Mechanics 2 – 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 $2.5ms^{-2}$.

a) Find the total time taken.
b) Draw a velocity-time graph to represent this journey.
c) Find the total distance travelled.
d) 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 pusuing the motorcyclist at this steady speed.

a) Represent this information in a velocity-time graph, starting from the time the motorcycle passes the police car.
b) How long after the motorcyclist passed the police car did it take for the police car to catch up?
c) 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.

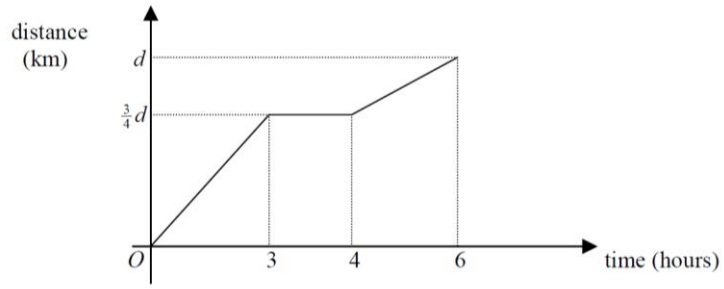

Fig. 1

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.