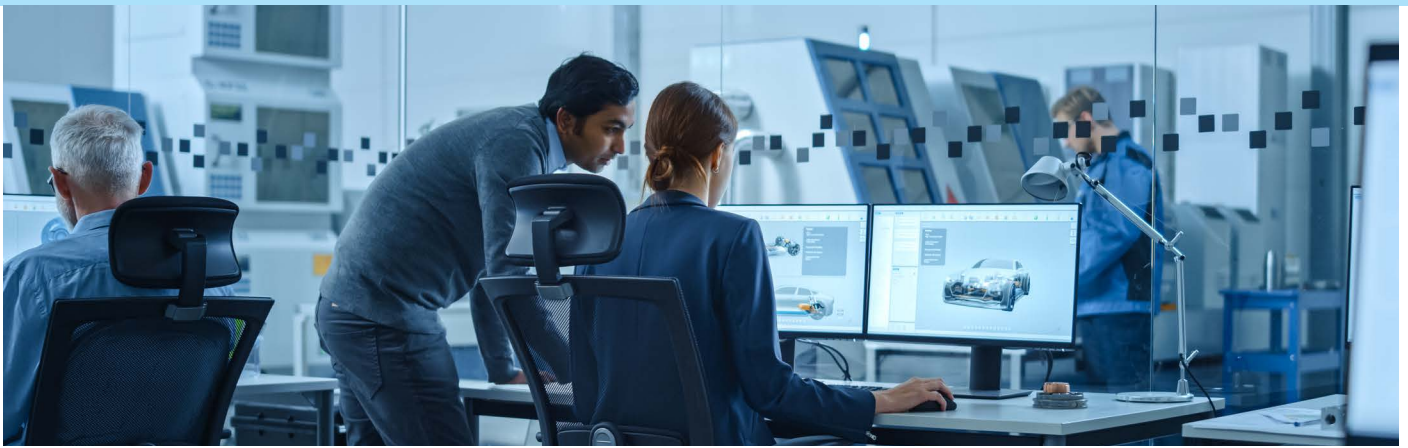


# MATHEMATICS IN CAREERS

## Investigation - Pet car alarm

**Key career focus for this investigation:** Software engineer, coding, information technology

**Related career areas:** Animal science



## THINKING ABOUT CAREERS

- Brainstorm information technology professions you can think of where maths is frequently used. Use <https://joboutlook.gov.au> to explore information technology related career pathways that include use of mathematics. *How is maths used in these scenarios? What maths is used in these scenarios?*
- This task focuses on how maths is used in designing a product that alerts a pet owner to an overheating car
- Explore careers such as software engineer, robotics engineer, to discover how maths is used in these. For a more extensive list of careers related to this task, with a maths / science focus, refer to the table at the end of the task and explore the maths used in these jobs.

## MATHEMATICS IN EVERYDAY LIFE AND CAREERS

### Mathematical focus for this investigation

- using formulas to solve problems
- using authentic situations to apply knowledge to solve real world problems
- implement algorithms

Scientists including information technology professionals use various formulae and algorithms. They apply their mathematical thinking and problem-solving skills in various situations. In this case specifically designing a product that alerts a pet owner to an overheating car.

Many people use various formulae and algorithms every day. For example, cooking recipes, long division and using a computer search engine all utilise algorithms. An algorithm is a well-defined set of instructions designed to perform a particular task or solve a type of problem. Anything that follows a set of specified instructions is an algorithm.

Brainstorm and share scenarios where this mathematics may be used in information technology professions to solve problems.

# MATHEMATICAL INVESTIGATION

## PET CAR ALARM

### TEACHER INFORMATION

### LINKS TO VICTORIAN CURRICULUM

Mathematics links to Victorian Curriculum Level 10	Application to work and life
<p><b>Patterns and algebra</b></p> <p>Implement algorithms using data structures in a general-purpose programming language (<a href="#">VCMNA334</a>)</p>	<p>Many people use various formulae and algorithms every day. For example, cooking recipes, long division and using a computer search engine all utilize algorithms. An algorithm is a well-defined set of instructions designed to perform a particular task or solve a type of problem. Anything that follows a set of specified instructions is an algorithm.</p>

### PROFICIENCY FOCUS: VICTORIAN CURRICULUM

#### This investigation focuses on: Understanding, Reasoning, Problem Solving

**Understanding** refers to students building a robust knowledge of adaptable and transferable mathematical concepts and structures.

