LOCKERBIE ACADEMY

TRANSPORT UNIT

Section 1

Learning Intentions

I am learning the link between PHYSICS and Road Safety

Transport Need to Know

Need to Know TRANSPORT 1

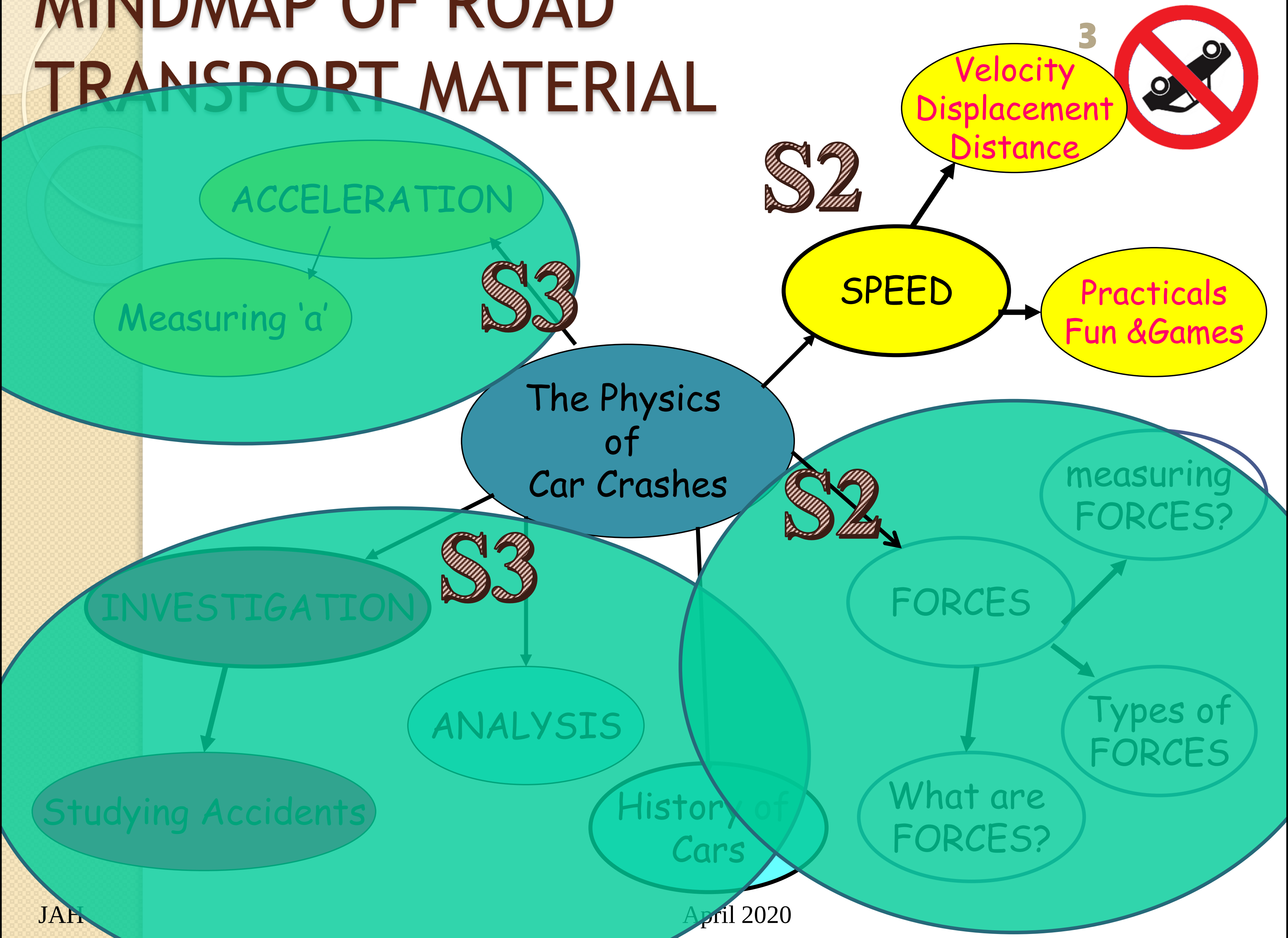
Need to Know Sheet

In the TRANSPORT PART 1 TOPIC

1. I know and can demonstrate how to travel safely.
2. I am learning to assess and manage risk, to protect myself and others, and to reduce the potential harm where possible.
3. I can persuade, argue, explore issues or express an opinion using relevant supporting detail and or evidence
4. When listening and talking with others for different purposes, I can:
   - communicate information, ideas or opinions
   - explain processes, concepts or ideas
   - identify issues raised, summarise findings or draw conclusions.
5. I know the common road signs from the Highway Code
6. I know the difference between a warning triangle sign and an order sign in a circle.
7. ***I know the definitions (meanings) of the words in the table.***
8. I can find the mean average of several numbers using a calculator.
9. In Physics we show the divide by sign as a line and say "over"
10. I can FIX my calculator FIX allows you to fix how many figures after the decimal point should be displayed i.e. it fixes the number of decimal places you quote a value to. This is really useful if you suffer from calculator diarrhoea, but be careful you could end up with zero!
11. I can lay out equations using the acronym I.E.S.S.U.U.
12. I know that the reaction time is the time it takes a person to react to a situation and

Collect a Need to Know Sheet and stick it in to your jotters. You should be referring to it every lesson and using it for revision.

MINDMAP OF ROAD TRANSPORT MATERIAL



Section 1 Road Safety

Learning Intentions & Success Criteria:

I am learning and can demonstrate how to travel safely.

I am learning to assess and manage risk, to protect myself and others, and to reduce the potential harm where possible.

I can persuade, argue, explore issues or express an opinion using relevant supporting detail and or evidence.

When listening and talking with others for different purposes, I can:

- *communicate information, ideas or opinions*
- *explain processes, concepts or ideas*
- *identify issues raised, summarise findings or draw conclusions.*

I am learning the common road signs from the Highway Code.

I am learning the difference between a warning triangle sign and an order sign in a circle.

WARNING

If you have problems with learning about Physics through ROAD SAFETY then PLEASE let your TEACHER KNOW a.s.a.p

car crash compilation (ouch!)

BACKGROUND

bbc news background

For an everyday activity, travelling by road is probably the riskiest thing many of us do on a regular basis.

On average, five people are killed every day on the roads in Great Britain. Hundreds more are injured, many of them seriously, often with life changing consequence.

In the past 10 years, the death toll has amounted to 18,314. As such road crashes are the largest single cause of accidental death for people aged between 5 and 35 years.

SPEED AND ROAD SAFETY

Speed is given as the MAIN cause of FATAL ACCIDENTS on Scotland's Roads

Road Accident Report

Research

- There were 1,870 road deaths in the UK, year ending June 2019 which is an increase compared to the previous year
- https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/848485/road-casualties-year-ending-june-2019.pdf

Check for yourself…

- https://roadtraffic.dft.gov.uk/custom-downloads/road-accidents

Select a group of road users, years, speed limits, type of road users and research to see if you can find out some of the following or your own queries

- On which roads do most road deaths occur?
- Which group of road user have the highest death toll?
- Which part of Great Britain has the highest injuries and why?
- Ask yourself some questions to answer

Global Statistics

- ACROSS THE WORLD……
- Nearly 1.25 million people die in road crashes each year, on average 3,287 deaths a day.
- An additional 20-50 million are injured or disabled.

CRASH TEST VIDEOS

- Worst Crashes: https://www.youtube.com/watch?v=gph2nqDWk7A
- Best test crash:
- http://www.youtube.com/watch?v=AMrSxi1Ooro&feature=related
- Baby seats:
- https://www.youtube.com/watch?v=uKwnh1jUHmU
- https://www.theguardian.com/money/video/2010/jun/18/crash-test-child-car-seats
- http://www.youtube.com/watch?v=Q8gU9zzCGA8
- NEWTON 1st Law
- http://www.youtube.com/watch?v=8zsE3mpZ6Hw&feature=related
- OLD v NEW https://www.youtube.com/watch?v=TikJC0x65X0

Moral /Ethical Reflection
Express Views

THINK OUT OF THE BOX!

Moral /Ethical Reflection
Express Views

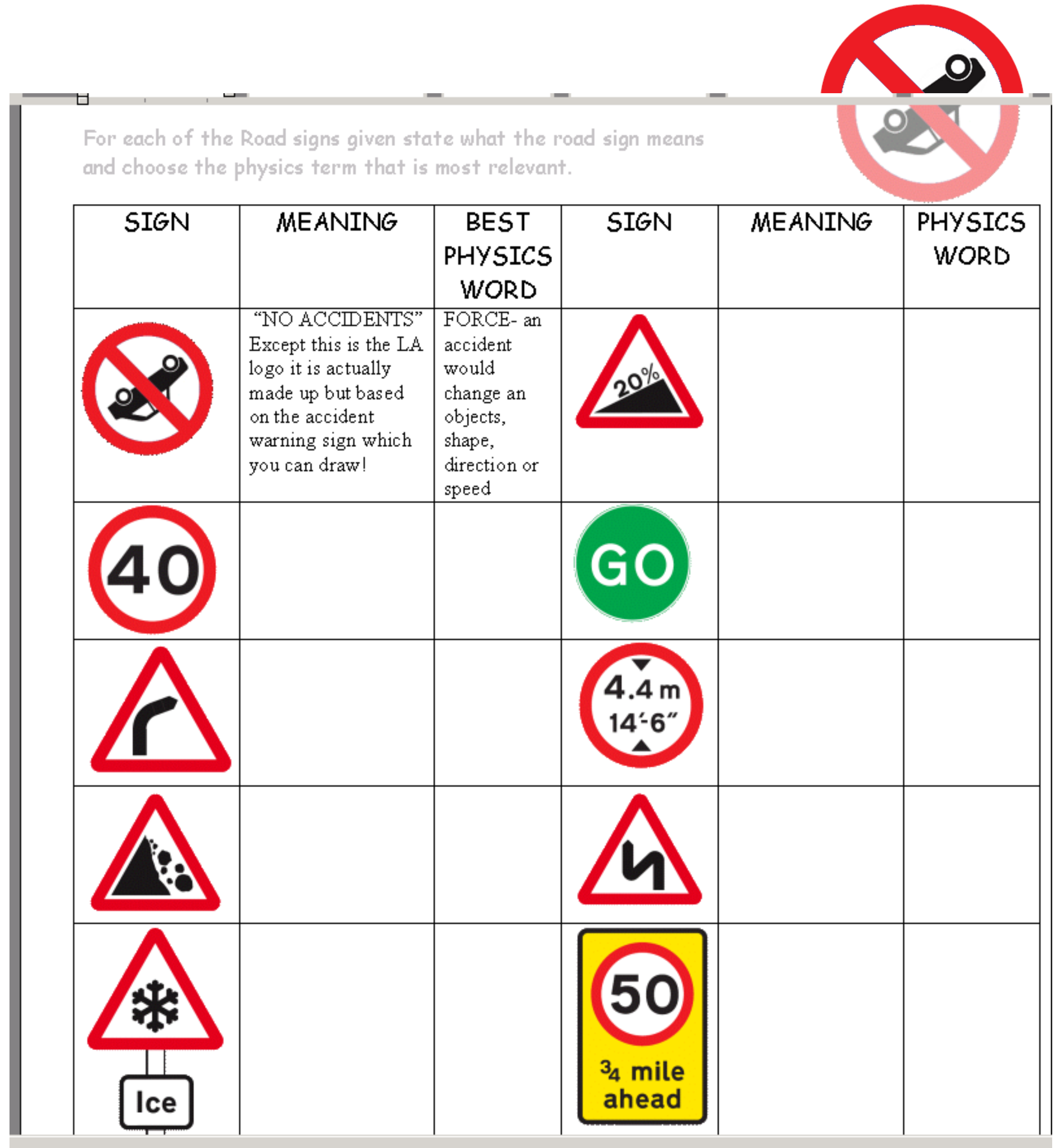
There is a saying among road safety professionals that ‘the safest car is the one with a spike sticking out of the steering wheel’

Could this be true?

Are there any disadvantages to making cars safer?

HOMEWORK

- HOMEWORK
- Collect one of the ROAD SIGN SHEETS
- Put your name on the top
- Find out what each of your road signs means.
- Only fill in the "*Meaning Column*"


For each of the Road signs given state what the road sign means and choose the physics term that is most relevant.

SIGN	MEANING	BEST PHYSICS WORD	SIGN	MEANING	PHYSICS WORD
	"NO ACCIDENTS" Except this is the LA logo it is actually made up but based on the accident warning sign which you can draw!	FORCE- an accident would change an objects, shape, direction or speed	20%		
40			GO		
			4.4 m 14'-6"		
Ice			50 ¾ mile ahead		

[Search for Physics of Road Signs]

Triangular Road Signs

https://www.highwaysindustry.com/millions-of-british-motorists-unable-to-identify-common-road-signs/

Shape of Signs

- **Circular road signs: Give orders** - they must be followed to stay within the law. Circles with a red border tell you what you must not do. Blue circles usually give a positive instruction, such as 'turn left ahead'.
- **Triangular road signs: warn**. Road signs in the shape of an equilateral triangle are designed to warn you about the road layout or any hazards that lie ahead, such as sharp bends.
- **Rectangular road signs: inform**. Blue rectangular signs give information on motorways, green signs direct you on primary roads, while white signs give directions on minor roads.

Take the test!

I know the difference between a warning triangle sign and an order sign in a circle.

