

'CARS - MATHS IN MOTION'

Suggested Programme of Study

Due to the cross curricular nature of this program, we have purposely not cross referenced this document to either the English National Curriculum documents or the Scottish Guidelines 5 to 14.

WEEK 1

One hour per day

Week 1 Day 1

Angle measurement

Introduce/Revise the correct use of the protractor.
Emphasise the idea of 'counting round' from zero to ensure that pupils use the correct set of numbers.

Introduce/Revise the vocabulary of acute, right angles and obtuse angles.
Give the children the opportunity to draw, estimate and then measure angles, gradually refining.

Week 1 Day 2

The concept of scale

Model cars and aircraft - the ratio of scale. (How much bigger is the real thing?)

Scale and Maps. Find the scale information on single sheet maps and books of maps.

Different modes of scale representation by ration and diagrammatically.
Making and marking a 'paper measuring strip' with an appropriate scale by placing a strip of plain paper adjacent to the scale diagram.

Use the scale diagram to measure straight (point to point) distances using the scale ruler.

Week 1 Day 3

Measuring curved lines

Use cotton or string to measure the length of curved lines (rivers and roads). Then use the 'paper measuring strip' or the scale diagram on the map to determine the actual distance on the ground.

Week 1 Day 4

Gear Ratio

Experiment and collect data on gear ratio using a bicycle (relating the pedal rotations to the wheel rotations).

Week 1 Day 5

Air Resistance (Drag, Lift and Downforce)

Experiment with the effect of air movement and resistance. Different sizes of parachute and weights of suspended object.

WEEK 2

Week 2 Day 1

Geographical detail and reference books

Introduce pupils to the country where the race is being held. (The race location has been chosen by the teacher beforehand). They become adept at finding it on different maps.

Use reference materials to gather information about different aspects of the country.

Week 2 Day 2

Measuring and estimating angles and straight lines

Introduce pupils to the duplicated track plans. They are shown the suggested method for drawing the lines which will be used to measure angles. They then measure and classify all the track features using the strategies that they mastered in Week 1 in order to find the total length of the track circuit.

Week 2 Day 3

A continuation of the activities on Week 2 Day 2.

Week 2 Day 4

Fuel consumption

Pupils should know (or be shown) what 'a litre' actually looks like. The concept of Inverse Proportion can be introduced at a level appropriate to the age and abilities of the pupils. Within the project there are only three values needed - Distance, Fuel Consumption and Fuel Volume.

Use the formula 'Distance divided by consumption = Fuel Required' on a series of examples.

Week 2 Day 5

Fuel consumption

Utilise the strategies devised in Day 4 to work out the fuel required for 'the race' - the default consumption is 2 km/litre.

Multiply the length of one lap by the number of laps in the race to determine the race distance.

Pupils should be prompted to realise that, if their answers have a decimal part they will need to 'round up', as opposed to 'nearest whole number'. Use the strategies devised on Day 4 to determine fuel required.

WEEK 3

Week 3 Day 1

Percentages and Workshop Adjustments

Pupils should understand the concept of percentage.

Show how to work out the percentage of 'Maximum Safe Speeds' using an electronic calculator, e.g. 82% of 256km/h.

Whole class

Pupils should be introduced to the software and shown how to display their 'Team Screens'.

Pupils should discuss the various options of 'Driver Temperament'. What do terms like 'Sedate', 'Cautious' or 'Dangerous' actually mean when selecting a driver.

Pupils should be shown how to access the 'Workshop Adjustments' and move the sliders to change the performance percentages. They should be given ample opportunity to experiment with different settings to achieve the best possible combination of percentages. Discussion (within each group) should be encouraged.

Week 3 Day 2

Probability Mean Speeds and Race Planning

Pupils should be shown the 'Race Planning' screen and how to enter the category for every feature and their own safe speeds.

Show pupils how to carry out a 'Practice Lap'.