This investigation focuses on:

- Describe their mathematical thinking.

**Reasoning** refers to students developing an increasingly sophisticated capacity for logical, statistical and probabilistic thinking and actions, such as conjecturing, hypothesising, analysing, proving, evaluating, explaining, inferring, justifying, refuting, abstracting and generalising.

This investigation focuses on:

- Students explaining their thinking
- Deduce and justify strategies used and conclusions reached
- Adapt the know to the unknown
- Transfer learning from one context to another.

**Problem Solving** is the ability of students to make choices, interpret, formulate, model and investigate situation, select and use technological functions and communicate solutions effectively.

This investigation focuses on:

- Students designing investigations and planning their approaches
- Verifying their answers are reasonable.

#### Information and Communication technology

Information Communication Technologies (ICT) are powerful tools that can support student learning. Students can develop and demonstrate their understanding of concepts and content in mathematics using a range of ICT tools. It is also important that students know how to use these ICT efficiently and responsibly, as well as learning how to protect themselves and secure their data.

# MATHEMATICAL INVESTIGATION

## PET CAR ALARM

### STUDENT INVESTIGATION WITH TEACHER GUIDE

#### INVESTIGATION BACKGROUND

Pets suffer when left unattended in a car with the windows rolled up on a hot sunny day. The temperature inside a car may reach greater than 40°C above the outside ambient temperature within an hour. By taking action to cool the interior and notifying the owner of impending pet harm, a car equipped with a pet-smart alarm could prevent harm to a pet left inside a hot car.

#### SOME PRE-INVESTIGATION TASKS

If your students have the TI calculator, they don't need the software. It is the calculator that connects to the TI-Innovator hub. The student is the brains that creates the codes that tells the TI-innovator what to do. For example, if the temperature reaches a critical temperature the code will direct the TI-innovator to activate the light sensor to flash, the sound sensor to beep and the sensor controlling the window to open.

If you have a TI-Nspire calculator, use this for the investigation. If you do not have a TI-Nspire calculator then:

1. Download the TI-Nspire™ CX II CAS student software from <https://education.ti.com/en-au/software/search>
2. Complete the 10 minutes of code for TI-Nspire™ CX II CAS technology, the link is <https://education.ti.com/en-au/activities/ti-codes/nspire/10-minutes>

#### YOUR INVESTIGATION

To understand the science behind the greenhouse effect and to use

- mathematics to analyse which characteristics to include in an ideal car
- coding and engineering to construct a model car with a pet-smart alarm system.

In your analysis you will need to include:

- An investigation into the temperature inside a closed car and if it increases by differing amounts depending on the colour of the car. If so how?
- An investigation into the temperature inside a closed car and if it changes by differing amounts as the size of the window changes. If so how?
- A graphical display showing the data collected to reach a decision on the colour and window size of the car.
- Does your analysis take into account the size of the pet? Discuss this.

If you have access to TI technology, use TI technology and Innovator Hub to build a model of the solution. Alternatively, another form of technology can be used to build a model of the solution.

To demonstrate the ideal model car with a pet smart alarm system you will:

- Construct a prototype car, including a support mechanism to hold the motor which opens the window.
- Write code to activate the alarm when the temperature reaches a critical level.

You will be required to demonstrate your working prototype through a short video created as the project is completed, which will document the process, and reveal the working prototype of the Pet Car Alarm.

