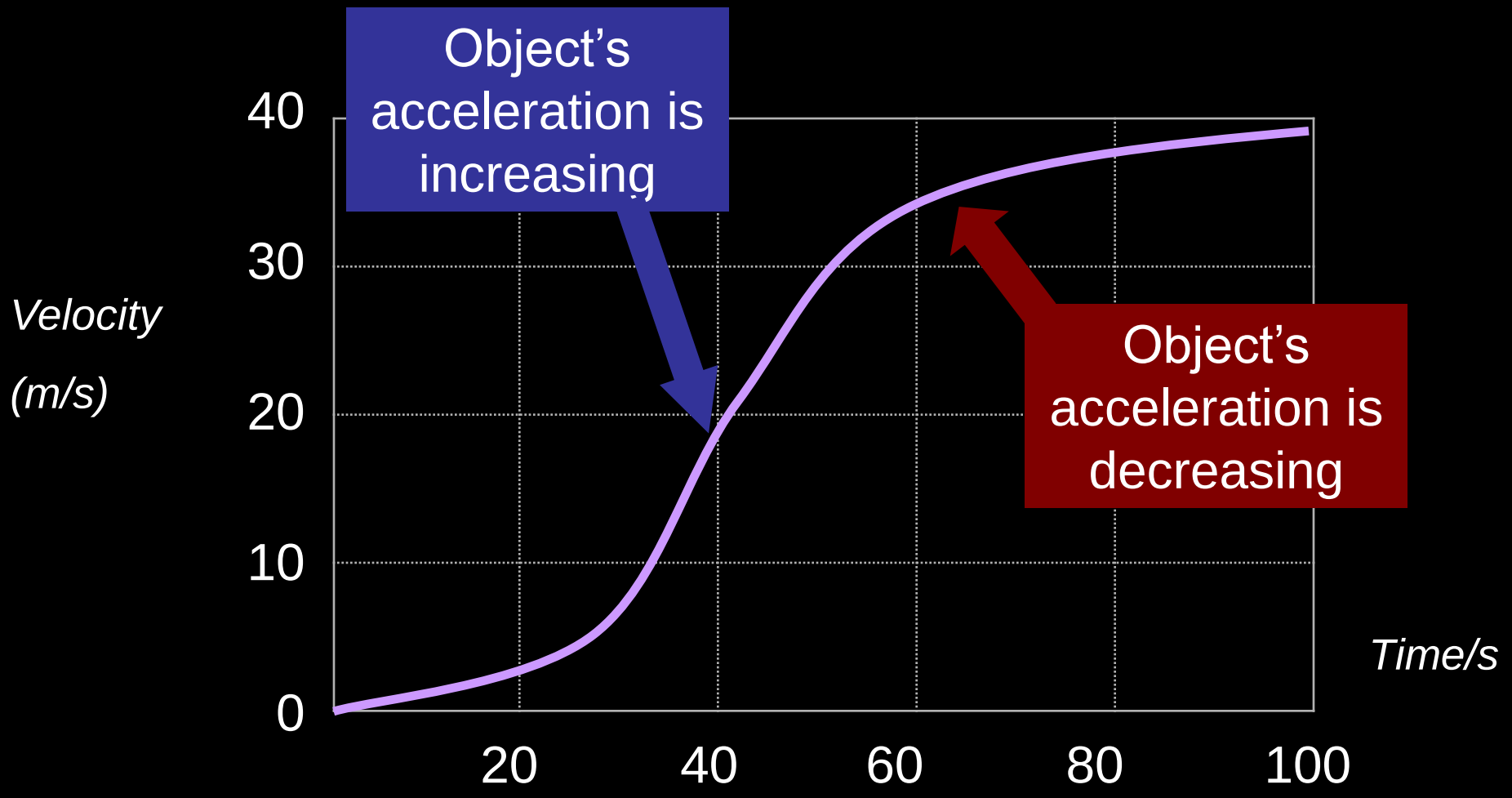
- How would you define a constant acceleration?
  - The speed is increasing at the same amount per second.