Encourage pupils to consider the possible significance of messages relating to probability and also other messages which appear after successful practice laps. (What does '1 in 10 chance of a crash' really mean in the context of a 50 lap race?)

Encourage pupils to discuss (within their group) their decisions about ideal speeds for each feature

(a) Give whatever instruction necessary to help any groups who have not yet been able to completed the 'Pre Race' planning in a satisfactory manner.

(b) Show other groups how to copy 'cars' so that they can create up to four cars from the data for the first car - making subtle changes and noting the effects.

[Week 3 Day 4](#)

Pit Team Briefing - Friction

Look at the weather forecast for the time of the race and study the tyre performance information for different weather conditions.

Experiments can be performed by dragging objects across different flat surfaces, rough, smooth, wet, dry, oily etc.

Enter fuel requirements and select tyres for the cars.

[Week 3 Day 5](#)

Race Day - Note taking

Explain to the pupils how to take notes of what is going to happen during the race. It should be pointed out that writing suitably spaced lap numbers before the race will aid the rapid noting of relevant information.

Point out to pupils that they will be expected to write an account of the race from these notes.

[WEEK 4](#)

[Week 4 Day 1](#)

Report Writing

Teachers should provide 'models of good practice' in report writing by showing newspaper reports from a variety of differing publications. An account of the race just completed - created by the teacher and read to the children, is particularly helpful. Pupils should write and illustrate their newspaper report of the race. The 'Race Log' file created during the race can also provide factual information of what might have been missed.

Week 4 Day 2

Statistics

Pupils should be shown race reports for a selected number of laps and given instruction in their interpretation.

Show how to interpret the 'Race Diagram' for race position, mean lap speeds, weather conditions, fuel state and tyre wear.

Show how to extract this information from the program.

Week 4 Day 3

Comparative Statistics

Pupils should be given photocopied printouts of their race statistics and those of the race winner - especially the 'Race Settings'.

In this way it will be possible for them to draw conclusions about how their performance can be improved in any subsequent races.

Week 4 Day 4

Spreadsheets

Pupils should be given access to spreadsheet software into which some lap report data has been loaded. The more able pupils can be shown how to import this data for themselves from CSV files.

Week 4 Day 5

Word Processing

Pupils can use word processor software to write up refined reports with embedded pictures and other information.

WEEK 5

It is important that pupils have the opportunity to exercise and develop their newly acquired skills. To achieve this, a second race should be planned on a different circuit. In this second race, an added degree of difficulty should be included. This is a change in the weather during the race. Two changes can be created for older or more experienced pupils.

Week 5 Day 1

Time - Estimated Lap Timings - Partial Fuel Loads

Pupils should be alerted to the following:-

- a. The weather is going to change during the race, suggesting a pit stop to change tyres.
- b. They will need to decide on the most suitable tyres after studying on screen statistics.
- c. They will need to calculate how many laps will have elapsed before the weather changes.
- d. They may decide to put only put in enough fuel to take them to the pit stop and then the end of the race.

Pupils may need to be lead to notice that the weather can change every 15 minutes and so knowing how many laps will be completed in a 15 minute period is essential. Discuss how many seconds there are in one minute and 15 minutes.

Discuss how you find how many laps a car can do in 15 minutes (by dividing 900 seconds by the lap time in seconds)

The pupils should work on examples.

Week 5 Days 2 - 5

Pupils go through the various stages outlined earlier - but with a greater level of independence. This should allow all work to have been completed by Day 5, when the race can be held.

Because of the increased level of independence of the pupils, the teacher will be able to spend more time helping the less able and encouraging the 'gifted and talented' pupils to undertake a wider range of mathematical experimentation within the context of the project.

WEEK 6

A third race can be planned with a complex track and more than one change in the weather. For able pupils, electronic calculators can be banned.

Pupils can be expected to carry out the various tasks with a greater degree of confidence and competence - secure in the exercise and understanding of the various mathematical skills that are part of 'Maths in Motion'.