STUDENTS ON TRACK

SUPERCARS CHAMPIONSHIP Repco

SECONDRY ANSWER BOOK

INFORMATION FOR SCHOOLS AND TEACHERS

A visit to a round of the Supercars Championship provides fantastic opportunities for students to engage with and get excited about STEM education. In an environment where they can see, hear and smell STEM in action, children can make meaningful connections between the Australian Curriculum and the action on track. This booklet has been designed to be completed by students either independently or collaboratively and can be utilised both on the day or back in the classroom.

Alignment with the Australian Curriculum Year 9 - 10

Curriculum Area: Science	
Physical Sciences	Investigate Newton's laws of motion and quantitatively analyse the relationship between force, mass and acceleration of objects (AC9S10U05) Apply the law of conservation of energy to analyse system efficiency in terms of energy inputs, outputs, transfers and transformations (AC9S9U05)
Curriculum Area: Mathematics	
Algebra	Recognise the connection between algebraic and graphical representations of exponential relations and solve related exponential equations, using digital tools where appropriate (AC9M10A03)
Measurement	Solve spatial problems, applying angle properties, scale, similarity, Pythagoras' theorem and trigonometry in right-angled triangles (AC9M9M01) Solve problems involving the surface area and volume of composite objects using appropriate units (AC9M10M01)

General Capabilities	Cross Curriculum Priorities
• Literacy • Numeracy • Critical and Creative Thinking • Personal and Social Capability	• Sustainability

Source: Australian Curriculum Version 9, https://v9.australiancurriculum.edu.au/

ESCAPE THE SUPERCARS GARAGE CHALLENGE!

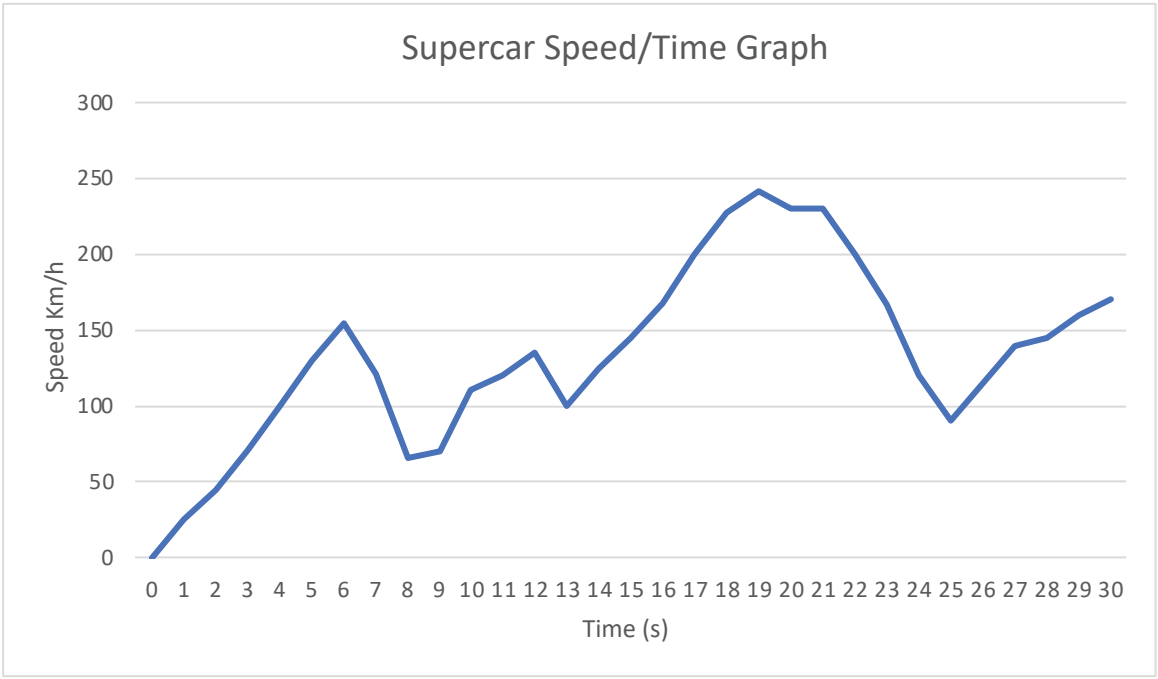
Scenario:

Oh no! You've been locked in a Supercars garage and need to escape. The door to get out is controlled by an eight-digit security keypad. To escape you must solve eight questions to reveal the secret security code and unlock the mechanism.

Rules:

- You can work independently, in pairs, or in small groups.
- Think carefully to answer each question.
- Write your answer down on the recording sheet.
- Once you have all the numbers for the keypad, check it with your teacher to find out if you can escape the garage!

Study this speed/time graph. It shows the speed of a Supercar over the first 30 seconds of a race.



1 For how many seconds was the Supercar in a state of deceleration?

The answer is the first digit in the code.

