SPEED, DISTANCE AND TIME

DATE OF SOLUTIONS: 30/05/2018
MAXIMUM MARK: 82

SOLUTIONS

GCSE (+ IGCSE) EXAM QUESTION PRACTICE

1 [Edexcel, 2004] Speed, Distance and Time Calculations **[3 Marks]**

Suhail cycles 117 km in 4 hours 30 minutes. → 4.5 HOURS!
Work out his average speed in km/h.

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}}$$

$$= \frac{117}{4.5}$$ (M1) [DIVIDE]

(B1) →

$$= 26$$

26 (A1) ..... km/h

Wendy travelled on the Eurostar train from St Pancras station to the Gare du Nord station.
The Eurostar train travelled a distance of 495 km.
The journey time was 2 hours 15 minutes. → 2·25 HOURS

Work out the average speed of the Eurostar train in kilometres per hour.

SPEED = DISTANCE / TIME

= 495 / 2·25 } (M1) [DIVIDE]

(B1) →

= 220

220 ..... km/h

Omar travelled from Nairobi to Mombasa by train.
The journey took 13 hours 15 minutes. → 13·25 HOURS
The average speed was 40 km/h.

SPEED = DISTANCE / TIME

Work out the distance from Nairobi to Mombasa.

DISTANCE = SPEED × TIME
= 40 × 13·25
= 530

M1 [MULTIPLY] B1

530 ..... km

An aeroplane flew from Qatar to Bahrain.
The distance flown was 135 km.
The average speed was 180 km/h.

Work out the time taken.
Give your answer in minutes.

SPEED = DISTANCE / TIME

TIME = DISTANCE / SPEED

= 135 / 180 (m1)

= 0.75 HOURS (m1)

0.75 × 60 = 45

45 (A1)

..... minutes

A plane flew from Frankfurt to Hong Kong.
The flight time was 10 hours 45 minutes.
The average speed was 852 km/h.

10 · 75 HOURS

SPEED = DISTANCE / TIME

Work out the distance the plane flew.

DISTANCE = SPEED × TIME

= 852 × 10 · 75

= 9159

M1 [MULTIPLY]

B1

A1

9159 km

The length of Rachael's journey from her home to work is 72 km.
The journey takes 1 hour 20 minutes.

Work out her average speed in km/h.

1.$\dot{3}$ HOURS

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}}$$

$$= \frac{72}{1.\dot{3}}$$ M1 [DIVIDING]

B1 '1.$\dot{3}$'

$$= 54 \text{ km/h}$$

A1

A train travels 165 km.
Its average speed for the journey is 60 km/h.
Work out the time that this journey takes.
Give your answer in hours and minutes.

SPEED = DISTANCE / TIME

TIME = DISTANCE / SPEED

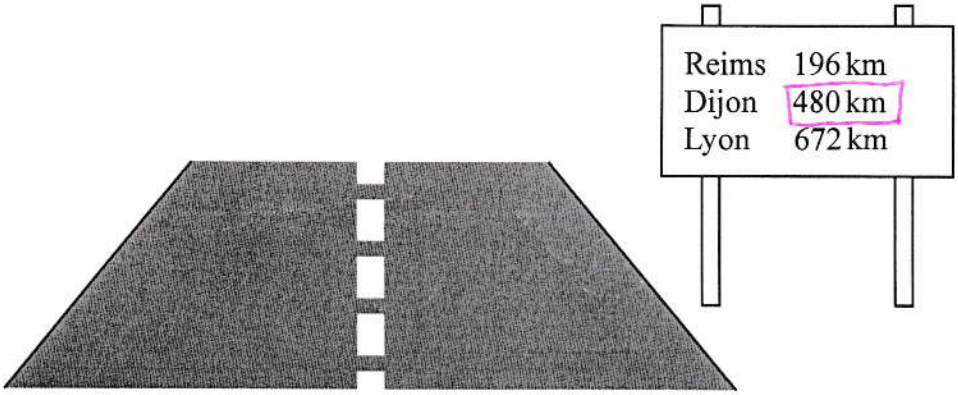
= 165 / 60 (M1)

= 2.75 HOURS (M1)

[0.75 × 60]

..... 2 ..... hours ..... 45 ..... minutes (A1)

Emily is driving in France.
She sees this sign.