- https://highwaycodetest.co.uk/road-traffic-signs/

SPEED AND ROAD SAFETY

Causes of road traffic accidents

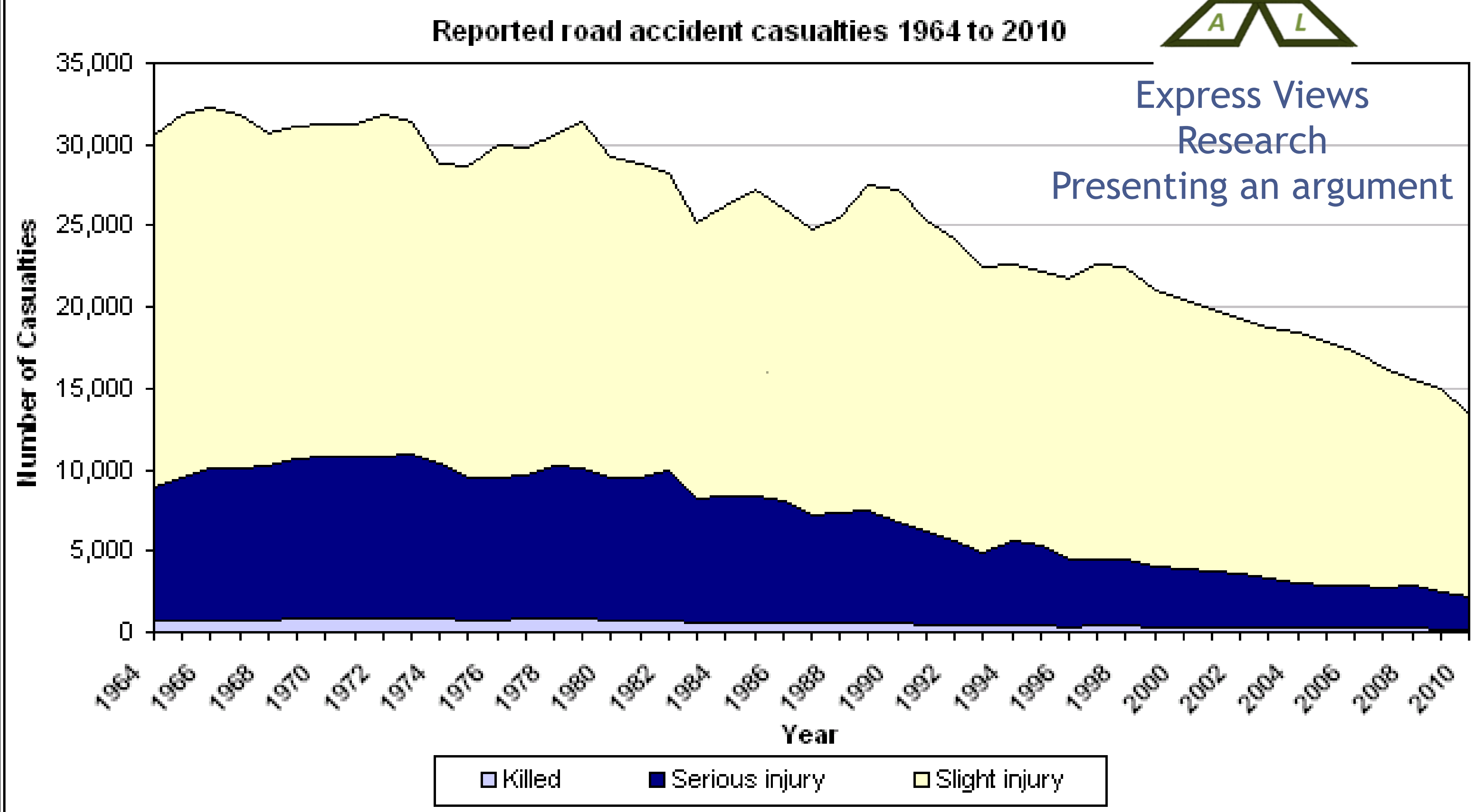
In Great Britain, data collected[6] about road traffic accidents in 1999 to 2002 examined the factors involved in each accident. Excessive speed was the most common contributory factor in fatal accidents, playing a part in 28% of all fatal accidents examined in the trial. Careless, thoughtless or reckless behaviour was next, being a contributory factor in 21% of all fatal accidents examined.

In accidents resulting in any severity of casualty, inattention was the most common contributory factor, found in 25% of all accidents examined in the trial. Failing to judge another person's path or speed was the next most common contributory factor, playing a part in 23% of all accidents examined.

road_traffic_accident.html

THINKING TASK!- More CARS less deaths- WHY?

Express Views
Research
Presenting an argument



[Crash Figures]


STOP
STOP
100 yds

Revision

1. What is the major cause of Road Deaths in the UK?
2. Between which ages are you most likely to die from a road death than anything else?
3. What does a red triangle sign mean?
4. What does a red circle sign mean?
5. What does the road sign above mean?

Revision

1. What is the major cause of Road Deaths in the UK?
Speed
2. Between which ages are you most likely to die from a road death than anything else? 5-35
3. What does a red triangle sign mean? warnings
4. What does a red circle sign mean? Give orders
5. What does the road sign above mean? No through road for vehicles.

Section 2
AVERAGE SPEED

Learning Intentions
I am learning about average speed

S2 PHYSICS & Road Safety

Name that sign, Revision!

Speed, Distance & Time

Learning Intentions and Success Criteria

- *I know the definitions (meaning) of the words speed, distance, average speed.*
- $average\ speed\ = \dfrac{total\ distance\ travelled}{time\ for\ the\ journey}$
- *Average speed = total distance ÷ time*
- $\bar{v} = \dfrac{d}{t}$
- *I know that speed is given as the MAIN cause of FATAL ACCIDENTS on Scotland's Roads.*

Speed, Distance & Time

- *I can find the mean average of several numbers using a calculator.*
- *I can find the average speed for a journey.*
- *I know that in Physics we show the divide by sign as a line and say "over"*
- *I can lay out equations using the acronym I.E.S.S.U.U.*

Important Notes

- No secs
- No STD's
- No p-ing (except in mph)
- No $re\dot{c}ur$


STOP

Word bank

- <u>Distance</u>- is how far you have travelled. It is another name for length. **It is measured in metres** or during our road safety topic miles.

- <u>Time</u>- the duration of the journey. It is measured in seconds or during our road safety topic hours.

- Speed – the distance you travel every second.

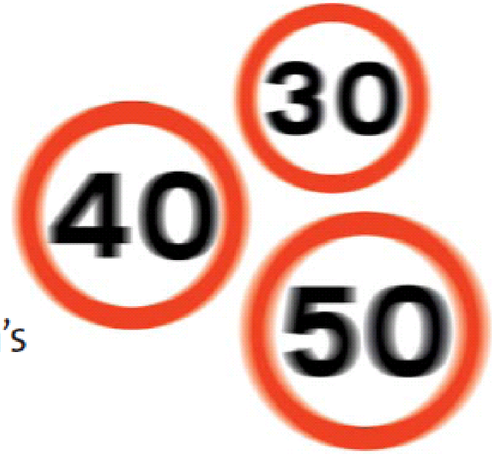
OR

- Speed is the distance travelled in unit time.

- In Science distances are measured in metres and our time is measured in seconds so units of speed would be metres per second (m/s or ms^{-1})
- In road safety we look at miles travelled every hour or miles per hour.

Did you know?

- Excessive speed contributes to 12% of all injury collisions, 18% of crashes resulting in a serious injury and 28% of all fatal collisions
- This means that around 1,000 people are killed each year on Britain's roads, and over 6,000 are seriously injured, because drivers and riders travel too fast.



Highway Code Rule 103

You MUST NOT exceed the maximum speed limits for the road and for your vehicle. Street lights usually mean that there is a 30 mph speed limit unless there are signs showing another limit.

What do you think?

Find out the normal speed limits for different types of roads and different vehicles. Why do some vehicles (for example, heavy goods vehicles) have lower limits?

Why are speed limits necessary? What would happen if drivers were allowed to drive at any speed they wanted? Would they all choose the same speed on a particular road? Would they choose speeds that were safe for pedestrians and cyclists?

How do higher speeds make crashes more likely? How do higher speeds make collisions more serious?

Speeding is not just exceeding the speed limit. It is also driving within the speed limit but too fast for the conditions (known as 'inappropriate speed'). Describe some situations where it is not safe to drive as fast as the speed limit.

Discussion Points

Stopping Distances

The faster a car is travelling, the longer it takes to stop. At just 30 mph, a car travels 44 feet (about 3 car lengths) each second.

Using the Highway Code, make a chart showing the differences in stopping distances between various speeds in between 20 mph and 70 mph. If a driver reacts slowly, the stopping distance will increase. What else increases stopping distances?

As well as being dangerous itself, going too fast also makes other types of driving more dangerous, e.g. driving too close to the vehicle in front. Make a list of types of bad driving that are made even worse at higher speeds.

Speed

The average speed is the distance travelled every second averaged for the whole journey.

Speed = total distance divided by the total journey time

$$\overline{Speed} = \frac{Distance}{Time}$$

where
$\bar{v}$=average speed (m/s)
d=distance (m)
t=time (s)

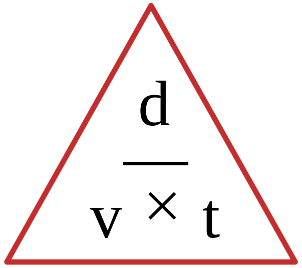
In Physics we show the divide by sign as a line and say "over"

The line over the v for speed means average

HOW TO LAY OUT EQUATIONS IN PHYSICS

Before we can do any calculations on this you need to know how to lay out questions in Physics. This video is a little out of date, and your exam paper wont be written in Scots but you'll get the idea.

http://www.youtube.com/watch?v=u7akhlAS5Ck



IESSUU

IESSUU

- **I**nformation
- **E**quation
- **S**ubstitution
- **S**olution
- **U**nits
- **U**nderline

& remember no SECS or STDs in PHYSICS

$$Speed\ (\text{metres/second}) = \frac{Distance\ (\text{metre})}{Time\ (\text{second})}$$

2. The Porsche travelled at 40 m/s for 2 minutes. Calculate the distance travelled.

speed=40 m/s

Time = 2 minutes (2×60)= 120 second

Information and conversion

$$Speed = \frac{Distance}{Time}$$

$$v = \frac{d}{t}$$

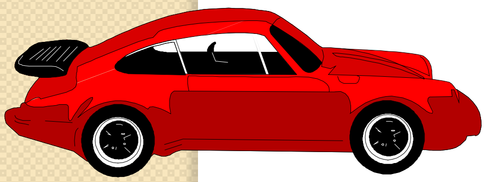
Equation

$$40 = \frac{d}{120}$$

Substitution

$$= 40\ m/s \times 120\ s$$

Solution



=4800 m

Units

Underline

- Toni walks 40m in 30s calculate her average speed.

v=?, t=30s, d=40m

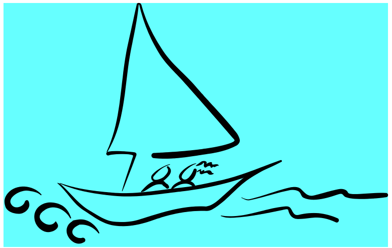
$$speed = \frac{distance}{time}$$

$$\text{or } \bar{v} = \frac{d}{t}$$

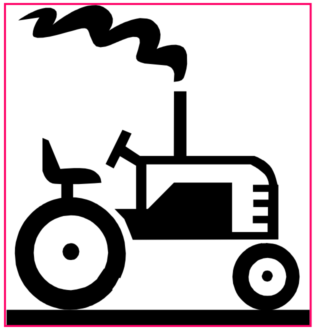
$$v = \frac{40}{30}$$

$$v = 1\, m/s$$

Work out the average speeds for the following journeys. Make sure you set out your working in the same way as the example above.



1. A boat travels 30 km in 3 hours.



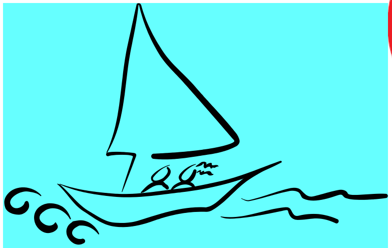
2. A tractor drives 18 km in 6 hours.

3. A frog jumps 25 metres in 5 seconds. (Take care with the units.)

4. A plane flies 600 km in 3 hours.

Let's try some examples

1. A boat travels 30 km in 3 hours.



$$v = \frac{d}{t}$$

$$v = \frac{30}{3}$$

$$\underline{\underline{v = 10\ km/h}}$$

$d = 30km$

$t = 3h$

$v = ?$

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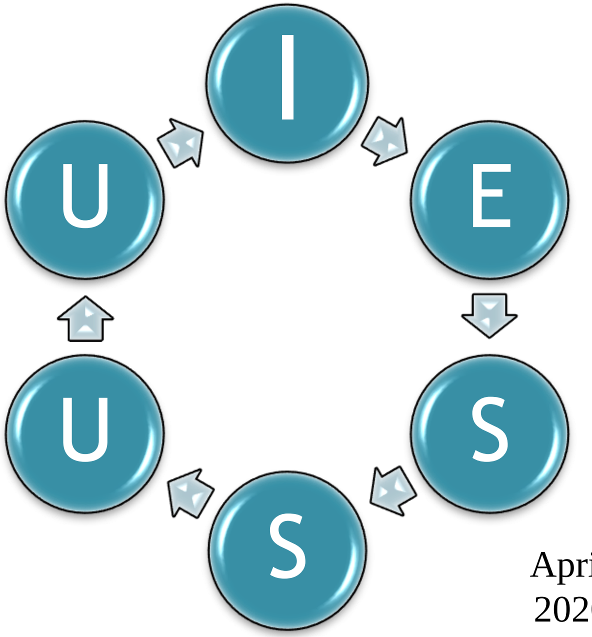


IESSUU

examples

IESSUU

2. A tractor drives 18 km in 6 hours.

$$v = \frac{d}{t}$$

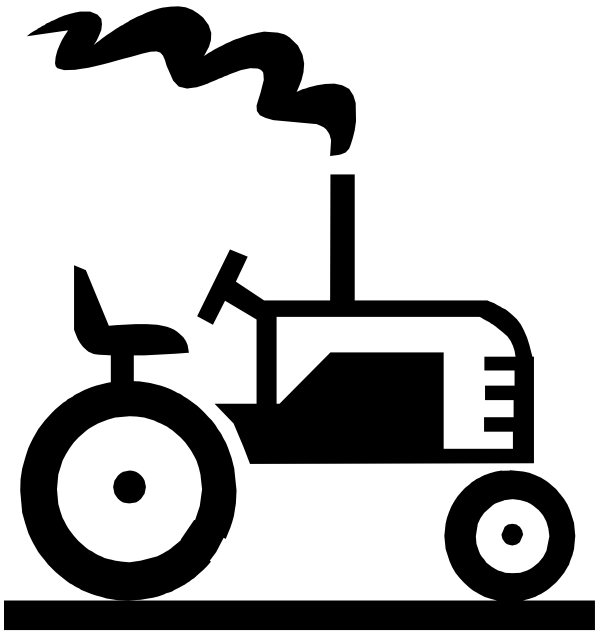
$$v = \frac{18}{6}$$

$$\underline{\underline{v = 3\ km/h}}$$

$d = 18km$

$t = 6h$

$v = ?$



3. A frog jumps 25 metres in 5 seconds. (Take care with the units.)

$$Speed = \frac{Distance}{Time}$$

$$v = \frac{d}{t}$$

$$v = \frac{25}{5}$$

$\underline{v=5m/s}$

d= 25m

t= 5s

v=?

4. A plane flies 600 km in 3 hours.

$$v = \frac{d}{t}$$

$$v = \frac{600}{3}$$

$$\underline{\underline{v = 200\ km/h}}$$

d= 600km

t= 3h

v=?

