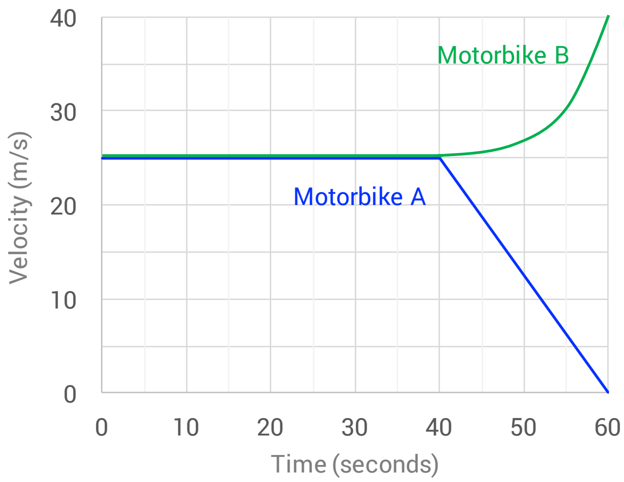
0 1

Motorbike A travels with a velocity of 25 m/s for 40 seconds before decelerating uniformly to rest over a period of 20 seconds.

0 1 . 1

Sketch a velocity-time graph for the motion of this motorbike using the below axes. Label your line **Motorbike A**.



0 1 . 2

Calculate the **deceleration** of Motorbike A in the last 20 seconds of its motion.

a = Δv ÷ t = (v − u) ÷ t = (0 − 25) ÷ 20 = −25 ÷ 20 = −1.25 m/s^2
Deceleration = **1.25 m/s^2**

0 1 . 3

Calculate the total distance travelled by Motorbike A.

Distance = area under v-t graph
Distance = (25 × 40) + (½ × 25 × 20) = **1250 m**

0 1 . 4

Motorbike B travels **side-by-side with motorbike A** for the first 40 seconds of its motion. At t = 40 seconds however, it begins to **accelerate at an *increasing* rate**.

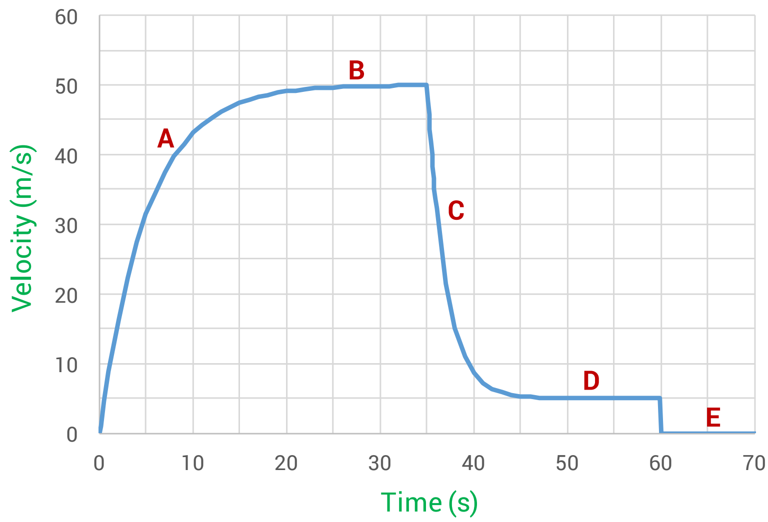
Sketch a velocity-time graph for the motion of motorbike B using the above axes. Label this line **Motorbike B**.

Same v-t graph as Motorbike A for first 40 seconds of motion [1].
From t = 40 seconds onwards, velocity [1] increases with time [1] with gradient / slope of graph increasing with time also [1].

Remember here that the gradient (slope) of a velocity-time graph represents the acceleration of an object. If an object is accelerating *at an increasing rate*, it means that its acceleration (rate of change of velocity) is increasing with time, which means that the gradient (slope) of its velocity-time graph must increase too.

0 2

Jason tries skydiving while on holiday in New Zealand. The below graph shows how his velocity changes from the moment he jumps out of the plane to the moment he lands on the ground.



0 2 . 1

Using the below table, describe his motion in each of the labelled sections of the graph.

Section	Description
A	Accelerating (at a decreasing rate)
B	Uniform (terminal) velocity
C	Decelerating (at a decreasing rate)
D	(Lower) uniform (terminal) velocity
E	Stationary

Be careful: for section A in the above graph, many students will say that the skydiver is slowing down because the gradient of the graph is decreasing, but that unfortunately is completely wrong! His velocity is increasing between 0 and (roughly) 25 seconds, so he is accelerating during this entire time. The *rate* at which his velocity is increasing – in other words, his acceleration – is decreasing, however. Got it? Great? Confused? Read it again!

0 2 . 2

Estimate the altitude from which he jumped. Show all of your working clearly in the space below.

Approximate number of squares under graph = 69 (allow 66 – 72)
Distance represented by each square = 5 × 5 = 25 m
Total distance = 69 × 25 = 1725 m

Altitude = **1725 m**
(allow answers in range 1650 – 1800 m)