Emily is going to drive to Dijon. [480 km]
She plans to drive at an average speed of 50 miles per hour.
Work out how long it should take Emily to drive to Dijon.

SPEED = DISTANCE / TIME

TIME = DISTANCE / SPEED

= 480 ← B1
80 ← B1

M1 [DIVIDE]

= 6 HOURS

5 MILES = 8 km
50 MILES = 80 km
50 mph = 80 km/h

A1

6 HOURS

Here is part of a timetable for the Paris to Montpellier express train service.

Paris	06 07	10 07	12 07	18 07	20 07
Valence	08 22	12 24	14 24	20 24	22 24
Nimes	09 09	13 05	15 05	21 05	23 05
Montpellier	09 37	13 34	15 34	21 34	23 34

3 H 27 M

The average speed of the 20 07 train from Paris is 224 km/h.

Work out the distance this train travels from Paris to Montpellier.

SPEED = DISTANCE / TIME

DISTANCE = SPEED x TIME

= 224 x 3.45 (B1)

27/60 = 0.45 HOURS

(M1) [MULTIPLY]

= 772.8

(A1)

772.8 km

Lizzy drove by car to visit her aunt.
She left home at 930 am.

Lizzy arrived at her aunt's house at 1115 am.
She drove a distance of 140 km.

TIME TAKEN = 1 HOUR 45
= 1.75 HOURS

Work out, in km/h, Lizzy's average speed for the journey.

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}}$$

$$= \frac{140}{1.75}$$ (M1) [DIVIDE]

(B1) →

$$= 80$$

(A1)

80 km/h

Sean drives from Manchester to Gretna Green.

He drives at an average speed of 50 mph for the first 3 hours of his journey.

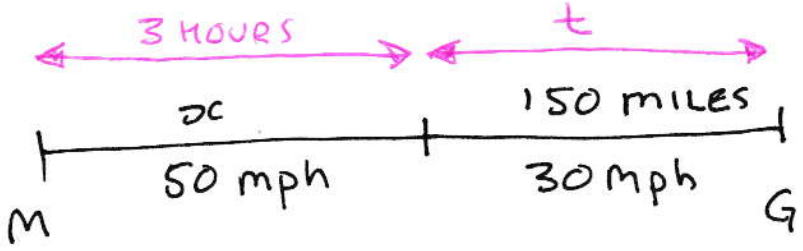
He then has 150 miles to drive to get to Gretna Green.
Sean drives these 150 miles at an average speed of 30 mph.

SPEED = DISTANCE / TIME

Sean says,

"My average speed from Manchester to Gretna Green was 40 mph."

Is Sean right?
You must show how you get your answer.



1ST

$x = 50 \times 3$

$= 150$ MILES (M1)

2ND

$t = \frac{150}{30}$

$= 5$ HOURS (M1)

3RD

$\text{OVERALL SPEED} = \frac{\text{TOTAL DISTANCE}}{\text{TOTAL TIME}}$

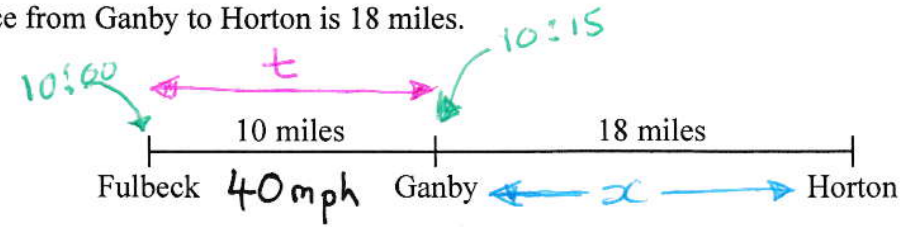
$= \frac{150+150}{3+5}$ (M1)

$= \frac{300}{8}$

$= 37.5$ mph (A1) [FOR BOTH]

$\Rightarrow$ SEAN IS WRONG

The distance from Fulbeck to Ganby is 10 miles.
The distance from Ganby to Horton is 18 miles.