IESSUU

Speed Dominoes

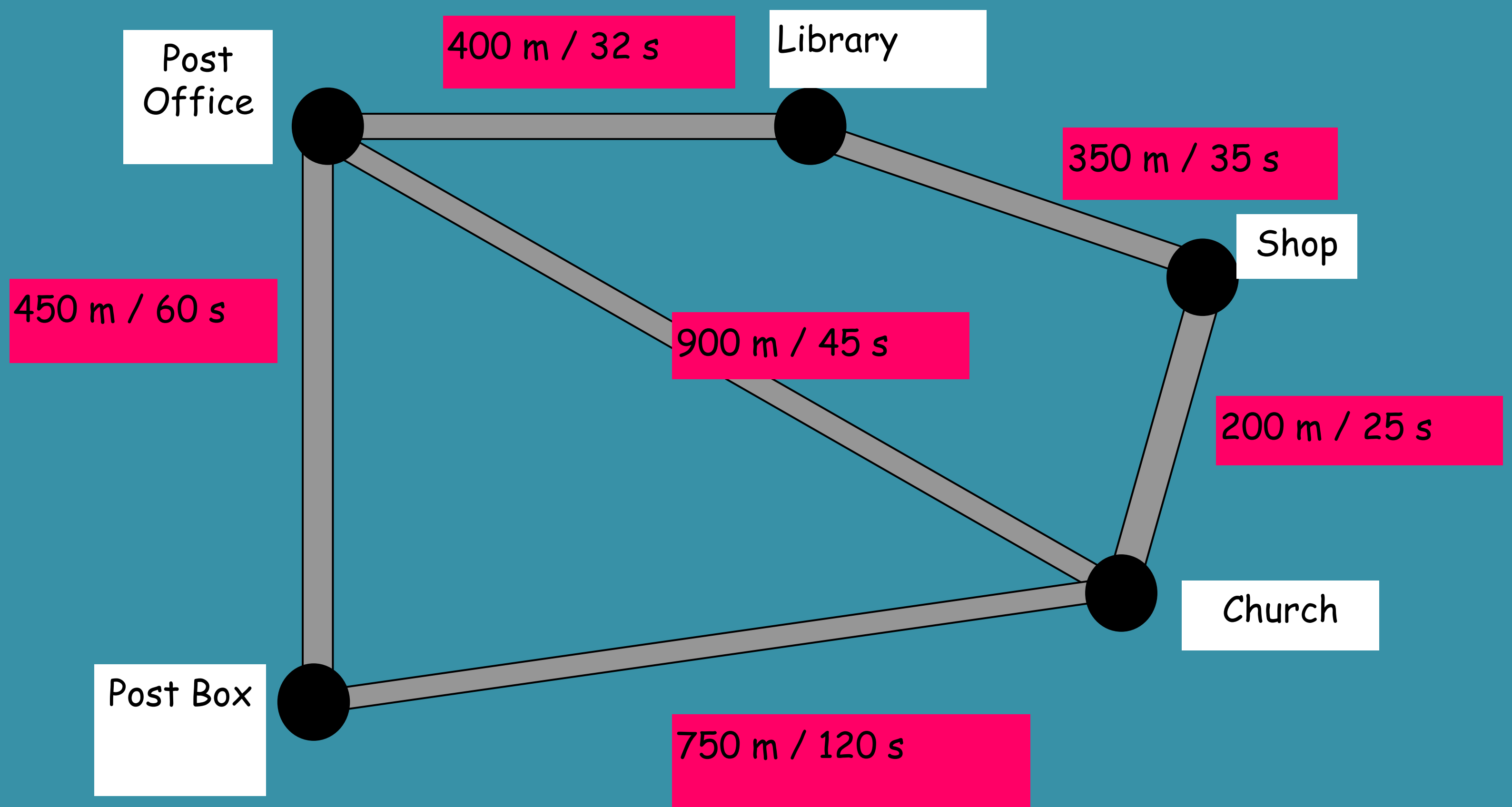
Answer = 17.5 m/s	Space for working	Answer = 5s	Space for working
average speed = ? distance = 500 metres time = 5 seconds		average speed = ? distance = 15 000 metres time = 25 seconds	
Answer = 45 m/s	Space for working	Answer = 100 m/s	Space for working
average speed = ? distance = 10 metres time = 0.5 seconds		average speed = ? distance = 45 metres time = 2.5 seconds	
Answer =	Space for working	Answer = 600 m/s	Space for working
average speed = ? distance = 750 metres time = 500 seconds		average speed = ? distance = 540 metres time = 12 seconds	
Answer = 1.5 m/s	Space for working	Answer = 18 m/s	Space for working
average speed = 12 metres per second distance = ? time = 6 seconds		average speed = 0.001 metres per second distance = ? time = 120 seconds	

speed dominoes

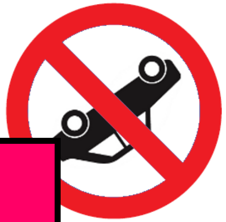
ADVANCED SPEED QUESTIONS

1. Calculate the speed of a motorbike if it travels 100 metres in 2.5 seconds?
2. Calculate the speed of a rocket if it can move 32 kilometres in 4 seconds?
3. Calculate the speed in m/s is a skateboarder moving if he can skate 6 kilometres in 10 minutes?
4. A red Ferrari zooms over 500 metres in 4 seconds, calculate its speed?
5. Calculate the time it would take a snail to slither 20 metres at 5 metres per hour?

THE POST VAN AND AVERAGE SPEED



Post Office Van speed



Journey	Average Speed
Post Office → Post Box	
Post Office → Church	
Post Box → Church	
Library → Shop → Church	
Post Office → Post Box → Church	
Post Office → Church → Shop → Library	

Try the additional questions to show what you can do.

PRACTICE- SPEED DISTANCE TIME

IESSUU

1. A car travels 200 miles in 4 hours. Calculate its average speed.
2. A man runs 100 m in 12.5 seconds. Calculate his average speed.
3. A train travels 80 miles in 1 hour 15 minutes. Calculate its average speed.
4. A person walks 15 km in 2 hour 30 minutes. Calculate his average speed.
5. A car travels 10 miles in 20 minutes. Calculate its average speed.
6. A jet fighter travels at 900 mph. How far will the jet travel in 4 hours?
7. An athlete runs at a constant speed of 8 m/s. How long will it take the athlete to run 400 m?
8. A tennis ball travels at 40 m/s. How far will it travel in 1½ seconds?
9. A car travels 15 miles in 45 minutes. Calculate its average speed.
10. A middle distance runner runs at an average speed of 6 m/s. How long will it take him to run 1500 m. give your answer in seconds. Convert your answer to minutes.

Page: 1 of 4 | Words: 1,450 | 159%

speed distance time practice

more practice questions

If you need additional help try these, for now just I,E,S!

Find it here search ASN

Speed, Distance, Time Worksheet ASN.

Calculate Speed

$$\bar{v} = \frac{d}{t}$$

1. A car travels a distance of 540km in 6 hours. Calculate the speed of the car.

v =	Equation:
d =	Substitution:
t =	Answer with unit.

2. John is a runner. He runs the 100m sprint in 20.0 s. Calculate the John's speed.

v =	Equation:
d =	Substitution:

Revision

1. State the meaning of the symbols shown above.
2. Explain the meaning of the term distance.
3. State the unit to measure distance.
4. State the meaning of the term speed.
5. State the formula to measure average speed.

LOCKERBIE ACADEMY

TRANSPORT UNIT

Section 3

MEASURING AVERAGE SPEED

S2 PHYSICS & Road Safety

PRACTICAL

Measuring Average Speed

Learning Intentions

- *I know that to measure average speed I measure the total distance and the time for the whole journey.*
- *I measure distance with a tape measure/metre stick*
- *I measure time with a stopwatch.*

Revision

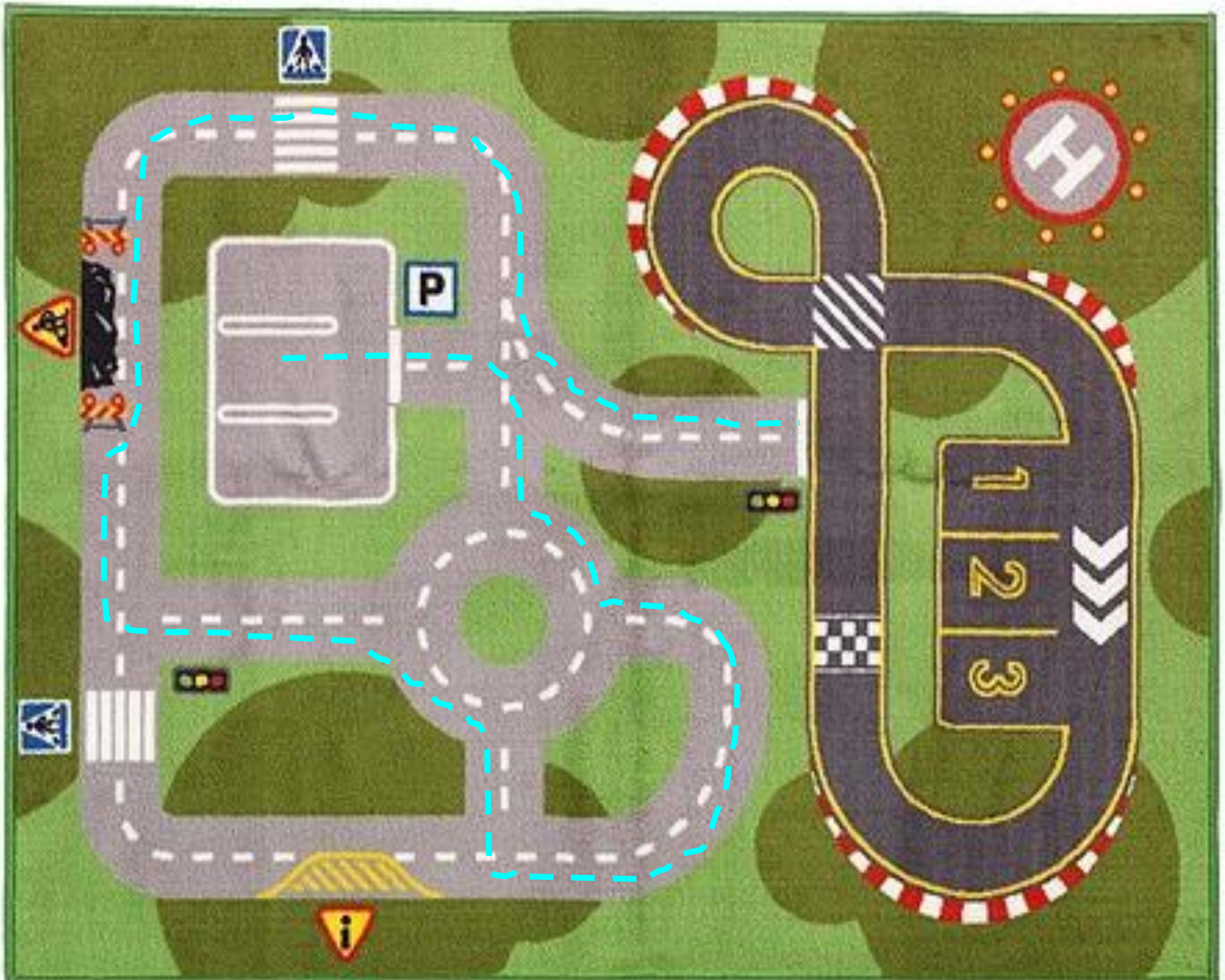
1. State the meaning of the symbols shown above.
2. Explain the meaning of the term speed
3. State what the bar means above v, $\bar{v}$
4. State the acronym to lay out equations
5. If Mrs Bowker cycled from Lockerbie to Dalkeith, a distance of 107 km and this takes 4 hours 16 mins, calculate her average speed.

Copy the table into your jotter

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Name of driver	Distance (m)	Time taken (s)	Average time for the 3 runs (s)	Average Speed (m/s)	How many times did they run off the track?	1-5 how good a driver

LOCKERBIE ACADEMY

Speed Task Mat


P
1
2
3

The SPEED OF MY CAR

TASK

We need to know the

1. distance your vehicle travelled.
2. Time for your journey.
3. The average speed over the whole journey for each team member.

Measuring
observing

The SPEED OF MY CAR

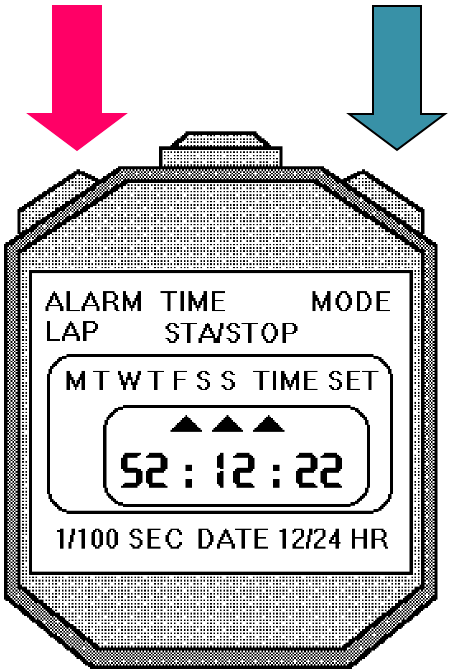
Your Team Challenge

- You must time how long it takes each member to complete the journey and measure the distance travelled along the track.
- Record each team member's time and calculate the average time and then the average speed for each journey.
- Record how many times the car goes off the track

Reading the stopclock

- The stopclock display can be a bit confusing.

- A number that looks like this: 0:0234 means 2.34 seconds.



Finding the average time

- To find the average speed from your results

1. Find Average time
   - Fix the calculator
   - Add the 3 times using the calculator
   - PUSH the = button
   - divide this answer by 3
2. Add this number to your table where it says average time.

- Find the speed using the formula
  - Speed = distance ÷ time
- Add this value of speed to your table.
- DO NOT give your average speed to more than 1 decimal place unless the value is very small.

Complete the table

- Find the average speed for each person in your group and add this to your table.

