

Mechanics 1 – Speed-Time Graphs

Please **complete** this homework by _____. Start it early. If you can't do a question you will then have time to ask your teacher for help or go to a drop in session.

Section 1 – Review of previous topics. Please complete all questions.

- 1) Convert the following into the given units
 - (a) 36,000cm into km
 - (b) 24000 seconds into hours and minutes.
 - (c) 72 km/h into ms^{-1}
 - (d) 35ms^{-1} into km/h

- 2) A ball is launched upwards from the top of a 15m tall building to a maximum height of 40m above the ground, before falling to the ground. Taking upwards as the positive direction, find
 - a) the total distance travelled by the ball.
 - b) The displacement of the ball from its original position.

- 3) A boy walks 32m west, then 24m south, at a constant speed.
 - a) Find the total distance travelled by the boy.
 - b) Find the displacement of the boy from his starting position, giving his direction as a bearing.
 - c) If it took the boy 28 seconds, what was his speed?

Section 2 – Consolidation of this week's topic. Please complete all questions.

Please note: it is not necessary to convert to SI units for questions 1 and 2.

- 1) A coach sets off from Brighton at 11:20am and travels at 45kmh^{-1} for **40 minutes**. It stays at its destination for an hour, then returns to Brighton at 50kmh^{-1} .
 - a) Sketch a displacement-time graph to show the motion of the coach.
 - b) At what time does the coach return to Brighton? **(5 marks)**

- 2) Two cars, A and B, are travelling in **opposite** directions along a straight road between two towns 42km apart. Both cars set off at 4:45pm. Car A travels at 75kmh^{-1} for 20 minutes, stops for 10 minutes and then completes its journey at 51kmh^{-1} . Car B travels at 72kmh^{-1} until 4:55pm, stops for 20 minutes and then completes its journey at 72kmh^{-1} .
 - a) Sketch a displacement-time graph to show the motion of the cars.
 - b) At what time are the cars in the same place? **(6 marks)**

- 3) A car accelerates from rest to 10ms^{-1} in 6 seconds, then maintains this speed for 14 seconds before accelerating at 3.75ms^{-2} to reach a speed of 25ms^{-1} . It maintains this speed for 500m, then decelerates to rest at 2.5ms^{-2} .
- Find the total time taken.
 - Draw a velocity-time graph to represent this journey.
 - Find the total distance travelled.
 - State the initial acceleration.
- (8 marks)**

- 4) A motorcyclist passes a parked police car at a steady 18ms^{-1} . Ten seconds later, the police car gives chase, accelerating to 24ms^{-1} in 10 seconds, then pursuing the motorcyclist at this steady speed.
- Represent this information in a velocity-time graph, starting from the time the motorcycle passes the police car.
 - How long after the motorcyclist passed the police car did it take for the police car to catch up?
 - How far did the police car travel in pursuit?
- (7 marks)**

Total for section 2: 26 marks

Section 3 – Extension question. If you are aiming for a top grade, you should attempt this question.

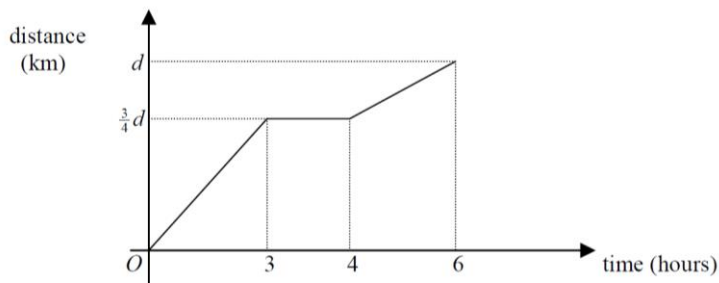


Fig. 1

Figure 1 shows a distance-time graph for a car journey from Birmingham to Newquay which included a stop for lunch at a service station near Exeter. During the first part of the journey three-quarters of the total distance, d , was covered in 3 hours. After a 1 hour stop, the remaining distance was completed in 2 hours.

(a) Calculate, in the form $k : 1$, the ratio of the average speed during the first 3 hours of the journey to the average speed during the last 2 hours of the journey.

Given that the average speed of the car over the whole journey (excluding the stop) was 80 km h^{-1} ,

(b) find the average speed of the car on the first part of the journey.