Raksha is going to drive from Fulbeck to Ganby.
Then she will drive from Ganby to Horton.
Raksha leaves Fulbeck at 10 00
She drives from Fulbeck to Ganby at an average speed of 40mph.
Raksha wants to get to Horton at 10 35
Work out the average speed Raksha must drive at from Ganby to Horton.

SPEED = DISTANCE / TIME

1ST

$t = \frac{10}{40}$

$= 0.25$ HOURS

$= 15$ MINS [ARRIVES AT GANBY AT 10:15]

M1

2ND

20 MINUTES TO GET TO HORTON

$\frac{20}{60} = 0.\dot{3}$ HOURS

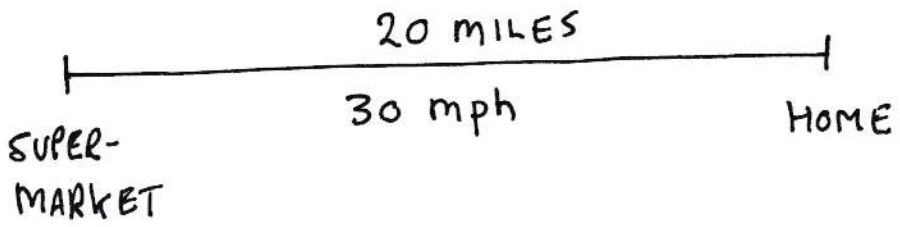
SPEED $= \frac{18}{0.\dot{3}}$ B1

$= 54$ mph

54 A1 ..... mph

David drives to the supermarket on his way home from work.
David leaves the supermarket at 1810
He drives 20 miles to his home.
The speed limit for the journey is 30 mph.
David drives within the speed limit.
Can David get home before 1900?
Give reasons for your answer.

SPEED = DISTANCE / TIME



TIME = DISTANCE / SPEED

= 20 / 30 (M1) ← IF DAVID DRIVES AT THE SPEED LIMIT

= 0.6̇ HOURS

= 40 MINS (M1)

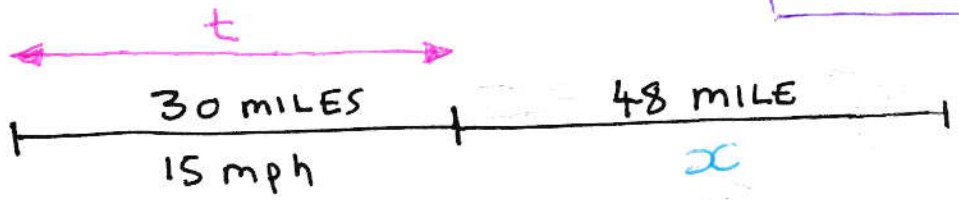
18:10 + 40 MINS → 18:50 (A1)

YES, DAVID CAN GET HOME BEFORE 19:00 WITHOUT BREAKING THE SPEED LIMIT

[OTHER METHODS ARE POSSIBLE, E.G. SHOWING DAVID ONLY NEEDS TO AVERAGE 24 MPH TO GET HOME BY 19:00]

Regan cycles 78 miles in 6 hours.
His average speed for the first 30 miles is 15 miles per hour.
Work out Regan's average speed for the last 48 miles.

SPEED = DISTANCE / TIME



1ST

$t = \frac{30}{15}$

$= 2$ HOURS (M1)

[SECOND PART TAKES 4 HOURS]

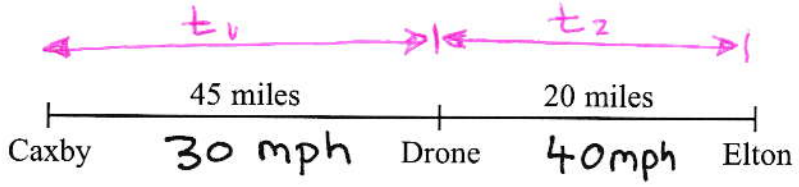
2ND

SPEED $= \frac{48}{4} = 12$ mph (M1)

12 (A1)

..... mph

The distance from Caxby to Drone is 45 miles.
The distance from Drone to Elton is 20 miles.