Recording Results

IESSUU

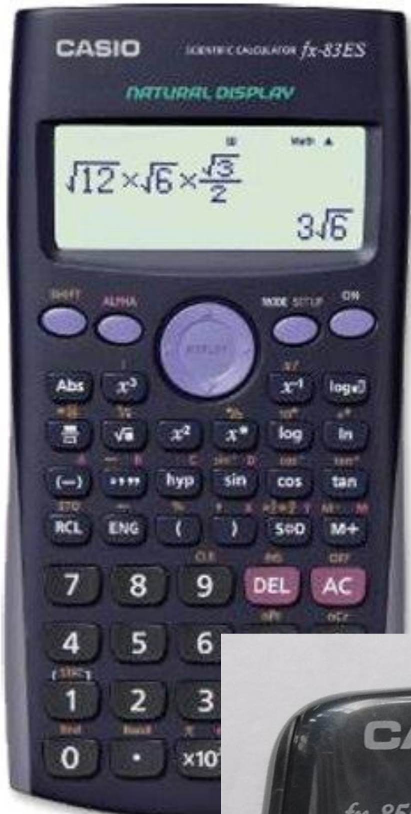
Section 4

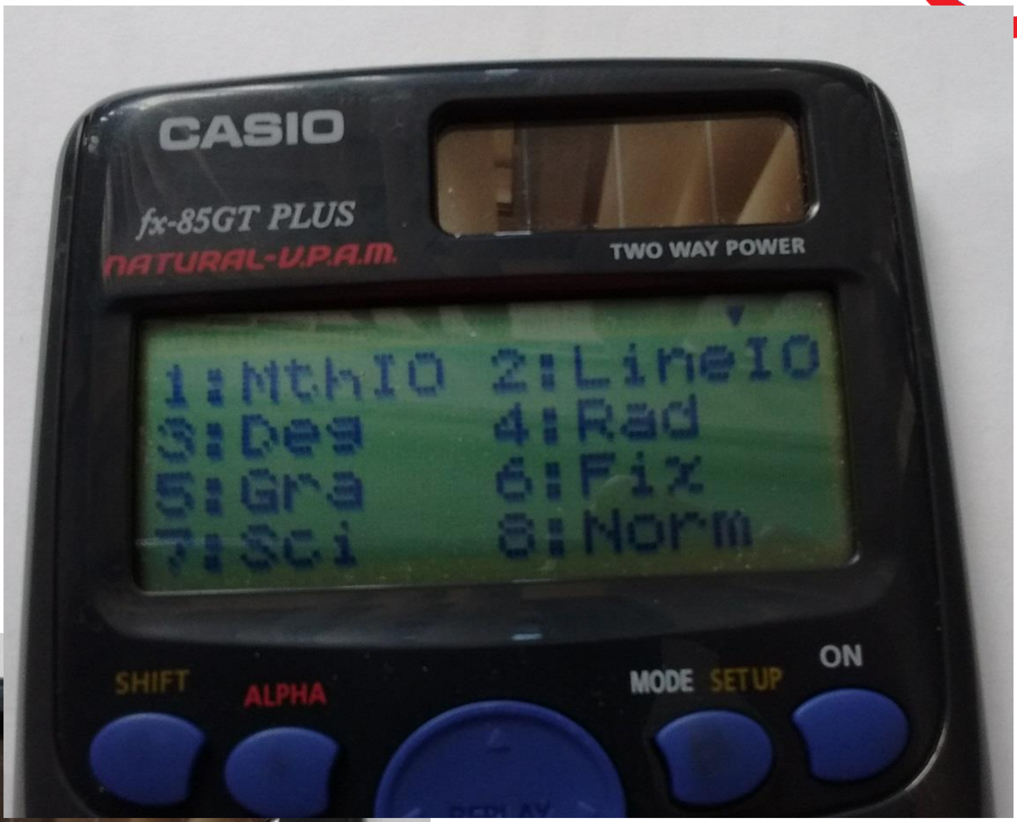
USING YOUR CALCULATOR

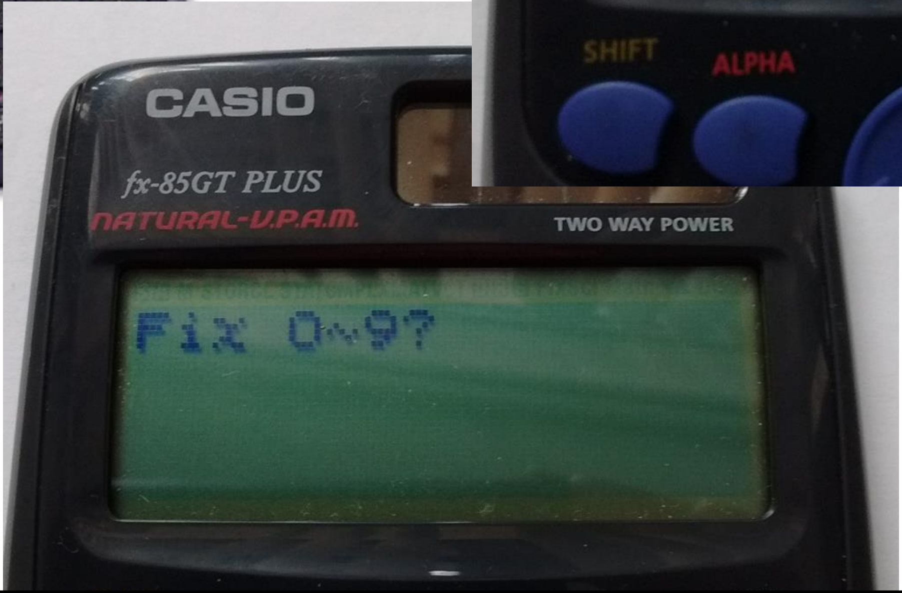
For extra learning on your calculator, with horrible background noise!

https://www.youtube.com/watch?v=J_qwqJqfFXE&list=PLA-Rcyle2UhVsMxjPVVHFfWHONcBW0Xxi

Shift set up gets the menu







Using your Calculators

Learning Intentions

- *I know how to get the menu on my calculator*
- *I can use the Fix,* $\frac{\square}{\square}$ *Norm, DMS button, ENG.*
- *I can check my calculator is in degrees and is on the right setting.*
- *I can convert minutes into parts of an hour and hours and minutes into hours and decimals into hours and minutes.*

USING YOUR CALCULATORS

- FIXING your calculators

FIX allows you to fix how many figures after the decimal point should be displayed .

This is really useful if you suffer from calculator diarrhoea.

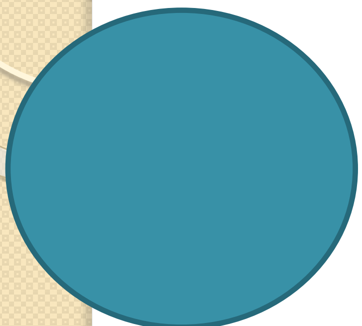
me and my calculator

Section 4b
Converting between hours minutes and seconds

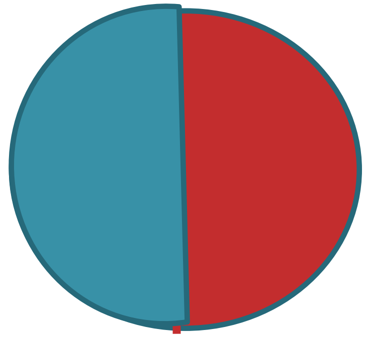
For extra learning about using the degrees minutes and seconds button your calculator.

https://www.youtube.com/watch?v=rDX93WuCCUw

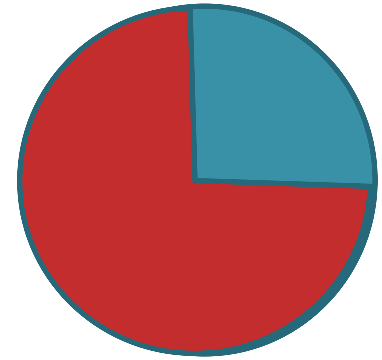
Eating Clock Cakes!



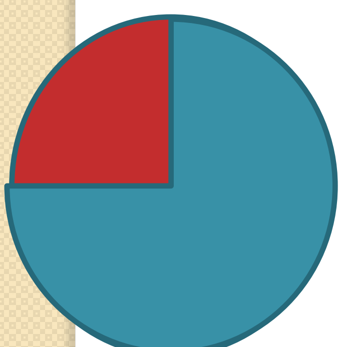
I eat 1 cake



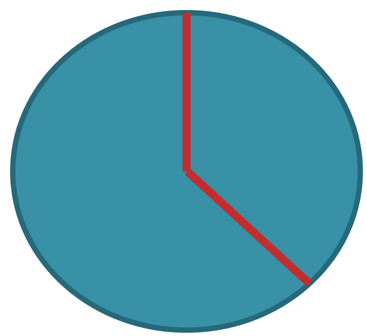
I eat ½ the cake



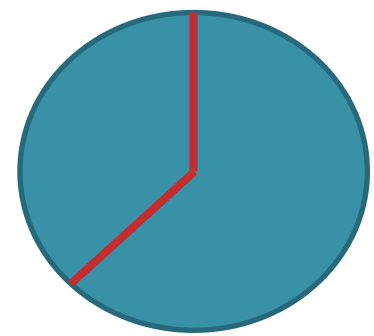
I eat ¼ of the cake



I eat ¾ of the cake



I eat 1/3 of the cake



I eat 2/3 of the cake

Converting between hours mins and seconds and parts of an hour

- 1. Calculate the following in terms of hours
  - a) 30 mins b) 15 mins c) 40 mins, d) 25 mins e) 5 mins f) 36 mins

2.

a) 3 hours 30 min b) 7 hours 24 mins c) 2 hours 10 mins d) 8 hours 17 mins e) 1 hour 18 mins

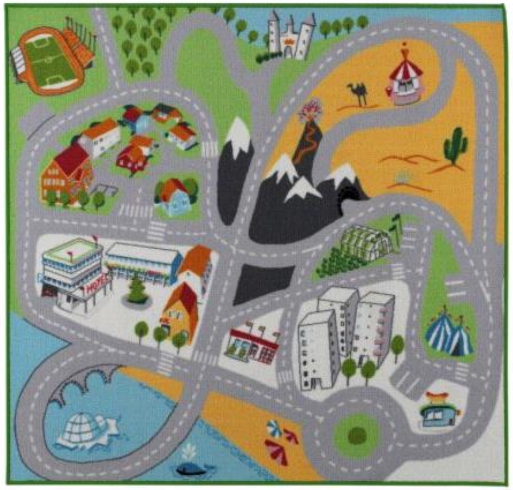
3. Convert the following parts of an hour to hours and minutes

a) 16.5 h b) 13.3 h c) 6.4 h d) 0.9 h e) 8.7 h

https://www.youtube.com/watch?v=rDX93WuCCUw

Let's try some examples

1. Matt's time for the course was 00:01:55. The course was 1.78m. What was Matt's speed around the course?



$$t = 00:01:55$$
$$= 1\min 55s = (1 \times 60) + 55s = 115s$$
$$d = 1.78m$$
$$v =$$

$$v = \frac{d}{t}$$
$$v = \frac{1.78}{115}$$
$$\underline{\underline{v = 0.015m/s}}$$

Section 5
REACTION TIME

Learning Intentions

- *I know that the reaction time is the time it takes a person to react to a situation and understand the dangers.*

- *The distance that a car travels during the driver's reaction time is called the Thinking Distance.*

Revision

1. State the meaning of the symbols shown above.
2. State the meaning of the term speed.
3. State the formula to measure average speed.
4. Mrs H drives 17 miles to work and it takes 24 mins. Calculate the average speed in mph. (If this is too hard just I.E.S.)

Reaction Time definition

Reaction time is the time it takes a person to react to a situation.

MEASURING REACTION TIME USING A COMPUTER

- On the internet try some of the experiments for finding your reaction time. *Write your answers in your jotter.*

Sheep Dash   Reaction Test Age   Fetch fido

Big dots

MEASURING REACTION TIME USING A RULER

Collect the helpsheet for the instructions on how to find REACTION TIME using a RULER. *Write your results in your jotter.*

REACTION TIME

MEASURING REACTION TIME USING A RULER

- To measure your reaction time you will need a 30 cm ruler, an instruction sheet and a partner.

To convert the distance to your reaction time….
Multiply *your average distance in metres by* ***0.2*** *and then* ***square root*** *your answer.*

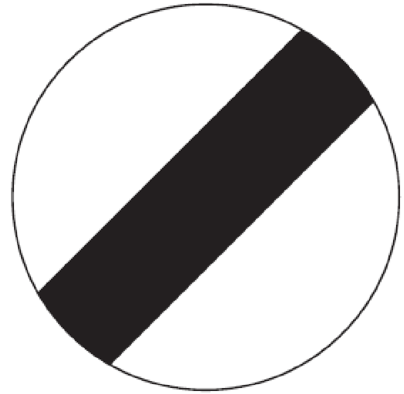
Safety

Section 6
Stopping Distance

Learning Intentions

- *The distance that a car travels during the driver's reaction time is called the Thinking Distance.*
- *The distance a vehicles travels during braking is called the braking distance*
- *The STOPPING DISTANCE of a car is made up of TWO parts: THINKING DISTANCE and BRAKING DISTANCE.*
- *Stopping distance= thinking distance + braking distance.*
- *I can identify things that affect, thinking distance and braking distance, all of which will change the stopping distance.*

Revision



1. State the meaning of the signs shown
2. Convert 48 mins into parts of an hour
3. Mr Asher cycled 502 miles in 6 days, cycling for 5 hours a day, calculate his average speed in mph
4. State the 4 things you mustn’t use in Physics when doing calculations.

The STOPPING DISTANCE of a car is made up of TWO parts

- **THINKING DISTANCE**

Thinking distance is the distance a car will travel in the time it takes you to react to the situation.

- **BRAKING DISTANCE**

The distance the car will travel as the brakes are applied

Stopping distance = thinking distance + braking distance

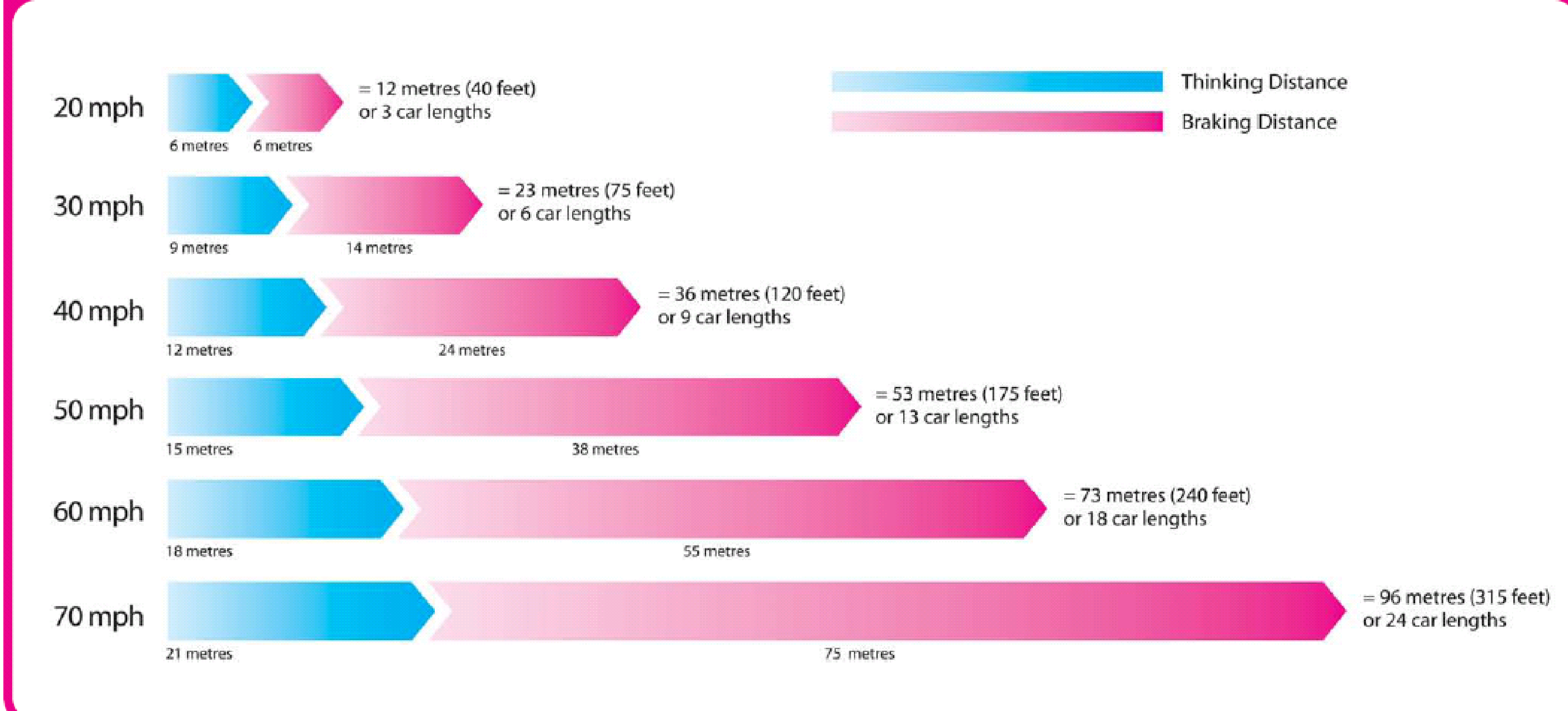
Stopping distance the distance it takes a vehicle to stop.

https://www.billplant.co.uk/blog/know-stopping-distances/

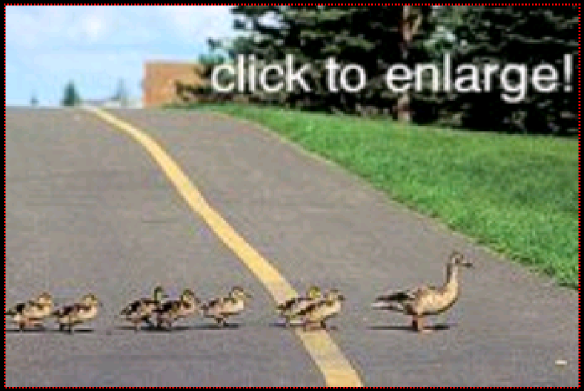
Did you know? A pedestrian hit by a car at:

- 20 mph, has a 97% chance of surviving (almost all live)
- 30 mph, has a 80% chance of surviving (most live)
- 35 mph, has a 50% chance of surviving (half live, half die)
- 40 mph, has only a 10% chance of surviving (almost all die).