8
In a speed/time graph, deceleration is shown as a downward trend. This graph shows the Supercar was decelerating between seconds 6-8, 12-13, 19-20, and 21-25. This means the Supercar was in a state of deceleration for a total of 8 seconds.

2 For how many seconds was the Supercar travelling at a constant speed?

The answer is the second digit in the code.

1
A horizontal line indicates speed is constant on a speed/time graph. This graph shows the Supercar was at a constant speed between seconds 20 and 21, for a total of 1 second.

3 According to the graph, the initial speed of the Supercar was 0km/h and the speed after 6 seconds was 150km/h. First convert 150km/h to metres per second (m/s) by dividing by 3.6. Then calculate the rate of acceleration after 6 seconds using the formula $a = \frac{speed_2 - speed_1}{t}$

Round the result to the nearest whole number to find the third digit in the code.

= 150 ÷ 3.6
= 41.67
(41.67 – 0) ÷ 6
= 6.945

Rounded to nearest whole number = 7

4 Newton's second law of motion states that The net force acting on an object equals the mass of an object multiplied by the acceleration. It can also be written as $F_{net} = ma$

Use this information to calculate the net force of the Supercar, with a mass of 1355kg and an acceleration rate of 23.67.

The digit in the hundreds place is the fourth digit in the code.

0
= 1355 x 23.67
= 32,072.85
The zero is in the hundreds place.

5 The radius of this tyre is 336mm. The width of the tyre is 290mm. Calculate the surface area of the tyre (the part of the tyre that contacts the track) by first working out its circumference using the formula $2\pi r$ then multiplying the result by the tyre's width.

The digit in the hundred thousands place is the fifth digit in the code.

6

R = 336mm

Circumference = 2 x 3.14 x 336
= 2110.08 x 290
= 611,923.2mm²

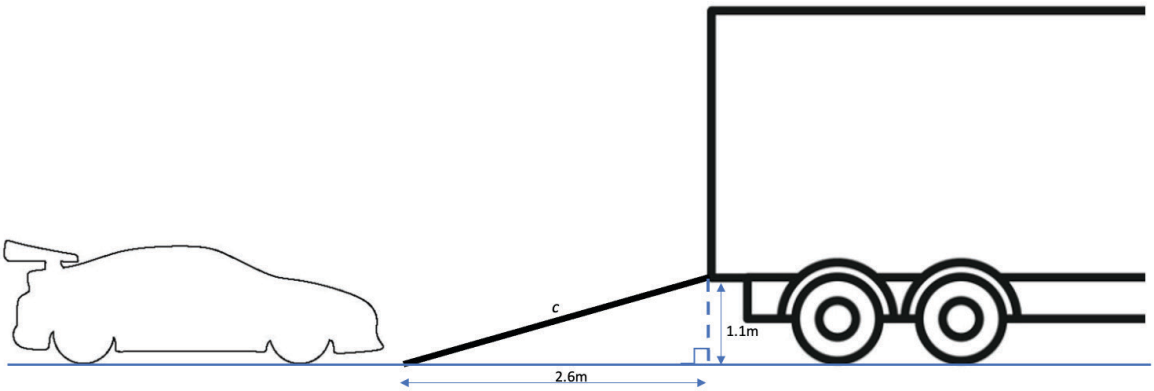
The 6 is in the hundred thousands place

6 Study this diagram. Use the Pythagorean formula $c = \sqrt{a^2 + b2}$ to calculate the length of the ramp the supercar needs to climb.

The digit in the thousandths place is the sixth digit in the code

3

$\sqrt{2.6^2 + 1.1^2}$ = 2.82312. The 3 is in the thousandths place.



7 Read these statements about types of energy involved in a Supercars race. Fill in the blanks to complete each statement.

The highlighted letters need to be rearranged to form the seventh digit in the code.

The highlighted letters spell out the number eight.

1. Chemical energy is the primary source of energy in a Supercar. It is stored in the F U E L which undergoes a chemical reaction to release energy.
2. Mechanical energy is generated by the Supercar E N G I N E ' S pistons and crankshaft.
3. Electrical energy is stored in the Supercar's B A T T E R Y which is used to power the ignition and electrical systems.
4. K I N E T I C energy is the energy that results from the mechanical energy from the engine allowing the Supercar to move.
5. Thermal energy is created in the form of H E A T produced by the Supercar engine's combustion as well as friction in its moving parts.

8 The amount of Kinetic energy (E_k), measured in joules (J), an object has can be calculated with the formula $E_k = \frac{1}{2}mv^2$ where m is the mass of the object, measured in kilograms (kg) and v is the speed at which it is moving, measured in metres per second (m/s).

Use the above information to calculate the amount of Kinetic energy a Supercar with a mass of 1355kg has when travelling at 68m/s.

The digit in the tens place is the eighth and final digit in the code.

