MODULE: *Marvellous Motion*

Intervention Session

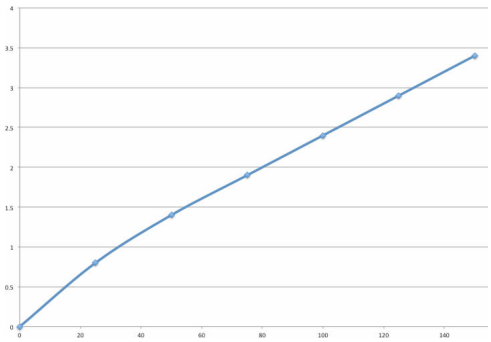
This session has been designed to help you practise answering TIMSS questions about the motion module in one hour. It also helps you to practise explaining the key concepts and apply your understanding.

1

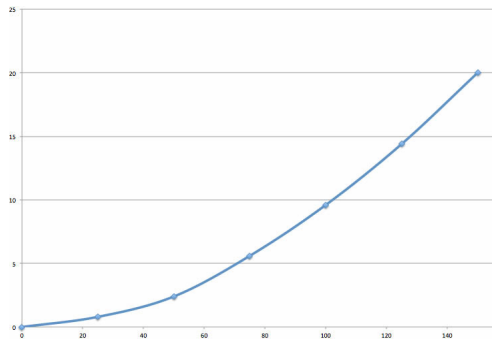
In a laboratory test a paper shape was dropped onto the floor from different heights. The time it took to reach the floor each time was recorded.

Height from the floor (cm)	Time to reach the floor (s)
0	0
25	0.8
50	1.4
75	1.9
100	2.4
125	2.9
150	3.4

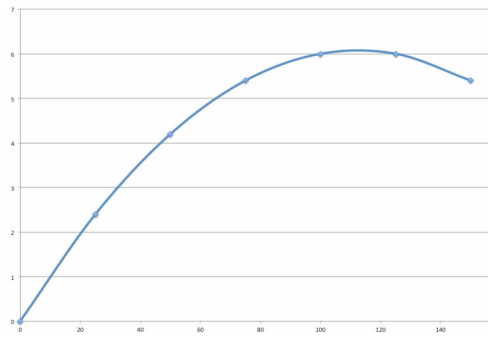
Which of the graphs (A-D) shows this data displayed correctly?



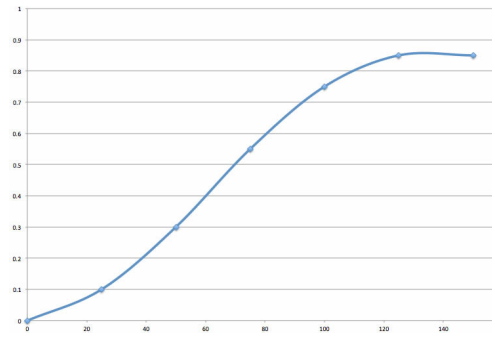
A



B



C



D

2 A Formula 1 car reaches a top speed of 310 km/h at the end of the Pit Straight at Sepang.

Read the statements 1–4 carefully. Decide if each one is true or false.

1. At this speed the F1 car would travel 310 kilometres in 1 hour.

2. This is a speed of 86.1 m/s.

3. It would take the F1 car 20 minutes to travel a distance of 103.3km at this speed.

4. In 45 minutes, the F1 car would travelled 232.5km at this speed.

Now choose one of the answers (A–D) below;

A. Statements 1, 2 and 3 are true. ☐

B. Statements 1, 3 and 4 are true. ☐

C. Statements 2, 3 and 4 are true. ☐

D. All the statements are true. ☐

3 This question is about animal champions.

	
A cheetah can bend its spine up and down, helping it reach a top speed of around 113kph.	A peregrine falcon can reach speeds of around 386kph when it dives towards its prey.
	
A barracuda can accelerate to a top speed of around 43kph to overtake its prey.	Sir Chris Hoy has won five Olympic gold medals for bike riding. His top speed was 78kph.

Read these statements carefully. Decide if each one is true or false.