Colin drives from Caxby to Drone.
Then he drives from Drone to Elton.
Colin drives from Caxby to Drone at an average speed of 30 mph.
He drives from Drone to Elton at an average speed of 40 mph.
Work out Colin's average speed for the whole journey from Caxby to Elton.

SPEED = DISTANCE / TIME

$t_1 = \frac{45}{30}$

$= 1.5$ HOURS

$t_2 = \frac{20}{40}$ (M1)

$= 0.5$ HOURS

AVERAGE SPEED = TOTAL DISTANCE / TOTAL TIME

$= \frac{45+20}{1.5+0.5}$ (M1)

$= 32.5$ (A1) mph

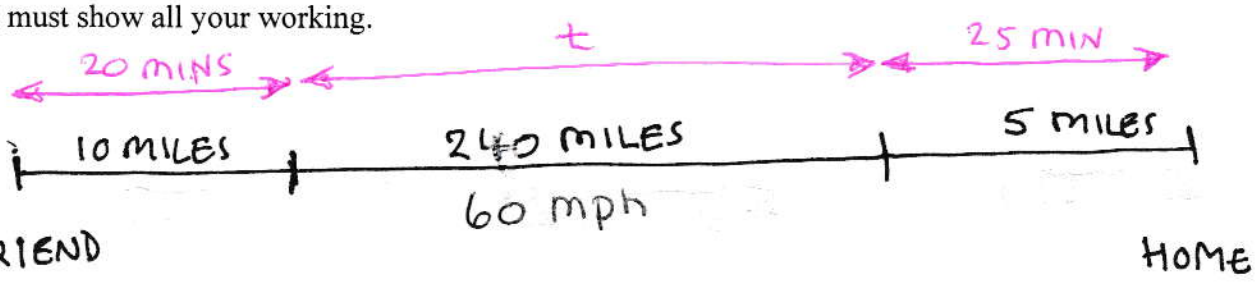
Sue is driving home from her friend's house.
Sue drives:

10 miles from her friend's house to the motorway
240 miles on the motorway
5 miles from the motorway to her home

Sue:

takes 20 minutes to drive from her friend's house to the motorway
drives at an average speed of 60 mph on the motorway
takes 25 minutes to drive from the motorway to her home

Sue stops for a 30 minute rest on her drive home.
Sue leaves her friend's house at 9.00 am.
What time does Sue get home?
You must show all your working.



1ST

$t = \frac{240}{60}$

$= 4$ HOURS [ON MOTORWAY] (M1)

SPEED = DISTANCE / TIME

2ND

TOTAL TIME = 20 MIN + 4 HOURS + 25 MIN + 30 MIN ('REST')

= 5 HOURS 15 MIN (M1)

3RD

TIME TO GET HOME = 9:00 + 5 HR 15 MIN

= 2:15 PM (A1)

James and Peter cycled along the same 50 km route.

James took $2\frac{1}{2}$ hours to cycle the 50 km.

Peter started to cycle 5 minutes after James started to cycle.
Peter caught up with James when they had both cycled 15 km.
James and Peter both cycled at constant speeds.
Work out Peter's speed.

SPEED = DISTANCE / TIME

1ST

AVERAGE SPEED [JAMES] $= \frac{50}{2.5}$

$= 20$ km/h (m1)

2ND

TIME JAMES TOOK TO TRAVEL 15 km

$T = \frac{15}{20}$

$= 0.75$ HOURS

$= 45$ MINUTES (m1)

3RD

TIME PETER TOOK $= 45 - 5$

$= 40$ MINUTES (m1)