Small increases in speed have massive effects



Stopping Times Example



Here's a good example. A car driver sees a **family of ducks** crossing the road in front of her. She brakes for 1·5 s and took 1·8 s to stop. *What is her reaction time?*

The total stopping time was 1·8 s. This is made of two parts: thinking and braking. The braking time was 1·5 s, so the thinking (reaction) time was 0·3 s.

By the way, she stopped in time - lucky she wasn't driving too fast!

Cute photo credit: Sherwood Park & District Chamber of Commerce

Stopping Distance, Thinking Distance, Braking Distance and Speed.

1. What is the link between Stopping Distance, Thinking Distance, and Braking Distance?
2. What affects the thinking distance?
3. List things that affect braking distance.
4. A person in a car travelling at 20 mph. has a thinking distance of 6m and a braking distance of 6m what is her stopping distance?
5. Copy and complete the table filling in the missing values from the white columns.

		Thinking	Braking	Stopping	Stopping	Reaction

Complete the sheet

Stopping Distance Sheet

Chicken Run -An investigation to measure reaction time and calculate stopping distances

Using the Reaction Timer box you will find:

- Your reaction time.
- How your reaction time changes if you are chatting or texting.
- You will calculate stopping distances for different speeds.

Recording Results
Safety
Hypothesizing
Processing Data.


is the person closest to stopping
position of "the car" without
being

Section 7
INSTANTANEOUS Speed

Learning Intentions

- *The instantaneous speed is the speed of an object at a certain instant of time.*
- To measure instantaneous speed use a light gate attached to an interface and computer. The length of the object divided by the time it takes the object to pass through the light gate = instantaneous speed.
- A speedometer measures the instantaneous speed.
- $instantaneous\ speed = \frac{length}{Time\ to\ pass\ a\ point}$

$$v = \frac{l}{t}$$

Revision

1. State the formula for average speed.
2. Explain the term stopping distance.
3. How do you get the menu on your calculator?
4. State the meaning of the term reaction time.
5. State the name of the distance a vehicle travels whilst a driver reacts to the situation.

A **speedometer** is a [gauge]() that measures and displays the instantaneous [speed]() of a land vehicle.

JAH

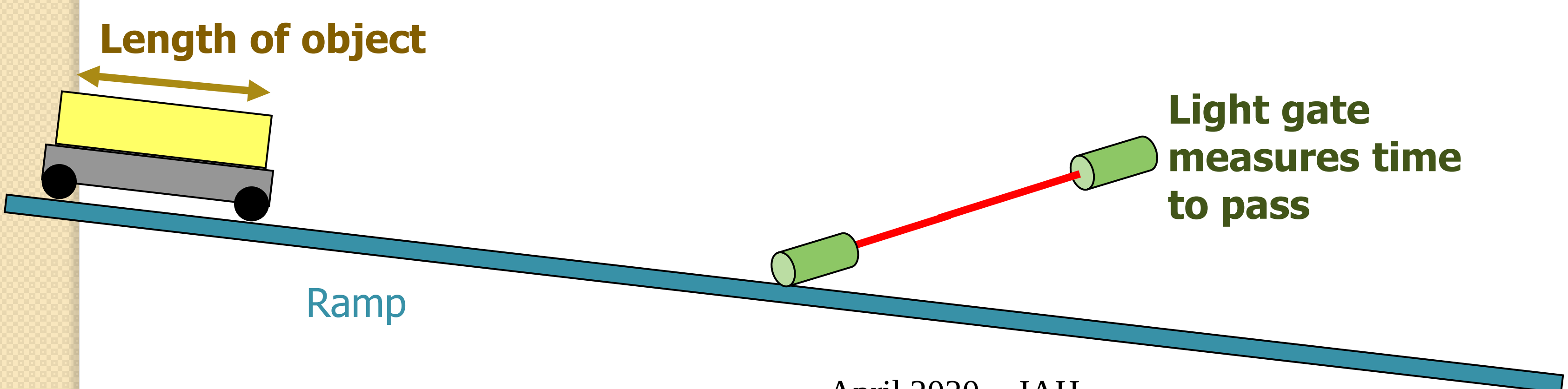
April 2020

Instantaneous Speed

The <u>instantaneous speed</u> is the speed of an object at a certain instant of time.

For example, a police speed camera measures the instantaneous velocity of the car.

$$instantaneous\ speed = \frac{length\ of\ vehicle}{time\ to\ pass\ a\ point}$$



Instantaneous Speed

Instantaneous speed is difficult to measure.

WHY?

REACTION TIME

Section 8 MEASURING INSTANTANEOUS Speed

Learning Intentions

- To measure instantaneous speed use a light gate attached to an interface and computer.
- The length of the object divided by the time it takes the object to pass through the light gate = instantaneous speed.

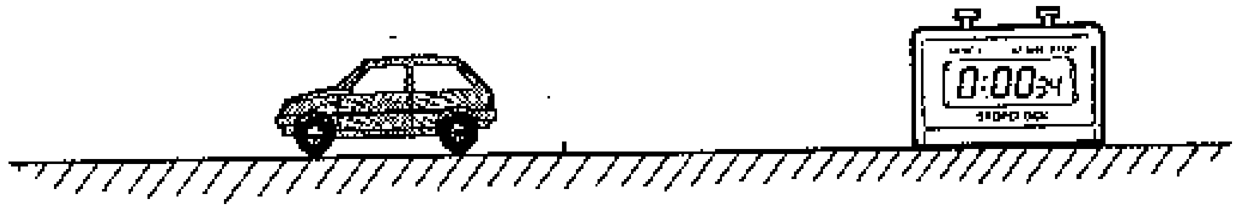
Revision

1. State the meaning of the road signs shown.
2. How do you calculate stopping distance.
3. State the meaning of the term instantaneous speed.

Measuring Instantaneous Speed Using A Stopwatch

What you need

- Model vehicle, ruler, chalk, stopclock.



What to do

1. Mark one chalk line/ white board marker on the bench. (Don't forget to rub it out when you have finished!).
2. Measure the length of the model vehicle. Record this in your jotter.
3. Push the car and time how long it takes the car to fully pass the line.

What to do

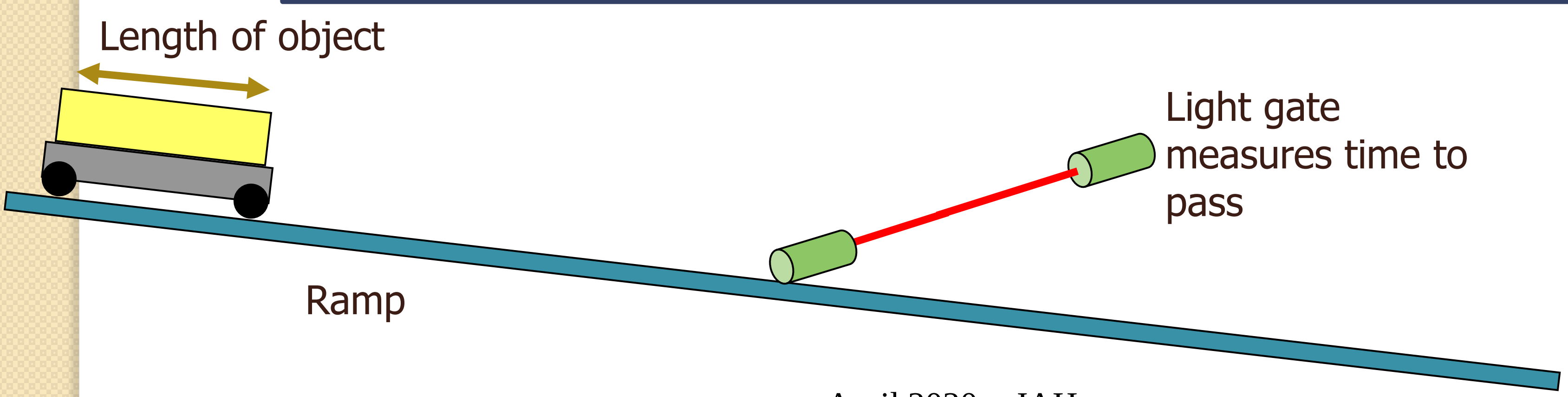
1. Mark a chalk line/ white board marker line on the bench. (Don’t forget to rub it out when you have finished!).
2. Measure the length of the model vehicle. Record this in your jotter.
3. Push the car and time how long it takes the car to fully pass the line.
   - Start the stopclock when the front edge of the vehicle reaches the chalk line.
   - Stop the stopclock when the end of the car reaches the chalk line.
   - Note the time from the stopclock in your jotter.
4. Calculate the speed using the formula:

$$speed = \frac{distance}{time}$$

Instantaneous Speed Using Light (

Another way to measure instantaneous speed is to use a light gate. The **length of the object** divided by the **time it takes to pass** gives its instantaneous speed.

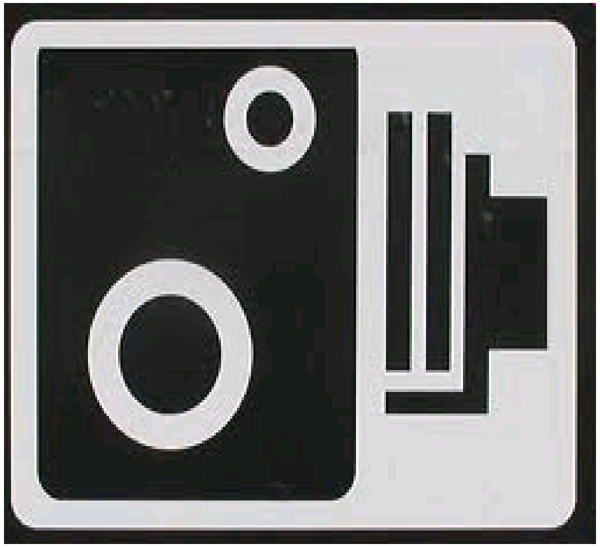
$$instantaneous\ speed = \frac{length}{time\ to\ pass\ a\ point}$$



Measuring Your Instantaneous Spe Speed Trap

1. Set up a "speed trap" on the playmat.
2. Open the ALBA programme and open the "Motion -*Introduction to Speed*" program
3. Measure the length of the mask on top of your vehicle.
4. Record the time for the vehicle to pass through the light gate.
5. Record the instantaneous speed of the vehicle.

INSTANTANEOUS SPEED- Road Safe



[Speed Cameras in D&G]

Speed cameras

Cameras are used to discourage drivers from exceeding the speed limit.

Using the websites **www.dft.gov.uk** (click on Road Safety and then Safety Cameras) and **www.nationalsafetycameras.co.uk**, find out the rules for placing speed cameras. On a road map, mark the locations of cameras in your area. Why do you think they are where they are?

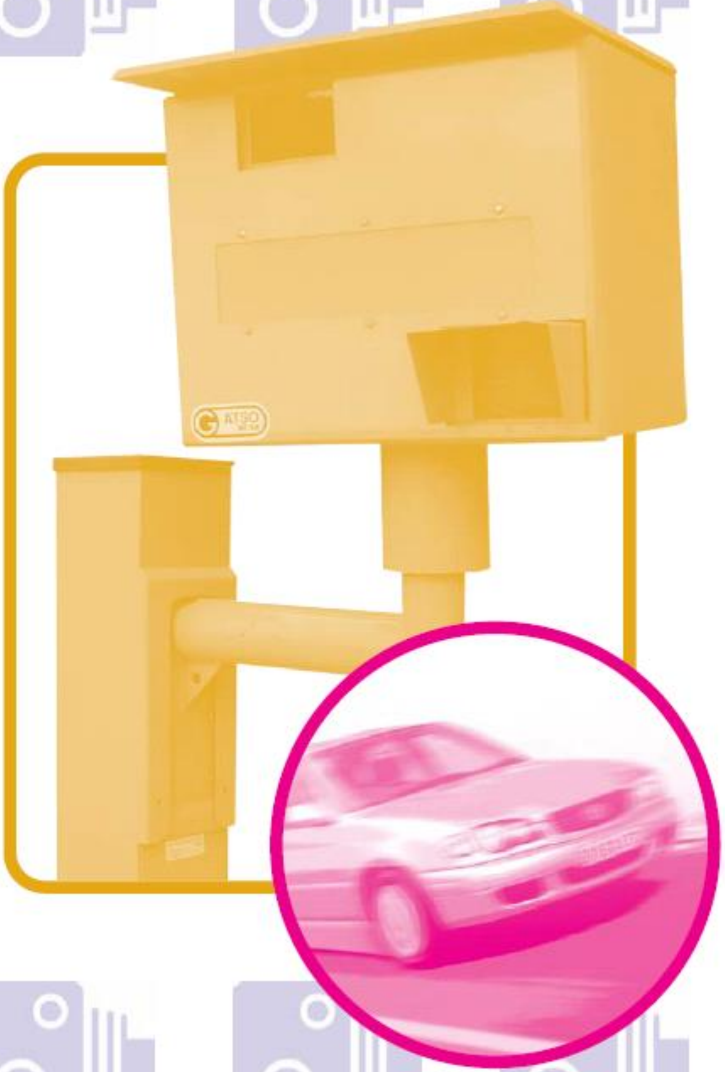
Write an article describing how cameras work, why they are needed and how effective they are. This could be for a local newspaper. Could you use quotes or statements from family members or friends about their views.

Cars

What features of car design help drivers to control their speed? Do any aspects of car design encourage drivers to go too fast? Also think about how cars are advertised and promoted. What sort of adverts would influence your choice of car and why? What else could manufacturers do to help drivers?

Most speedometers are a dial with numbers around the edge and an arrow pointing towards the speed the vehicle is doing. Is this the best design? Are there other types?