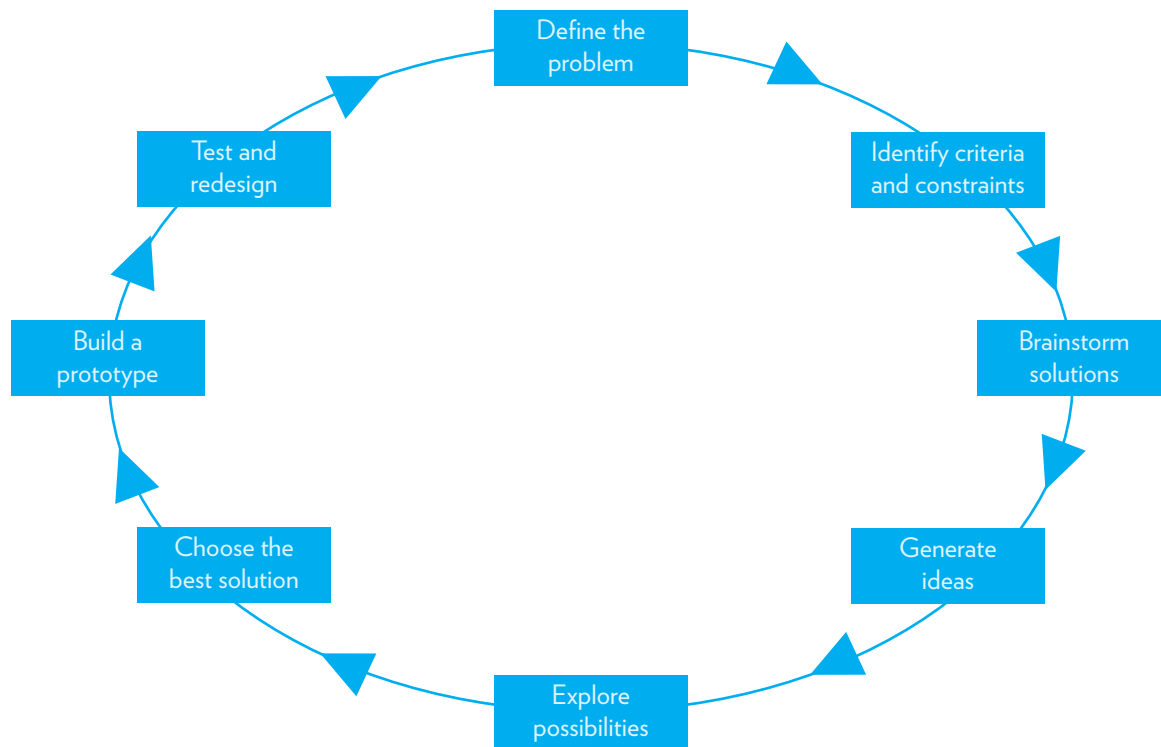
# MATHEMATICAL INVESTIGATION

## PET CAR ALARM

### REFERENCE MATERIAL

Teachers can teach students some basic coding using the TI or other CAS or a coding program.

The Engineering Design Process (diagram below) may be a helpful tool in developing your teams' ideas and helping you think through your solution.



The following TI link will be of assistance in writing the code and creating the model

<https://education.ti.com/en-au/petalarm>

### ADDITIONAL INFORMATION - ENABLING PROMPTS

Students will need time to work through the science experiments, and then consider an analysis of the data.

### EXTENDED OR ADVANCED INVESTIGATION

Suggest ways of further refining the pet smart alarm and other applications of this investigation.

### CAREERS RELATED TO THIS INVESTIGATION

Refer to the student investigation, it provides:

- An extensive table of careers related to this investigation
- Further career references

# MATHEMATICAL INVESTIGATION

## PET CAR ALARM

### CAREERS ACTIVITIES

Refer to the student investigation, it provides:

- A table of the top 10 rated jobs of 2021. This data comes from careercast.com. Have students investigate the jobs specific to this investigation.

### INDUSTRY PARTNER

This project was produced collaboratively between The Mathematical Association of Victoria (MAV) and Texas Instruments

TI has for decades, operated with a passion to create a better world by making electronics more affordable through semiconductors.

We have operated with a passion to create a better world by making electronics more affordable through semiconductors. We were pioneers in the transition of the world from vacuum tubes to transistors and then to integrated circuits (ICs) – and we've been advancing IC technology and the ability to reliably produce ICs in high volumes for decades. Each generation of innovation builds upon the last to make technology smaller, more efficient, more reliable and more affordable – making it possible for semiconductors to go into electronics everywhere. We think of this as Engineering Progress. It's what we do and have been doing for decades:

- The object-detection capability used in a \$20 million military radar system from the 1980s is now possible using a \$20 radar chip in automobiles everywhere to increase vehicle safety and reduce collisions.
- Home automation systems that cost tens of thousands of dollars 20 years ago are now only hundreds of dollars. Today, these systems are more accessible to homeowners and are making homes safer, more convenient and more energy efficient.
- Technology that previously was only used in expensive factory robotic systems is affordable enough to be integrated into home appliances, making common household tasks, like vacuuming, easier and more convenient.

Our passion to create a better world by making electronics more affordable through semiconductors is alive today as we help our customers develop new applications, particularly in the industrial and automotive markets.  
[www.ti.com/about-ti/company/what-we-do.html](http://www.ti.com/about-ti/company/what-we-do.html)