# VELOCITY TIME GRAPHS; SUMMARY

- The gradient of a velocity time graph gives the acceleration of an object
- the area under a velocity time graph gives the total distance traveled
- *Increasing* or *decreasing* gradient gives the rate at which the acceleration is increasing or decreasing
- A straight line means there is a constant acceleration (speed increasing by the same amount each second)
- *Zero* gradient means the object is travelling at constant speed

# Velocity-time graph for non-uniform motion

(higher level only)

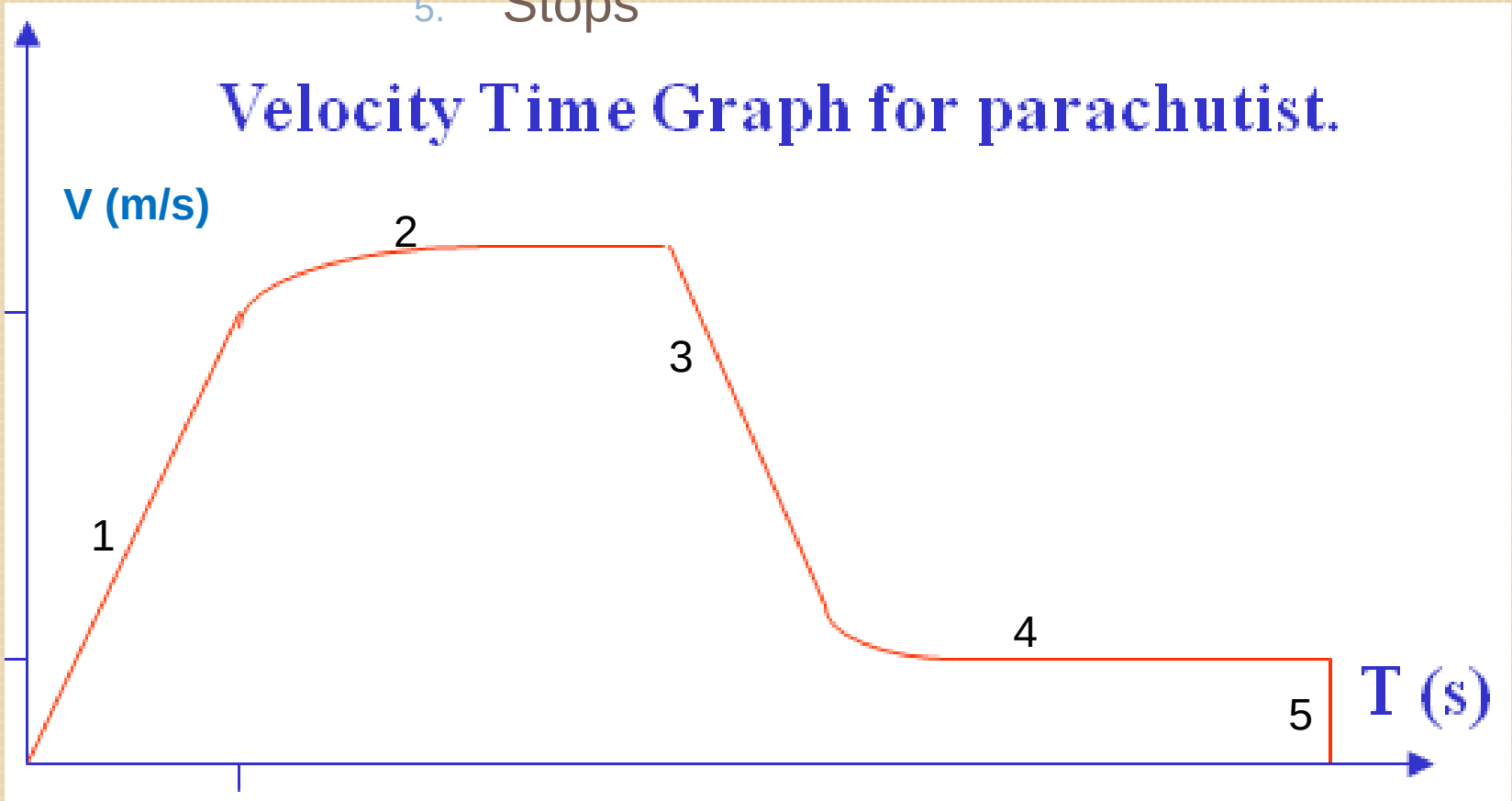


**TASK**

**Quickly sketch a graph of velocity against time for a parachutist**

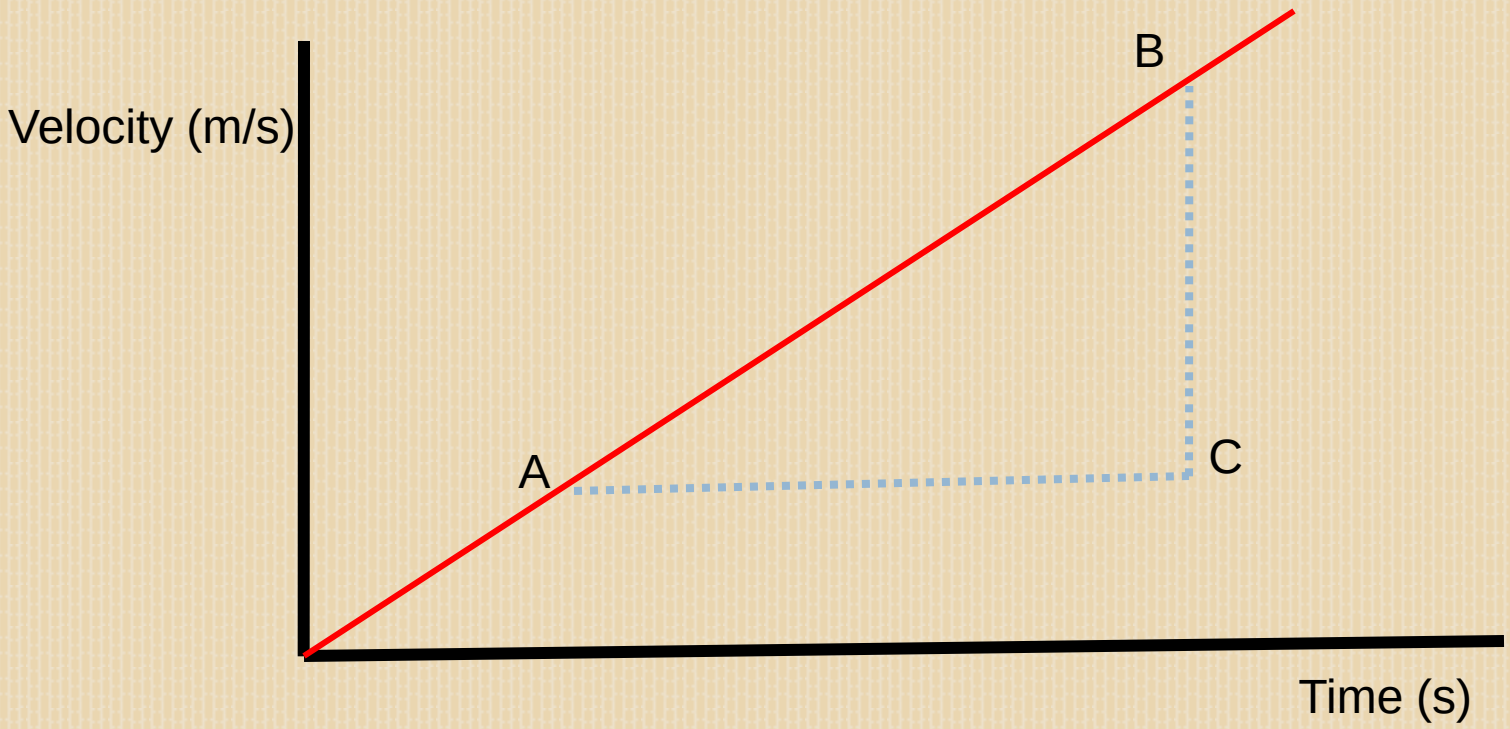
Include the 5 key points

1. Jumps out of plane then accelerates at constant rate
2. Acceleration slows and reaches terminal velocity (constant speed)
3. Opens shoot – decelerates hard
4. Reaches terminal velocity again
5. Stops