6

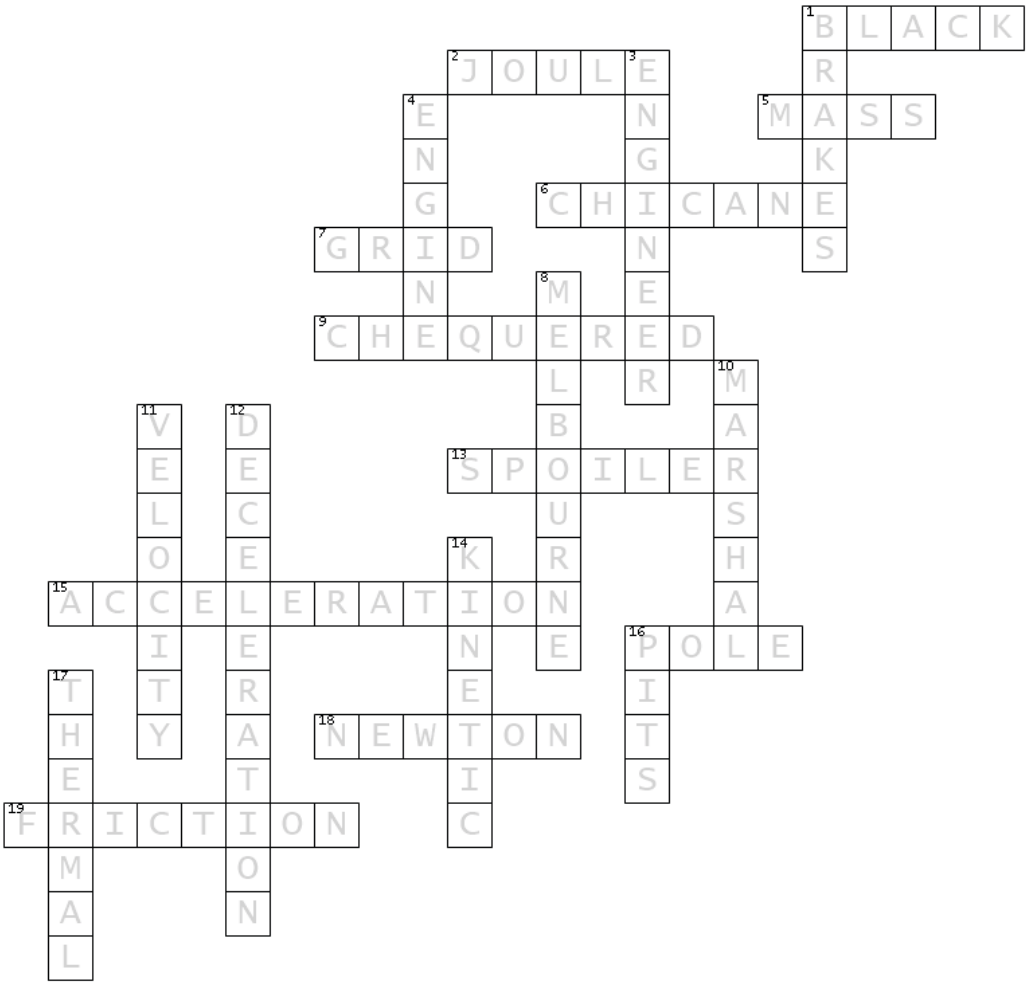
.5 x 1355 x 68^2
= 3,132,760J
The 6 is in the tens place

ESCAPE THE SUPERCARS GARAGE RECORDING SHEET

1st Digit	2nd Digit	3rd Digit	4th Digit
8	1	7	0

5th Digit	6th Digit	7th Digit	8th Digit
6	3	8	6

SUPERCARS CROSS WORD PUZZLE!



ACROSS	DOWN
1. Colour of flag indicating driver penalty	**1.** Allows driver to decelerate Supercar
2. Measure of Kinetic Energy	**3.** Person skilled in working with vehicles and machinery
5. Fundamental property of an object measured in kgs.	**4.** Provides power to Supercar
6. Sharp double-bend in a race track	**8.** City where Sandown 500 is held
7. Starting formation	**10.** Safety official at racetrack
9. Flag shown to indicate the end of the race	**11.** Describes how fast something is travelling
13. Provides downforce to Supercar	**12.** Slowing down
15. Speeding up	**14.** Type of energy due to motion
16. Starting position at front of grid	**16.** Place to change tyres, refuel
18. Unit that forces are measured in	**17.** Type of energy that produces heat
19. Contact force between tyres and track	

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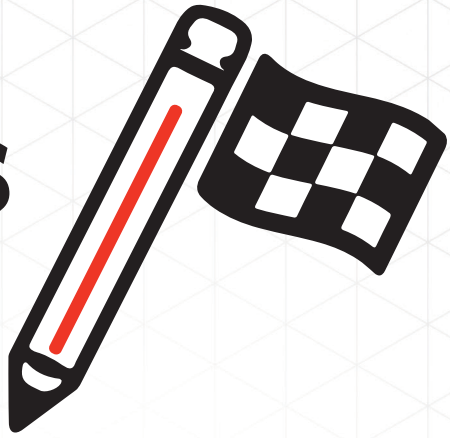

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