1. The barracuda is adapted for travelling at high speeds.
2. Water resistance is greater than air resistance so this reduces the top speed of the barracuda.
3. The cheetah and the peregrine have evolved over thousands of years to travel at high speeds.
4. A human, even without a bike, can travel faster than a barracuda.

Now choose the correct answer (A–D) from the list below;

A. Statements 1 and 2 are true. ☐

B. Statements 1, 2 and 3 are true. ☐

C. Statements 1, 3 and 4 are true. ☐

D. None of the statements are true. ☐

4 Usain Bolt holds the world record for the 100m.

His world record time is 9.58 seconds.

a) What was his average speed for this 100m race?

b) Describe how his speed would change from the starting blocks to the finishing line.

c) This is the data from the race:

Time from start (s)	Speed (km/h)
0	0
0.5	12.8
1.2	15.8
2.1	20.8
3.4	28.1
4.2	36.3
5.8	42.8
6.8	43.2
7.8	44.5
8.4	44.6
9.3	43.8
9.58	43.3

What was his fastest speed during the race?

d) Plot a graph of this data.

Use the table to predict the speed he was travelling after 5 seconds of the race.

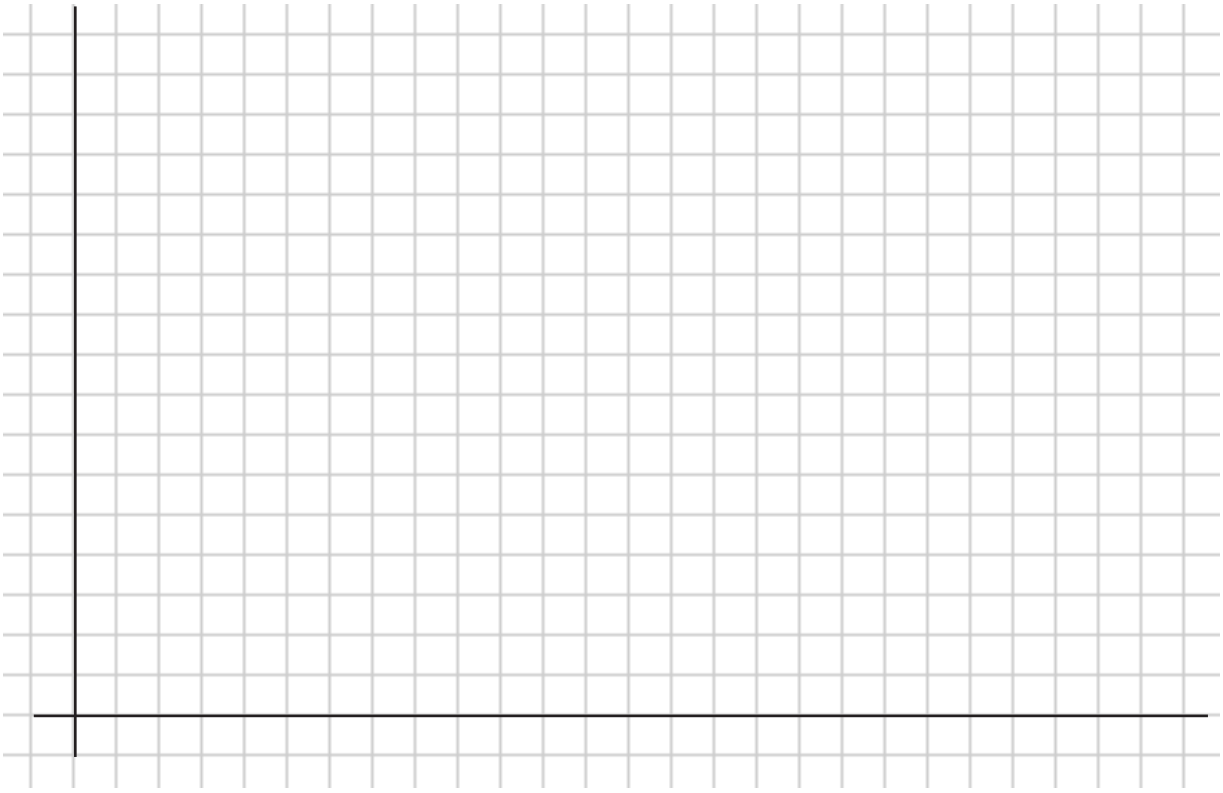
5

A parachute is made from a circle of thin plastic, 4 lengths of string and 5 paper clips. After each test, the radius of the parachute is reduced.