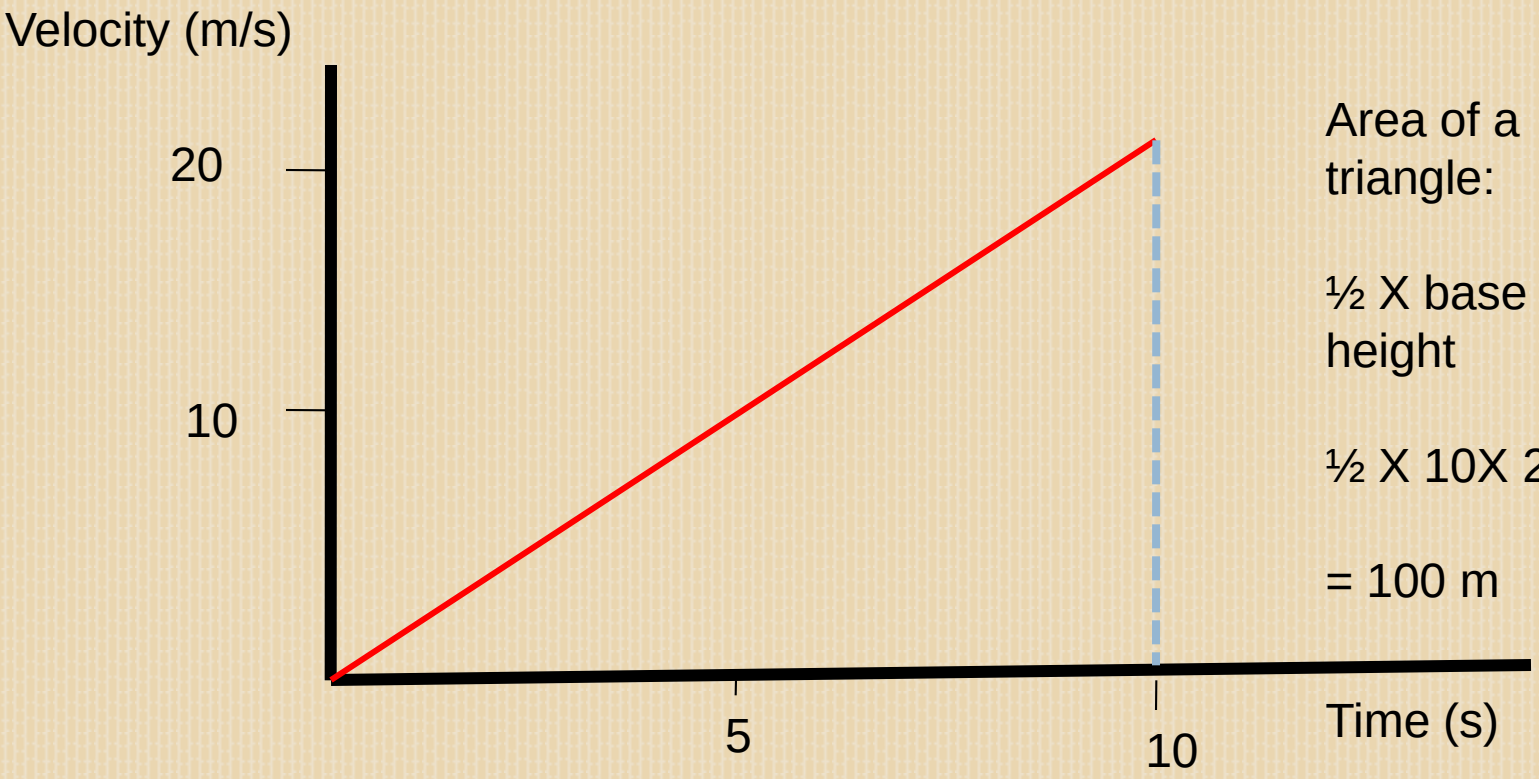
# MEASURING ACCELERATION

- Acceleration is measured by the gradient of a speed-time graph



# MEASURING DISTANCE TRAVELLED

- Distance travelled is measure by the area under the graph of a speed time graph




Area of a triangle:

