Maths Investigation –

3D Object

Make Me a Radical Robot!

The Scenario

Tommy from Tommy's Toy Treasure Trove (your local toy store) is feeling rather bored with the toys in his shop. He wants to design a new and interesting toy robot that children will desperately want to buy. The problem is, he doesn't have any ideas!

To help him find some inspiration, Tommy is holding a competition for the children of the town to design a new and exciting toy robot. Tommy will choose the best design, create the new toy in his factory, then sell the product in his toy store.

You have decided to enter Tommy's competition.

The Task

Design and create a 3D robot that children will love to be entered in Tommy's design competition.

Follow the competition submission rules and the size and shape guidelines, set out below.

Competition Submission Rules

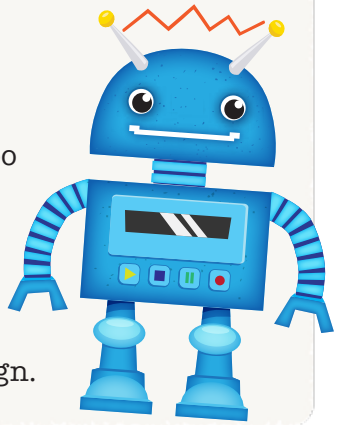
Tommy has asked that each competition entry submits the following:

- A labelled, 2D diagram of the design (drawn to scale), which shows the various features of the robot.
- A materials matrix which explains which materials should be used for each part of the robot.
- A coloured, 3D model of the robot which shows what the finished product might look like.
- A persuasive poster to be displayed at Tommy's, convincing parents to buy the robot for their children.

Size and Shape Guidelines

Tommy is looking for a new, fun and creative toy, so he doesn't want to set too many design restrictions. However, he has set down the following size and shape guidelines for the competition:

- Tommy would like the robot to be no taller than 30 centimetres.
- Tommy would like to see both prisms and pyramids used in the design.
- Tommy would like to see at least five different 3D objects used in the design.



The Procedure

1. Check your understanding of the task

Carefully read through the task, the list of competition submission rules and the size and shape guidelines. If there are any instructions that you do not understand, ask your teacher to explain them to you.

2. Brainstorm some possible robot designs and create a design overview

Using the brainstorming worksheet, play around with some possible designs. Don't worry if your ideas seem a little crazy! After the brainstorm, record your best ideas on the design overview template.

3. Draw a labelled, 2D diagram of your design (drawn to scale)

Draw a detailed representation of your design idea on the worksheet provided. Label any special features on the diagram and explain their function e.g. when you press this button, the robot's eyes flash.

4. Compete the materials matrix

Consider which materials should be used for each part of your robot. Complete the materials matrix provided to explain to Tommy which materials should be used for each part of the robot and why.

5. Draw and construct the nets required to create your model

Draw, colour and construct the nets of the 3D objects required to build your model. Ensure that the size of the nets corresponds with the size of the 3D objects that you will need.

6. Build your 3D robot model

Construct a model of your robot by joining all your nets together. Add any additional features to the outside of the model as necessary e.g. switches, buttons, knobs.

7. Plan and create your persuasive poster

Tommy's goal is to sell, sell, sell! Plan and create a persuasive poster to hang in his store to convince parents to buy this new and interesting toy for their children. Don't forget to use persuasive devices!

8. Present your design

Present your diagram, model and poster to the class. Explain how you met the competition submission rules and the size and shape guidelines.

The Materials

- Cardboard
- Coloured markers or paint
- Scissors
- Adhesive supplies (glue, tape, blu-tac)

Name _____ **Date** _____

Design Brainstorm

In the space below, record some ideas for your robot design. You might like to think about:

- the size of your robot
- the 3D objects that will make up your robot
- the colours or patterns on your robot
- the materials your robot will be made from
- the new, fun and interesting features your robot will have.

My Radical Robot: Design Ideas

Name _____ **Date** _____

Design Overview

Use the template below to record the key features of your radical robot design.

Size (in cm)	3D Objects
Height: Width: Arms/Legs:	Prisms: Pyramids:
Colours and Patterns	**Materials**
Fun Features	**Simple Design Sketch**

Name _____ **Date** _____

2D Diagram

In the box below (or on a separate page), draw a two-dimensional diagram of your radical robot design. You will need to:

- use an appropriate scale, according to the measurements you have decided upon
- label the special features of your design and briefly explain their function
- colour your design according to the colours you have decided upon.

Scale: _____ = _____

Name _____ Date _____

Materials Matrix

Carefully consider which manufacturing materials should be used for each part of your robot. Complete the materials matrix to explain to Tommy which materials should be used for each part of your robot and why.

Part of robot	Choice of material	Reason for choice

Name _____ **Date** _____

Reflection

1. Did you enjoy working on this investigation? Give reasons to explain your answer.

2. Did you face any challenges during the investigation? If so, how did you overcome them?

3. How do you feel about your robot design? Is there anything you would change?

4. What new knowledge and skills did you learn by completing this investigation?

5. Circle the statement that best suits how you feel about working with 3D objects.

a) I feel very confident working with 3D objects.
b) My understanding of 3D objects is improving.
c) I still need some help when working with 3D objects.

Teacher Notes

Rationale

Mathematics investigations open students' minds to the possibility of multiple approaches, multiple outcomes and multiple solutions. When linked to the world in which they live, open-ended investigations can help students see the relevance of mathematics within their lives. They also provide wonderful opportunities for differentiation, enabling students to feel confident and successful as they engage with tasks at their own individual level.

Overview

This mathematics investigation has been designed to accompany a unit of work on 3D objects. It requires students to apply their knowledge and understanding of 3D objects to a real-world situation.

Objective

To design a radical robot, taking into account a list of size and shape guidelines.

Duration

Approximately five 60 minute lessons

Prior Learning

Before commencing the investigation, students should be familiar with the following concepts:

- drawing scaled representations of 2D shapes
- drawing and constructing nets of 3D objects.

Differentiation: Supporting Students

Less confident students could be supported in their learning by allow them to consult with a teacher or teacher aide during the brainstorming and designing process. Alternatively, the task could be simplified by allowing less confident students to construct their robots using only a small number of simple prisms.

Differentiation: Extending Students

More capable students could be encouraged to extend their learning by using more sophisticated 3D objects in their robot design e.g. cones, cylinders, tetrahedrons. Students could also be encouraged to use technology to create a television commercial to advertise their robot.

Monitoring Student Understanding

Due to the open-ended nature of this investigation, students' responses will vary significantly. For this reason, no answer sheet has been provided. Teachers must therefore check that each student has completed the investigation according to the task requirements.