For each test, the parachute is dropped from a height of 2m. Its fall is timed. The only variable which changes is the radius of the parachute.

Radius of parachute (cm)	Time taken to fall 2m (seconds)
12	1.7
11	1.64
10	1.58
9	1.54
8	1.51
7	1.45
6	1.42
5	1.34

a) Plot this data on the axes given below:



b) Write a conclusion for this experiment based on the graph above.

c) Predict the time a parachute with a 20cm radius would take to fall 2m. Justify your answer.

6

This question is about the acceleration of cars.

1.	2.	3.	4.
			
Mercedes SLS AMG	Aston Martin V8 Virage	BMW i8	Perodua Buddyz
0–100kph in 3.9 seconds	0–100kph in 4.5 seconds	0–100kph in 4.8 seconds	0–100kph in 9.8 seconds
Acceleration = 25.6	Acceleration = 22.2	Acceleration =	Acceleration =

a) Which car accelerates the fastest? How do you know?

b) Calculate the missing values for acceleration and add them to the table (calculate in kph/s).

7 Look carefully at these two pictures. One bike is stremlines, while the other is not.

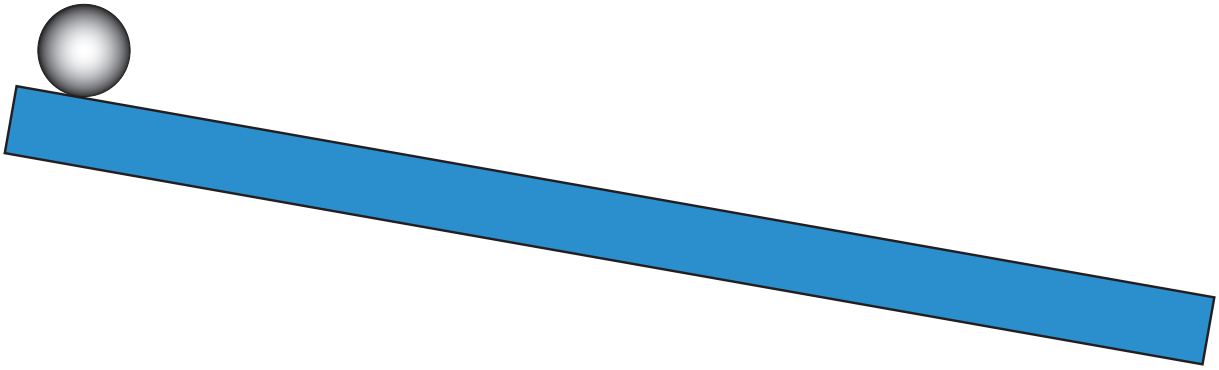
	
Bike A	**Bike B**

The size of the engine in the two bikes is one factor that will have an effect on their speeds.