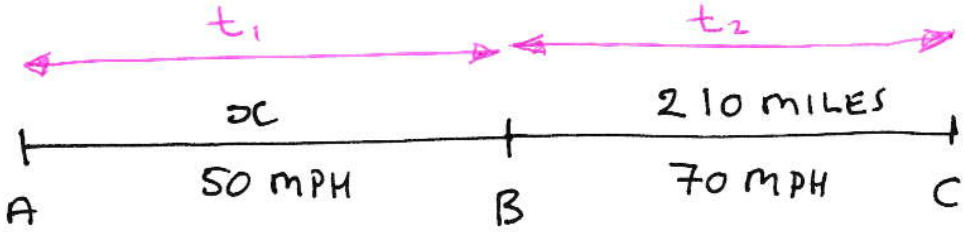
$\frac{40}{60} = 0.\dot{6}$ HOURS

4TH

AVERAGE SPEED [PETER] $= \frac{15}{0.6}$ (m1)

$= 22.5$ (A1)

Harry travels from Appleton to Brockley at an average speed of 50 mph.
He then travels from Brockley to Cantham at an average speed of 70 mph.
Harry takes a total time of 5 hours to travel from Appleton to Cantham.
The distance from Brockley to Cantham is 210 miles.
Calculate Harry's average speed for the total distance travelled from Appleton to Cantham.



1ST

$t_2 = \frac{\text{DISTANCE}}{\text{SPEED}}$

$= \frac{210}{70}$

$= 3$ HRS (M1) $\longrightarrow$ $t_1 = 5 - 3$

$= 2$ HRS (M1)

2ND

$x = \text{SPEED} \times \text{TIME}$

$= 50 \times 2$

$= 100$ MILES (M1)

3RD

$\text{AVERAGE SPEED [TOTAL JOURNEY]} = \frac{\text{TOTAL DISTANCE}}{\text{TOTAL TIME}}$

$= \frac{100 + 210}{5}$

62 (A1) ..... mph

An object is travelling at a speed of 2650 metres per second.

How many seconds will the object take to travel a distance of 3.45×10^{10} metres?

Give your answer in standard form, correct to 2 significant figures.

SPEED = DISTANCE / TIME

TIME = DISTANCE / SPEED

$= \frac{3.45 \times 10^{10}}{2650}$ (m1)

$= 13\,018\,867.92$ (m1)

1.3×10^{7} (A1) ..... seconds

Steve travelled from Ashton to Barnfield.
He travelled 235 miles, correct to the nearest 5 miles. → 235 ± 2.5
The journey took him 200 minutes, correct to the nearest 5 minutes. → 200 ± 2.5
Calculate the lower bound for the average speed of the journey.
Give your answer in miles per hour, correct to 3 significant figures.
You must show all your working.

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}}$$

$$= \frac{235 - 2.5}{200 + 2.5} \quad \text{B1}$$

$$= \frac{232.5}{202.5} \text{ [MINUTES]} \quad \text{B1}$$

$$= \frac{232.5}{3.375} \text{ [HOURS]} \quad \text{M1 [CHANGE TO HOURS]}$$

$$= 68.888\ldots$$

68.9 A1 ..... mph

[LOWER = $\frac{\text{LOWER}}{\text{UPPER}}$]

A spacecraft travels from Earth to Mars at an average speed of 13 km/s.
The spacecraft travels a distance of 1.4×10^8 miles.
Calculate the number of days the spacecraft takes to travel from Earth to Mars.
Use
1 mile = 1.6 km
1 km/s = 2250 miles per hour } USE ONE OF THESE [I HAVE CHOSEN TO CHANGE KM INTO MILES]

1ST

13 km/s = 13 × 2250 mph
= 29250 mph (m1)

2ND

TIME = DISTANCE / SPEED
= $\frac{1.4 \times 10^8}{29250}$ [MILES] / [MILES PER HOUR] (m1)
= 4786.32 ... HOURS

[÷ 24] → 199.43 (A1) ..... days

The world speed record for a train is 360 mph.
It takes Malcolm 6 seconds to drive a train 1 kilometre.
Has the train broken the world speed record?
Use 5 miles = 8 km.
You must show how you get your answer.

