THE JAGUAR MATHS IN MOTION CHALLENGE FOR SCHOOLS

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CarsMaths in Motion

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SUGGESTED PROGRAM 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 students use the correct set of numbers.
Introduce/Revise the vocabulary of acute, right, reflex and obtuse angles.
Give students 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 ratio 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.

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WEEK 2

Week 2 Day 1

Geographical detail and reference books.
Introduce students 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 3

Week 3 Day 1

Percentages and Workshop Adjustments.
Students 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 - Students should be introduced to the software and shown how to display their 'Team Screens'.
Students should discuss the various options of 'Driver Temperament'. What do terms like 'Sedate','Cautious' or 'Dangerous' actually mean when selecting a driver.
Students 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.
Students should be shown the 'Race Planning' screen and how to enter the category for every feature and their own safe speeds.
Show students how to carry out a 'Practice Lap'.
Encourage students 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 students 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.
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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 students 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 students 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.
Students 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
Students 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.
Students 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.
Students should be given access to spreadsheet software into which some lap report data has been loaded. The more able students can be shown how to import this data for themselves from CSV files.
Week 4 Day 5
Word Processing.
Students can use word processor software to write up refined reports with embedded pictures and other information.

WEEK 5

It is important that students 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 students.

Week 5 Day 1
Time - Estimated Lap Timings - Partial Fuel Loads.

Students should be alerted to the following:-
a. The weather will 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.

Students 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 students should work on examples.

Week 5 Days 2 - 5

Students 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 students, the teacher will be able to spend more time helping the less able and encouraging more able students 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 students, electronic calculators can be banned.
Students 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 'Cars Maths in Motion'.