Design a new speedometer. Think about how it tells the driver what speed they are doing and how it could warn him or her if they are going too fast.



	BUILT-UP AREAS * (30)	SINGLE CARRIAGEWAY	DUAL CARRIAGEWAY	MOTORWAY (70)
Cars and motorcycles (including car derived vans up to 2 tonnes maximum laden weight)	30	60	70	70
Cars towing caravans or trailers (including car derived vans and motorcycles)	30	50	60	60
Buses and coaches (not exceeding 12 metres in overall length)	30	50	60	70
Goods vehicles (not exceeding 7.5 tonnes maximum laden weight)	30	50	60	70**
Goods vehicles (exceeding 7.5 tonnes maximum laden weight)	30	40	50	60

These are the national speed limits and apply to all roads unless

These are the national speed limits and apply to all roads unless signs show otherwise.

* The 30 mph limit applies to all traffic on all roads in England and Wales (only Class C and unclassified roads in Scotland) with street lighting unless signs show otherwise.

** 60 if articulated or towing a trailer.

Built up areas generally have roads with street lights. Unless signed otherwise, the speed limit is always 30mph, no matter the number of lanes.

Single carriageway is an undivided road with no centre barrier.

Dual carriageway is a two way divided road with a central barrier that you are able to cross from side roads.

Motorway is a two way divided road with a central barrier containing slip roads. It is only possible to access a motorway via slip roads and there is no crossway traffic.

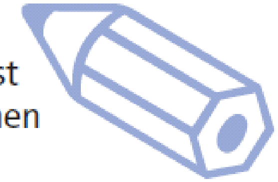
Activities

There are many reasons and excuses for speeding (such as "I was late", "everyone else does it" and "I enjoy driving fast").

In a pair:

- Make a list of all the reasons you can think of
- Create a questionnaire (example opposite)
- Ask people you know who drive (parents, their friends, teachers, etc) to complete the questionnaire
- Keep the questionnaires anonymous, but record whether the respondents are male or female and their age
- Collate all the responses together.

Speeding Questionnaire



Produce a report analysing the results and identifying the most common reasons for speeding and any differences between men and women and between age groups.

Respondent 1	Male	Female	Age	
Reason for Speeding	Never	Sometimes	Often	Always
Late				
Other drivers speeding				
I think it's safe to speed				

Discussion Points

In small groups:

- Brainstorm the best ways of raising awareness about the dangers of speeding.
- What methods would you use e.g. TV adverts, posters, something else?
- Where would you target publicity? (locations/events)

Activities

Design an awareness raising campaign to include a leaflet, poster and press release.

Who do you think are the key target groups? Think about age, sex, and also social activities. Also take into consideration those locations and times where speeding is more common. Decide whether to cover all drivers or a specific group (does your decision change the method you would use, your target group or where you would locate the campaign?) Think about campaigns used by other groups and try to make yours effective for your target audience. Run your campaign either in school or in your local community, make sure that you establish a way to evaluate the success of the campaign. Set a time limit for the campaign, this could be a couple of days or a week or more. You will need to draw up a plan of action to ensure the smooth running of the campaign and source all the materials that you need to set it up. Have you ever been a passenger in a car and been concerned that the driver is going too fast? Look at **www.brag.org.uk** to see how one group of young people have dealt with this issue.

Take it further...

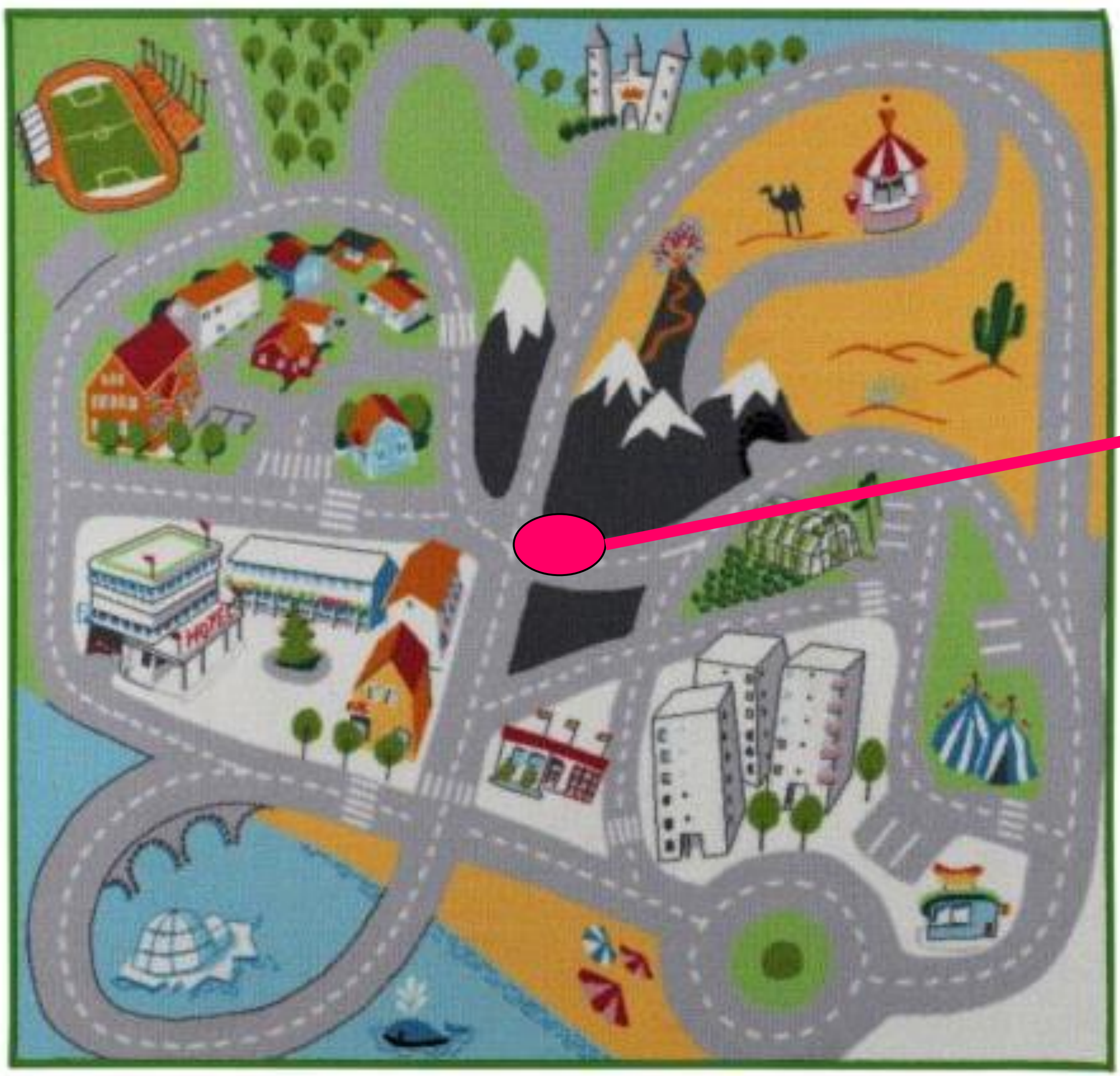
Did you know?

In 2004 a survey of vehicle speeds in Britain:

- 53% of car drivers exceed the speed limit on 30 mph roads in built-up areas
- On 40 mph roads, 27% of car drivers exceed the speed limit
- On motorways, 56% of car drivers exceed the speed limit
- On dual carriageways in non-built up areas, 49% of car drivers exceed the speed limit
- 48% of motorcyclists exceed the speed limit on 30 mph roads in built up areas.

Activities

In the future, cars may not be able to exceed the speed limit. Using the Useful Links section, find out about Intelligent Speed Adaptation (ISA). Organise a class debate. Have one or two people to speak for and against the motion "This class calls for all cars to be fitted with technology to stop them exceeding the speed limit". Think about the advantages and disadvantages of taking the control away from the driver. What is best for society?



“Speed camera” Measure instantaneous speed here

"Speed camera"
Measure instantaneous speed here

- At rest- in Physics we use this term to mean not moving. We can also say the object is stationary.

- *It is not the same word as pens and pencils which are stationery!*

Section 9
Uniform/ Constant/ Steady Speed

Learning Intention
Uniform speed is when the speed remains constant and doesn't change for all or part of the journey.

Revision

1. State the meaning of the word instantaneous speed.
2. Why is it difficult to measure instantaneous speed?
3. State the equation for instantaneous speed.
4. What instrument in the car measures your instantaneous speed?
5. If Mrs Bowker cycled from Lockerbie to Dalkeith, a distance of 107 km and this takes 4 hours 16 mins, calculate her average speed.

Uniform/constant/steady Speed

<u>Uniform/ constant/ steady Speed</u>

Sometimes through the whole journey your speed will not change. This could be because you have cruise controls on. We would say that your speed is UNIFORM when your speed isn't changing. It remains constant.

$$\textit{Uniform speed} = \frac{\textit{distance travelled}}{\textit{time for the journey}}$$

Uniform Speed /constant speed/ steady speed

When your speed is uniform we mean that your speed isn't changing. It remains constant or steady

$$Uniform\ speed = \frac{distance\ travelled}{time\ for\ the\ journey}$$

Uniform speed

Do you think people often travel at a uniform speed?

Discuss times when the speed might be uniform and when it might not be uniform.

WHY?

$$\textit{average speed} = \frac{\textit{total distance travelled}}{\textit{time for the whole journey}}$$

$$\textit{instantaneous speed} = \frac{\textit{length}}{\textit{time to pass a point}}$$

$$\textit{Uniform speed} = \frac{\textit{distance travelled}}{\textit{time for the journey}}$$

Section 10
displacement &
velocity

Learning Intentions

- *Velocity = Displacement÷Time*
- Displacement is the direct distance from the start of your journey to the end is a certain direction.
- Velocity is the displacement covered during the journey divided by the time taken. It is measured in metres per second m/s. You must quote a direction when writing down a velocity

Distance = “how far we’ve travelled”

$\Rightarrow$ symbol *d*

$\Rightarrow$ units metres, *m*

And later we’ll show distance is….

$\Rightarrow$ (scalar quantity

(the magnitude and unit fully describes this quantity)

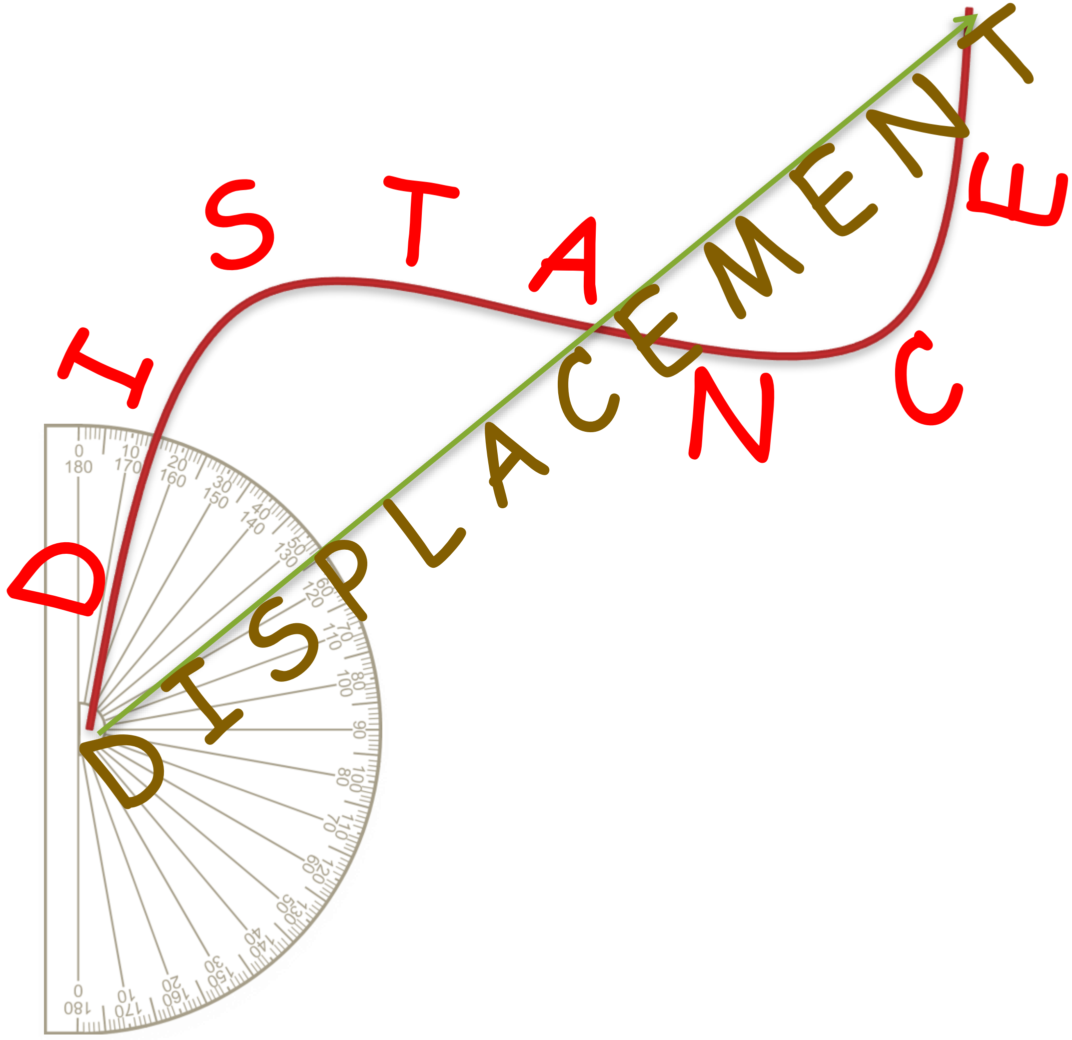
Displacement = "how far we've travelled in a straight line (from *A* to B)" (include your direction)

⇒ symbol *s*

⇒ units, metres, *m*

⇒ Vector quantity

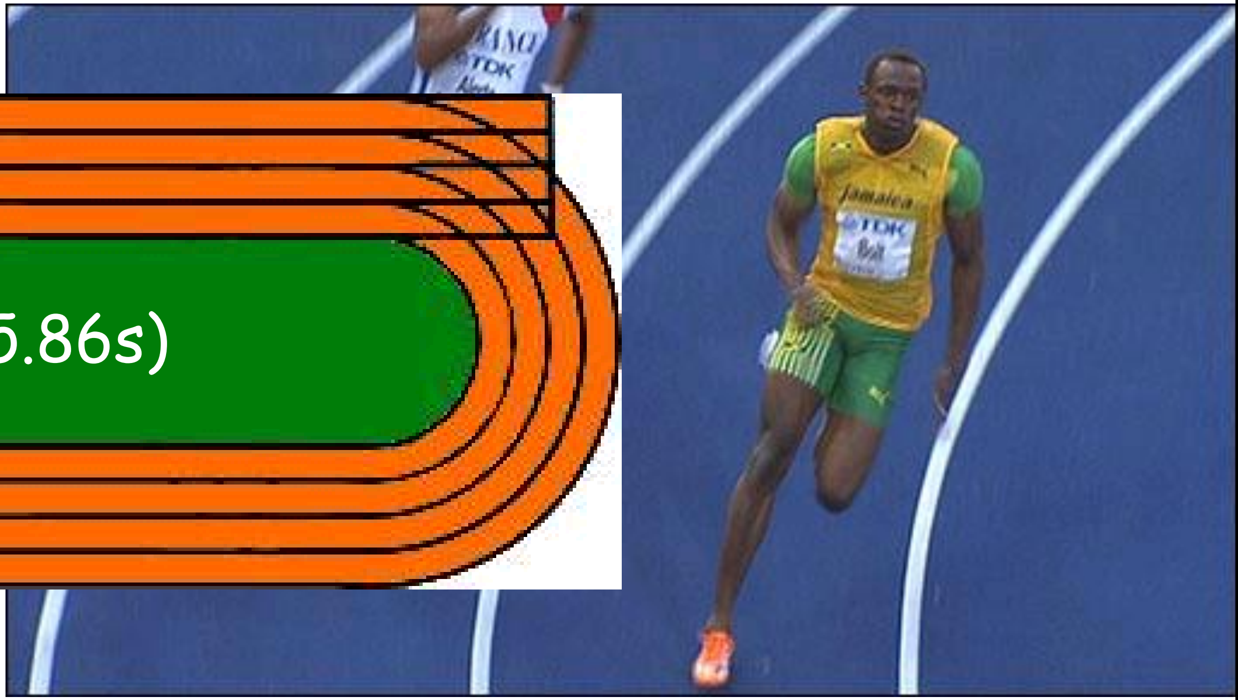
⇒ Must quote the direction


DISTANCE
DISPLACEMENT

- Displacement is how far you have travelled in a straight line. We would say “as the crow flies”

- Displacement is how far you have travelled in a straight line. We would say "as the crow flies"

- In a 100 m race the magnitude of your distance and displacement are the same, but not in a 400 m race



http://news.bbc.co.uk/sport1/hi/athletics/8210700.stm

http://www.telegraph.co.uk/sport/sportvideo/7236169/Usain-Bolt-blasts-to-400m-victory.html

Distance can have the same magnitude (size) as displacement but displacement can never be greater than distance
Speed and velocity can have the same magnitude if you travel in a straight line
Velocity can never be greater than your speed.