8 km = 5 miles
⇒ 1 km = 0.625 miles (m1)

6 seconds = $\frac{6}{60}$ mins
= 0.1 mins (m1)
= $\frac{0.1}{60}$ hours
= 0.0016 hours (m1)

Speed = $\frac{\text{distance}}{\text{time}}$
= $\frac{0.625}{0.0016}$ (m1)
= 375 mph (A1)

NEW SPEED RECORD!

A road is 4530 m long, correct to the nearest 10 metres. → 4530 ± 5
Kirsty drove along the road in 205 seconds, correct to the nearest 5 seconds. → 205 ± 2·5
The average speed limit for the road is 80 km/h.
Could Kirsty's average speed have been greater than 80 km/h?
You must show your working.

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}}$$

(B1)

$$= \frac{4530+5}{205-2\cdot5}$$

[UPPER = UPPER / LOWER]

(B1)

$$= \frac{4535}{202\cdot5} \quad \text{[METRES]} \quad \text{[SECONDS]}$$

$$= \frac{4\cdot535}{0\cdot05625} \quad \text{[km]} \ (\text{M1}) \ \text{[METRES]} \quad \text{[HOURS]} \ (\text{M1}) \ \text{[HOURS]}$$

$$= \underline{\underline{80\cdot6\dot{2}}} \ \text{km/h}$$ (A1) [BOTH ANSWER + STATEMENT]

YES, KIRSTY'S AVERAGE SPEED MIGHT HAVE BEEN MORE THAN 80 km/h

A plane flew from Bogotá to Quito.

The distance the plane flew was 725 km.
The time taken by the plane was 1 hour 24 minutes. → 1·4 HOURS $\left[\frac{24}{60} = 0.4\right]$

Work out the average speed of the plane.
Give your answer correct to 3 significant figures.

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}}$$

$$= \frac{725}{1.4}$$ (M1) [DIVIDE]

(B1) →

518 (A1) ..... km/h

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There is no warranty that these solutions will meet Your requirements or provide the results which You want, or that they are complete, or that they are error-free. If You find anything confusing within these solutions then it is Your responsibility to seek clarification from Your teacher, tutor or mentor.

Please report any errors or omissions that You find*. These solutions will be updated to correct errors that are discovered. It is recommended that You always check that You have the most up-to-date version of these solutions.

The methods used in these solutions, where relevant, are methods which have been successfully used with students. The method shown for a particular question is not always the only method and there is no claim that the method that is used is necessarily the most efficient or 'best' method. From time to time, a solution to a question might be updated to show a different method if it is judged that it is a good idea to do so.

Sometimes a method used in these solutions might be unfamiliar to You. If You are able to use a different method to obtain the correct answer then You should consider to keep using your existing method and not change to the method that is used here. However, the choice of method is always up to You and it is often useful if You know more than one method to solve a particular type of problem.

Within these solutions there is an indication of where marks **might** be awarded for each question. B marks, M marks and A marks have been used in a similar, but **not identical**, way that an exam board uses these marks within their mark schemes. This slight difference in the use of these marking symbols has been done for simplicity and convenience. Sometimes B marks, M marks and A marks have been interchanged, when compared to an examiners' mark scheme and sometimes the marks have been awarded for different aspects of a solution when compared to an examiners' mark scheme.

B1 – This is an unconditional accuracy mark (the specific number, word or phrase must be seen. This type of mark cannot be given as a result of 'follow through').

M1 – This is a method mark. Method marks have been shown in places where they might be awarded for the method that is shown. If You use a different method to get a correct answer, then the same number of method marks would be awarded but it is not practical to show all possible methods, and the way in which marks might be awarded for their use, within these particular solutions. When appropriate, You should seek clarity and download the relevant examiner mark scheme from the exam board's web site.

A1 – These are accuracy marks. Accuracy marks are typically awarded after method marks. If the correct answer is obtained, then You should normally (but not always) expect to be awarded all of the method marks (provided that You have shown a method) and all of the accuracy marks.

Note that some questions contain the words 'show that', 'show your working out', or similar. These questions require working out to be shown. Failure to show sufficient working out is likely to result in no marks being awarded, even if the final answer is correct.

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