½ X base X height

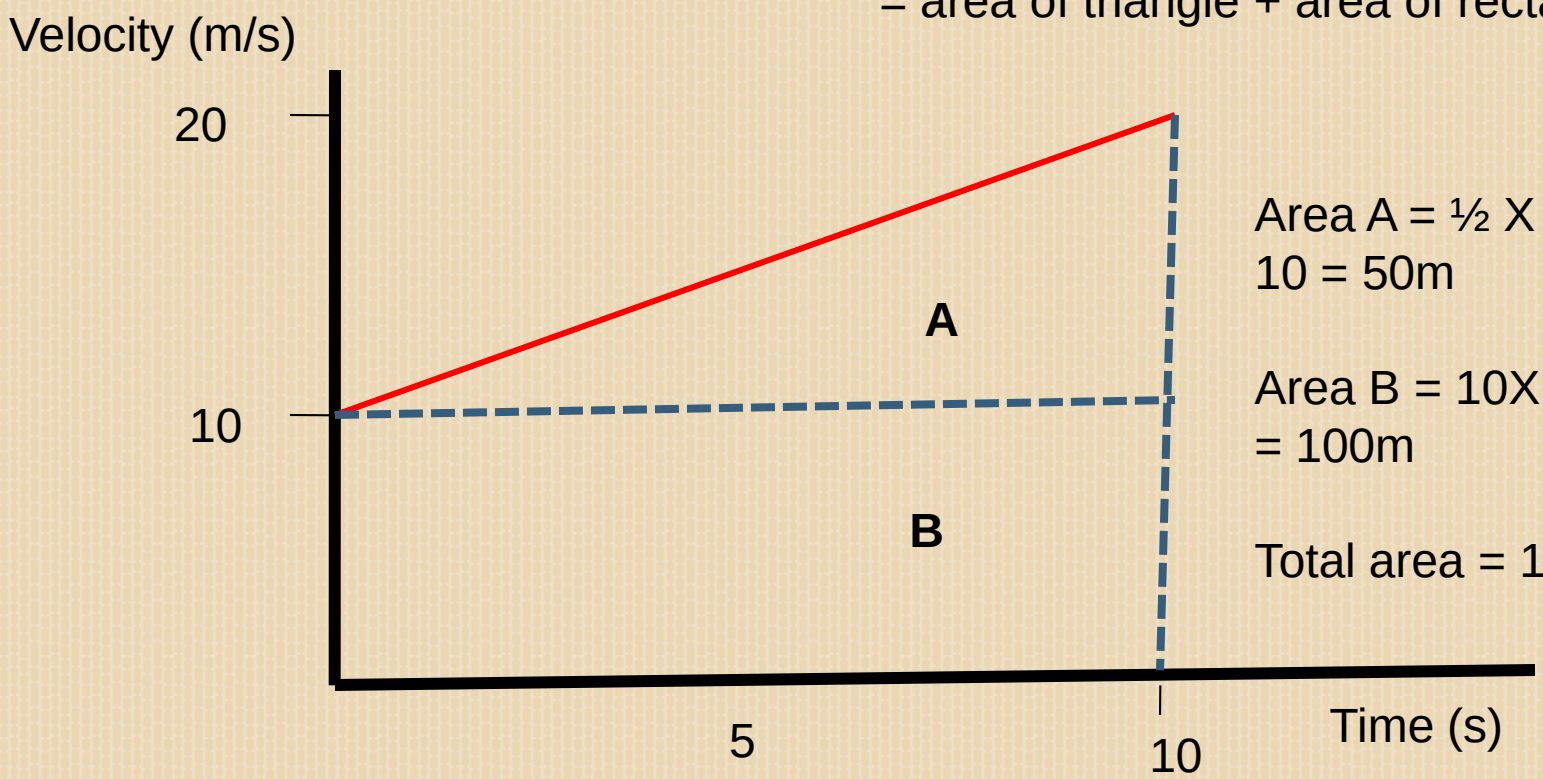
½ X 10X 20

= 100 m

# ..... BUT WHAT IF THE SHAPE ISN'T A TRIANGLE?

Distance travelled = area under graph

= area of triangle + area of rectangle




Area A = ½ X 10 X 10 = 50m

Area B = 10X10 = 100m

Total area = 150m

# Worksheet time


1) How fast was the object going after 10 seconds? 40 m/s

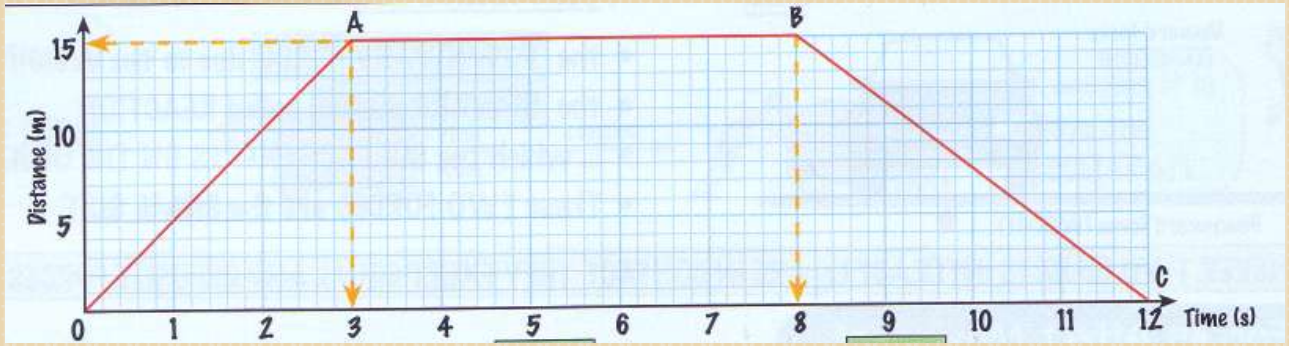
2) What is the acceleration from 20 to 30 seconds? 2 m/s2

3) What was the deceleration from 30 to 50s? 3 m/s2

The area under a speed/time graph represents the distance travelled

4) How far did the object move in 50s (higher level)? 200+400+400+100+600 = 1700m

# PROBLEMS




1. Calculate the speed over OA AB and BC 5, 0, 3.75m/s


2. Calculate (a)the acceleration over OA, AB and BC
(b) the total distance traveled in the 12 s

5m/s$^2$, 0, 3.75m/s$^2$, 127.5m

# PLENARY - DISTANCE, SPEED AND TIME

Complete the table:

| Features of graph | Distance-time graph | Speed-time graph |
|---|---|---|
| **flat section shows** | Object stationary | Constant speed |
| **straight uphill section shows** | Constant speed away away from home | Constant acceleration |
| **straight downhill section shows** | Constant speed towards home | Constant deceleration |
| **curves show** | Change in speed | Change in acceleration |
| **area under the graph line shows** | Not applicable | Distance travelled |