The Velocity of my vehicle

TASK

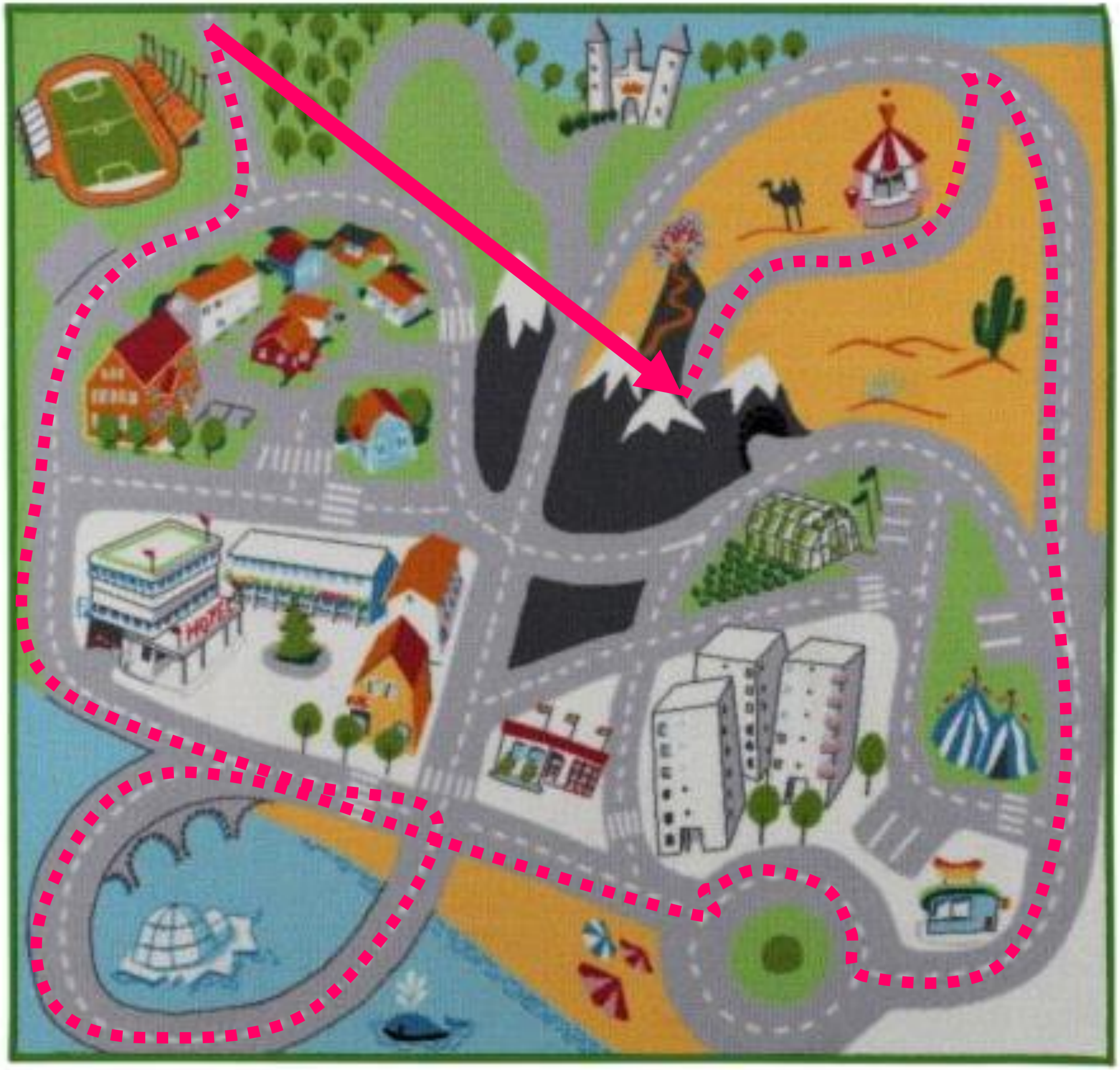
We need to know the

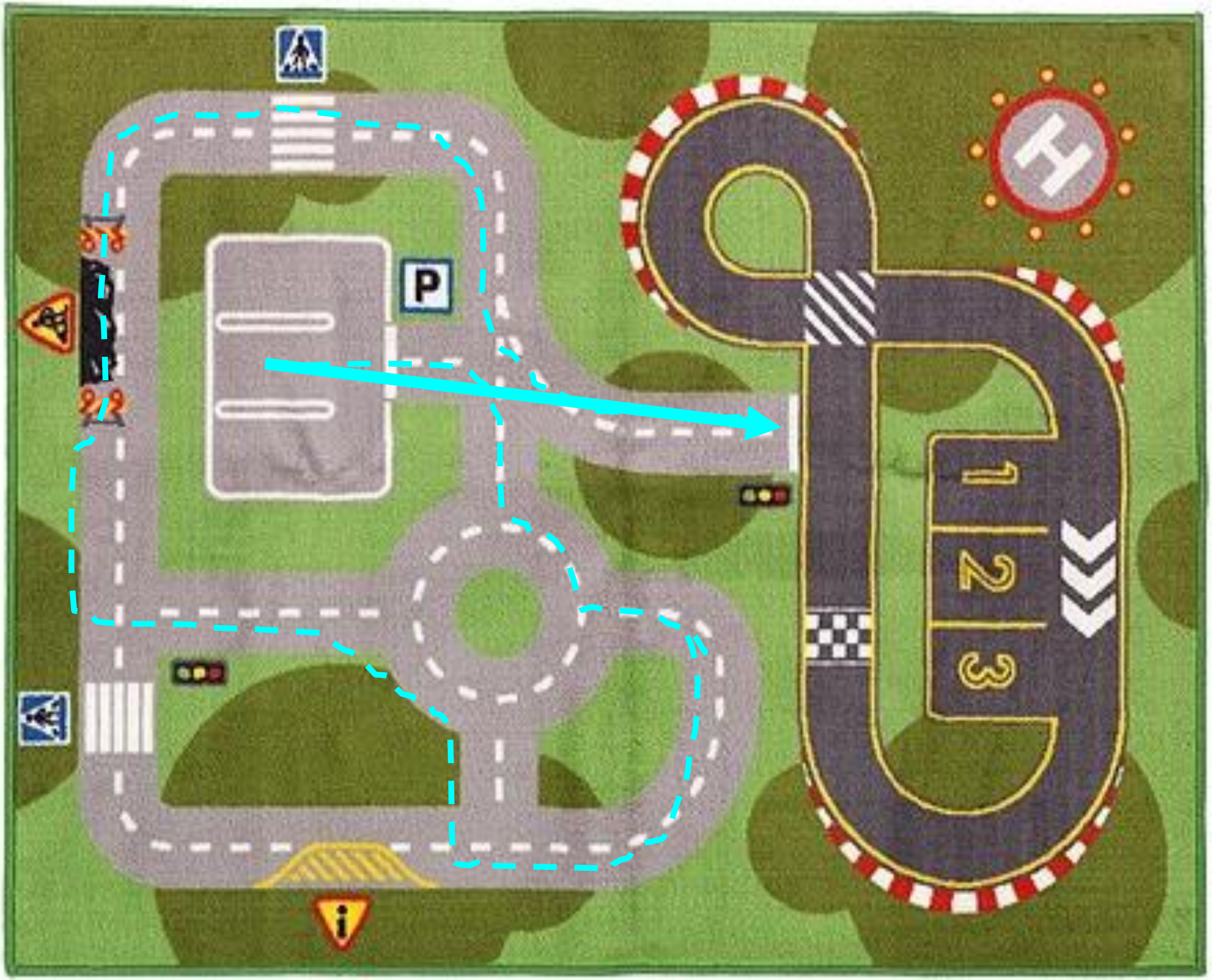
1. displacement of your vehicle.
2. the time for the whole journey
3. the AVERAGE VELOCITY of the vehicle for the journey

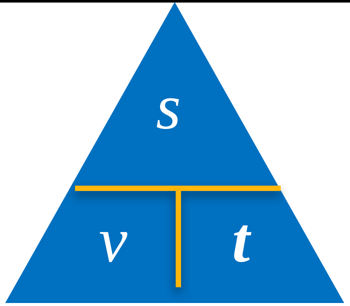
YOUR TASK.

Working in teams you need to:

1. *Measure the DISPLACEMENT that the car will travel following the pre-defined course.*
2. *Record this value on your worksheet.*
3. *Time how long each person in the group takes to complete the course.*
4. *Record this value on your worksheet*
5. *Time how long your journey takes and note down*
6. *Record as tally marks on your worksheet every time each person in the group leaves the track*
7. *Find the DIRECTION of travel from START to FINISH using a compass or your mobile phone.*


HOTEL


P
1
2
3

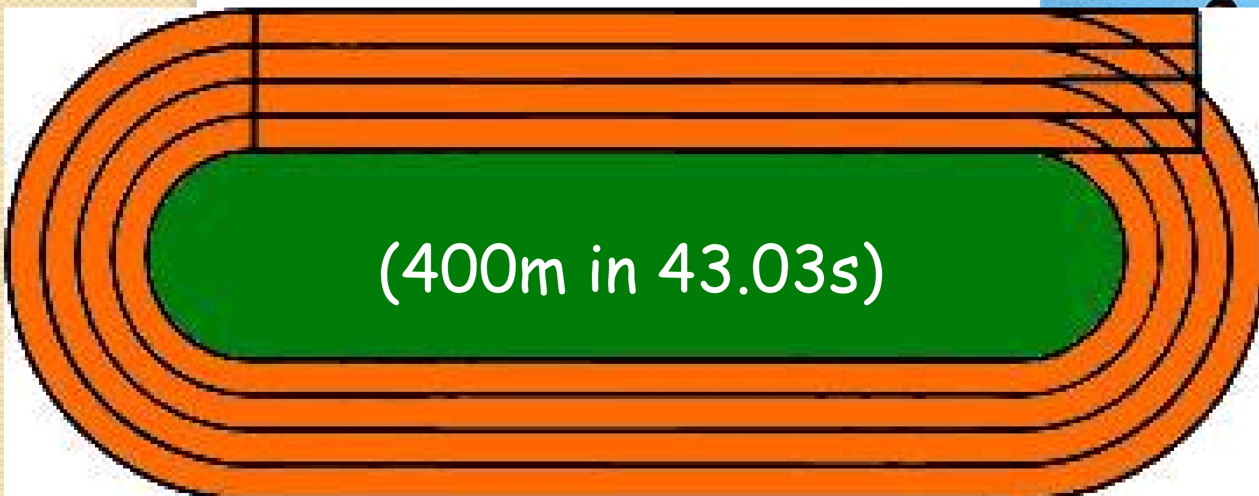


$$\textit{Velocity}\ \text{(metres/second)} = \frac{\textit{Displacement}\ \text{(metres)}}{\textit{Time}\ \text{(second)}}$$

$$Velocity = \frac{displacement}{time}$$

$$v = \frac{s}{t}$$

- Velocity = displacement ÷ time
- In a 100 m race the magnitude of your speed and velocity are the same, but not in a 400 m race