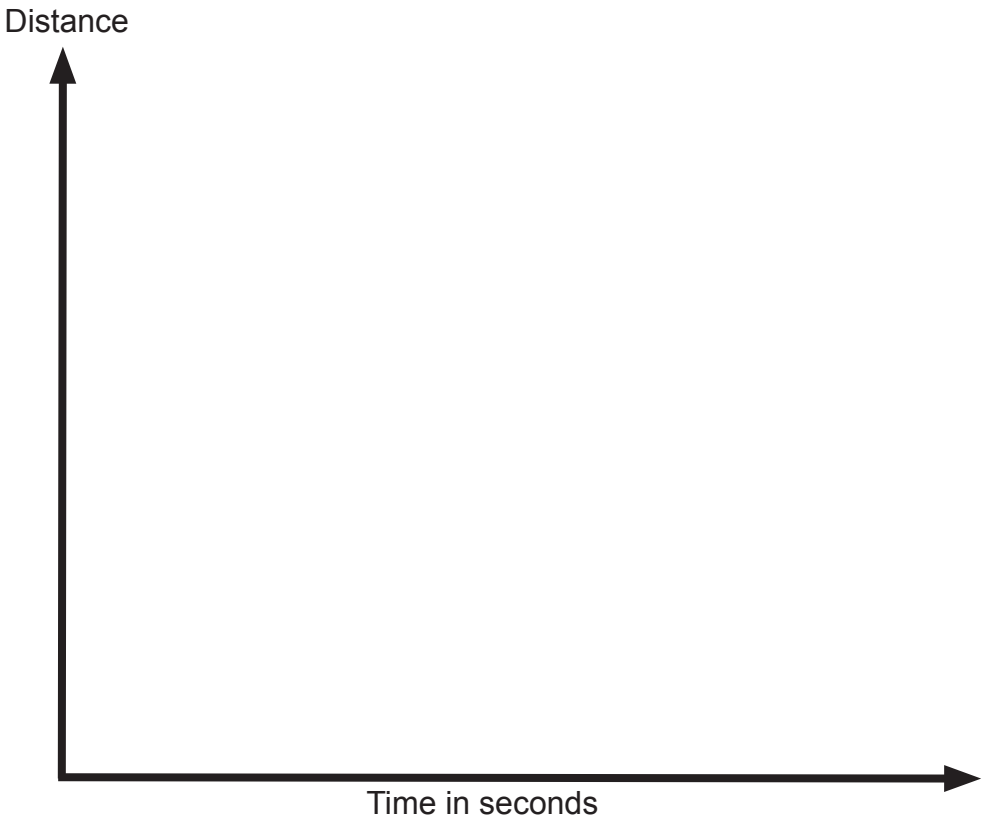
Look carefully at the design of the two bikes. What other factors will affect the speeds of the bikes? Explain your answer.

8 A ball bearing takes 7 seconds to run down a track. It travels at a constant speed.

a) Draw the position of the ball bearing each second as it runs down the track.



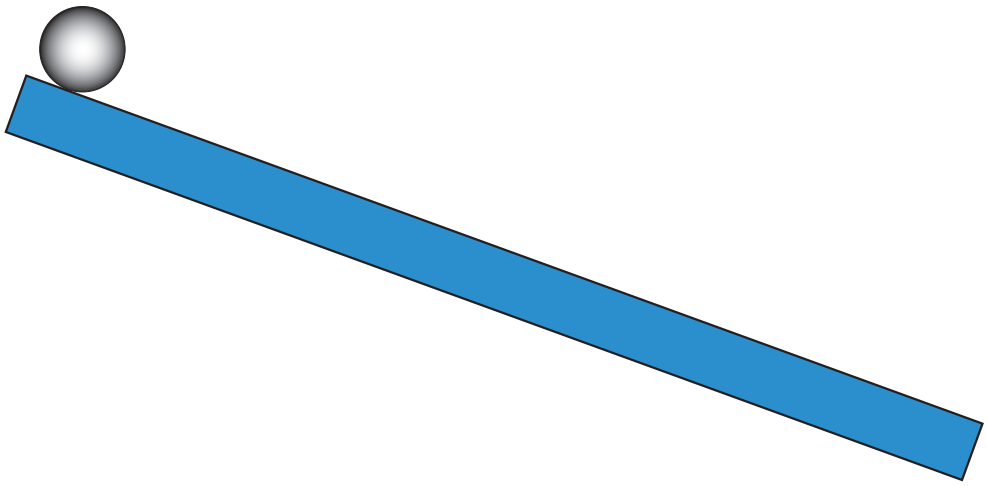
b) Use this to sketch a distance-time graph for the ball bearing.



c) Draw a second line on your sketch graph to show a faster, constant speed.

d) The end of the track is raised and the ball bearing now accelerates as it rolls. This time, it only takes 5 seconds to run down the track.

Draw positions for the ball bearing to show its acceleration.



e) Sketch a second graph, this time to show the acceleration.