Answer the questions on the sheet

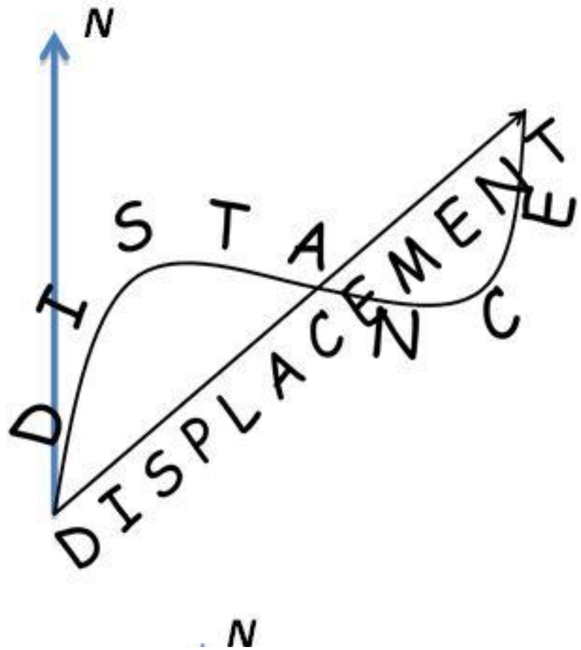
VELOCITY

Displacement = *10 m*

Distance = *15 m*

Time = *5 s*

Direction = °



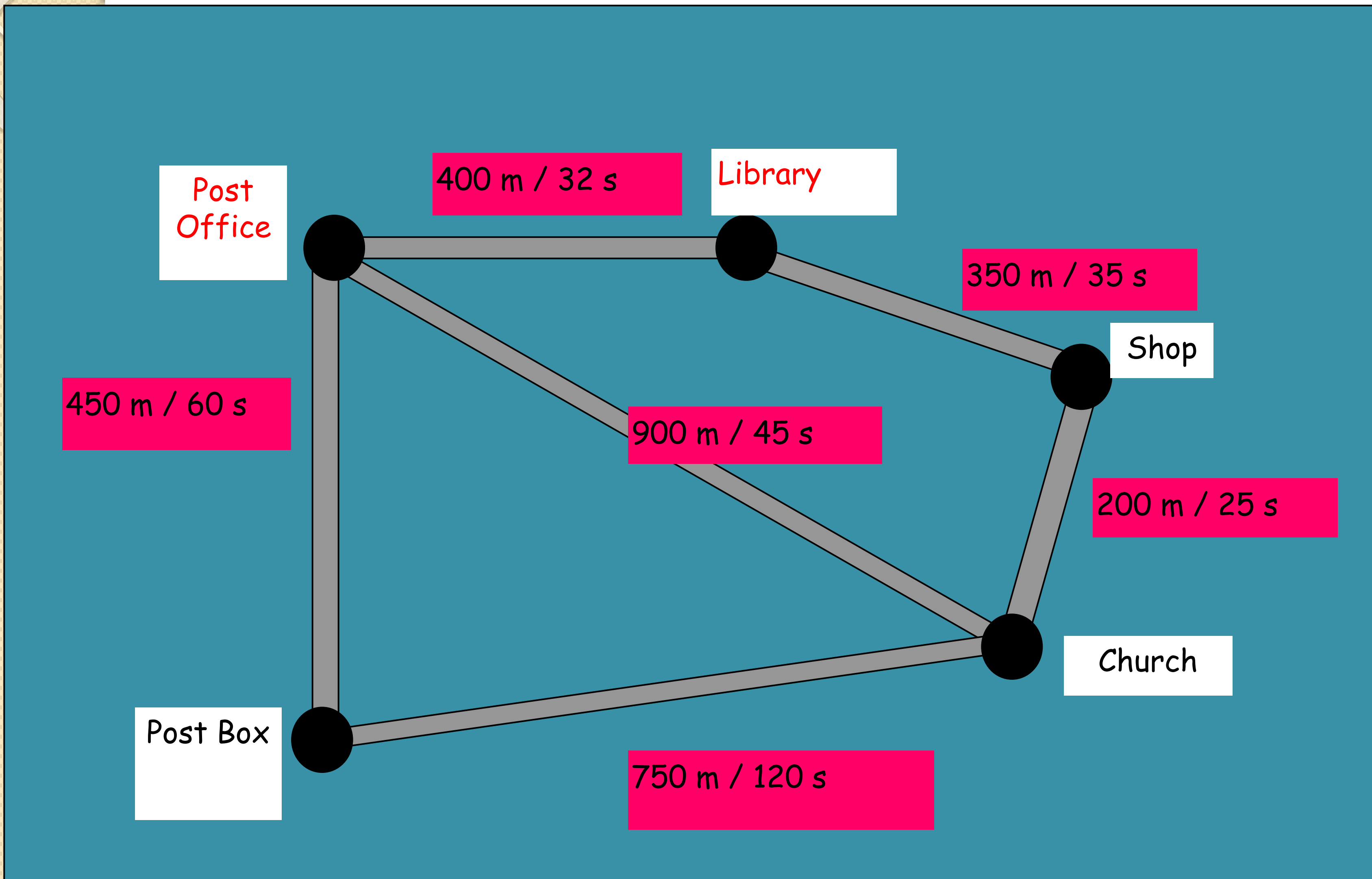
Speed =

Velocity =

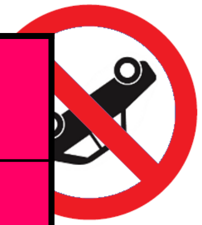
[displacement and velocity]

THE POST VAN & AVERAGE VELOCITY.

velocity post van



Journey	Average Velocity
Post Office → Post Box	
Post Office → Church	
Post Box → Church	
Post Office → Library → Shop → Church	
Post Office → Post Box → Church	
Post Office → Church → Shop → Library	



You need, teacher, books, tape measure, string, stopwatch and compass

Take your teacher on a velocity walk in the playground

DYNAMIC WORD BINGO-REVISION

Distance	Acceleration	Mechanics
Displacement	At rest	Vehicle
Average Speed	Velocity	Time
Inst. Speed	stationary	Speed
kinematics	uniform speed	Instantaneous speed
dynamics	m/s	metres
second		

TRANSPORT UNIT

Scalar

- A quantity that is fully described by a value and unit

Vector

- A quantity that is fully described by a value, a direction and unit

CHECK OUT MORE ON VELOCITY & VECTORS

- http://www.physicsclassroom.com/class/1dkin/U1L1a.cfm

REVIEW

REVIEW

<u>WHAT ARE DISTANCE AND DISPLACEMENT?</u>

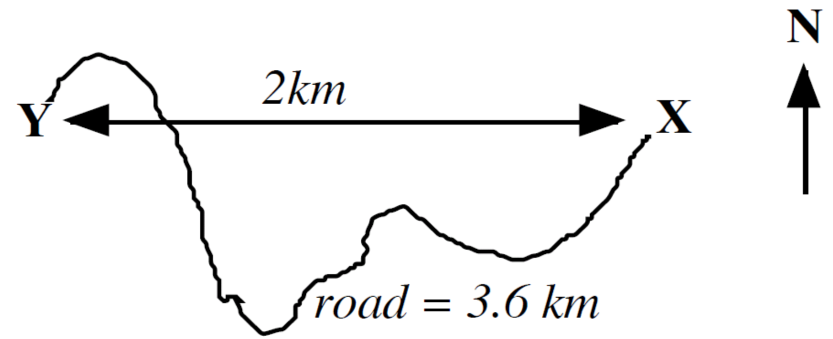
- **<u>Distance</u> is length. How far you've travelled (e.g. 100 metres)**
- **<u>Displacement</u> is direct distance in a particular direction (e.g. 100 metres to the right)**

- ***<u>WHAT ARE SPEED AND VELOCITY?</u>***
- **<u>Speed</u> is the rate of covering a distance (e.g. 50km/h)**
- **<u>Velocity</u> is rate of displacement in a particular direction (e.g. 50 km/h north)**

Revision
Vectors and Scalars

1. What is the difference between a vector quantity and a scalar quantity?
2. Use your answer to question 1 to explain the difference between distance and displacement.

Vectors and Scalars



1. A man walks from X to Y along a winding road.

a) State his displacement at the end of his walk.

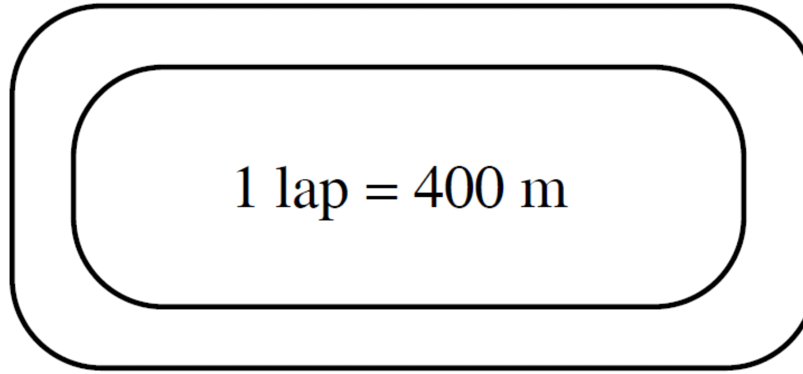
b) State the distance he has walked

2. If the walker in question 1 above took 40 minutes for his walk, calculate the walkers

a) average speed

b) average velocity?

Repeat this question for a runner in the 800 m race whose winning time was 1 min 54 s.



One complete lap of a running track is 400m.

An athlete completes one lap in 48 s in the 400 m race. Determine her

- a) distance travelled
- b) displacement
- c) average speed
- d) average velocity.

Practice Questions

A car travels 40 km north, then turns back south for 10 km. The journey takes 1 hour.

What is

a) the displacement of the car

b) the distance the car has travelled

c) the average velocity of the car }use km h-1

d) the average speed of the car? }

Practice Questions

A car drives 60 km north, then 80 km east, as shown in the diagram. The journey takes 2 hours.

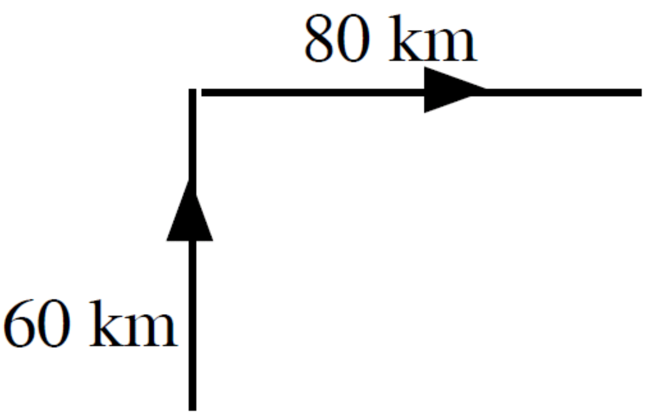
Calculate the

a) distance travelled

b) displacement

c) average speed

d) average velocity.



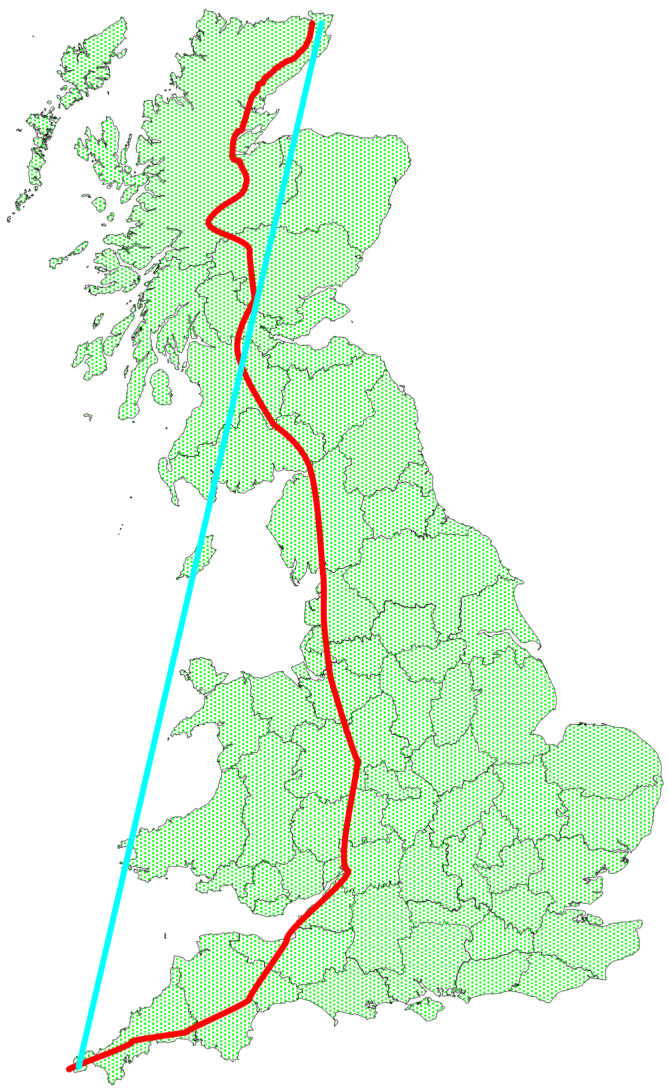
REVISION

Check through your Need to Know Sheet and check that you understand everything on it.

- State the difference between distance and displacement.
- State the difference between speed and velocity
- State the acronym you should use when you do a calculation.
- Record the types of speed we have covered.
- Which document gives the rules for UK roads?
- Draw the road sign for the following
  - National Speed Limit Applies
  - No entry
  - Risk of ice.
- State the two parts that make up the stopping distance of a vehicle.

ADDITIONAL MATERIAL

FOR THOSE WHO NEED ADDITIONAL MATERIALS FOR BRAIN FOOD TRY THESE SLIDES.



1193 miles

26½ hours

What was the average speed for the journey?

615 miles

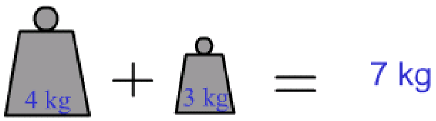
26½ hours

What was the average velocity for the journey?

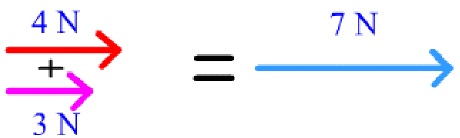
Virtual Int 2 Physics

Adding vectors

When two or more scalar quantities are added together the result is simply the arithmetic sum of each. For example a mass of 4 kg and one of 3 kg, when added make a mass of 7 kg.

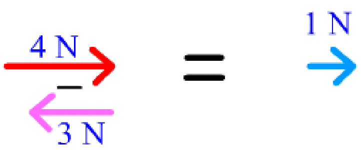


When two or more vector quantities are added, provided they act in the same direction, the addition is quite straightforward. A force of 4 N to the right is added to a second force of 3 N to give a resultant force of 7 N to the right



The addition of two or more vectors is called the resultant.

The situation becomes a little bit more complicated if the second force is directed to the left. Now we must remember that vectors can be positive or negative.
The resultant is 4 N +(- 3) N which is 1 N to the right.



Notice how we represent a vector by a line with an arrow.
The LENGTH of the line represents the SIZE of the vector, for example we could use 1 cm to represent 1 N. The DIRECTION of the line must be parallel to the vector direction AND point in the correct direction. Notice that the -3N force above has the arrow pointing to the left.

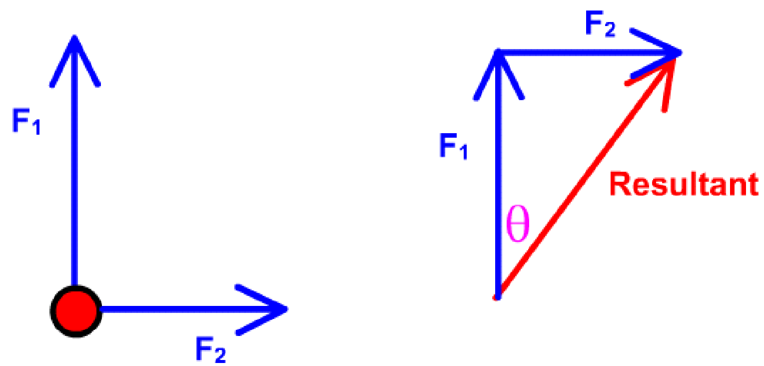
When giving the answer to a vector problem you MUST give both the size (magnitude) and direction.

Click here to continue

Virtual Int 2 Physics

Adding vectors (2)

The resultant of two or more forces which act at an angle to each other can be found by drawing a vector diagram. Consider the example below where two forces act on an object as shown.



A vector diagram is drawn by taking each of the vectors in turn and joining them HEAD to TAIL.

The line from the tail of the first vector to the head of the last represents the resultant.

The size and direction of the resultant can be found by drawing the vectors to scale, for example using 1 cm for 1 N, then measuring the size of the resultant with a ruler AND then measuring the angle with a protractor.

Alternatively Pythagoras Theorem can be used to find the size of the resultant, when the two vectors are at 90°. The angle can be calculated using trigonometry, for example $\tan\theta = \dfrac{F_2}{F_1}$.