miniVEX Basics

Group Name______________________ Group Members_________________________

Project: NASA is in the market for a new planetary rover to explore the recently discover planet Zezuno. You are required to construct and test a robot that is capable of following a set of commands to explore the planet's surface. Before the robot is deployed, it must be extensively tested to ensure it will perform as expected. You can't fly a technician to Zezuno to reboot the robot!

Before we send our robot into space, we must first test it thoroughly here on earth. Run the following experiments and observe how your robot behaves. Do not move to the next experiment until your teacher has seen your current experiment.

Program your robot to drive Forward for 25mm:
How close to 25mm does your robot get? _________________

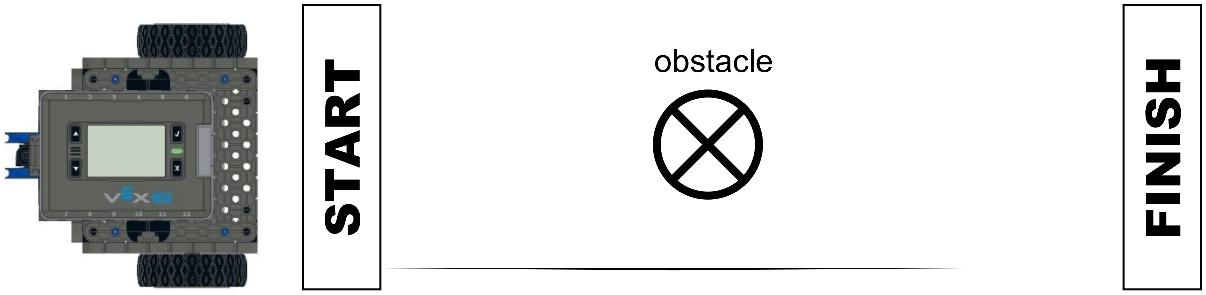
Program your robot to drive Forward for 500mm
How close to 500mm does your robot get? _________________

Drive Forward 500mm slowly and then 500mm backwards as fast as possible.

Make your robot turn around a complete circle (360 degrees).
How accurate was it? Experiment with different Drivetrain configurations to make it more accurate.

Drive forward for 500mm (OR 20 inches), turn around 180° and drive back to where you started

Drive around an obstacle



Make your robot drive in a 'figure of 8'

(hint: draw a diagram first in the space below before you start programming. Don't forget to mark your starting point!)

What is a Robot?

When you hear the word 'robot' some famous movie robots spring to mind. Robots in real life however are not yet up to the standard of their movie counterparts.

Robots are becoming more prevalent in today's society. They are used in high level applications such as space exploration right through to commercial vacuuming robots found in everyday households. You are required to do a research assignment on robotics in general and to focus on one robot in particular.

Robots come in many different shapes and sizes and are often tailored to meet a particular need or action.

Assessment

Create a report on robotics. Your teacher will tell you the format of the report. The following questions will need to be addressed in your work.

- What is a robot?
- Why do we have robots?
- Name some different types of robots?
- What are the main components of a robot?
- Where did the term 'Robot' come from?

Pick one robot and elaborate on it. You must have your robot choice approved by your teacher before you start your research. You will need to include the following information in your report:

Sensors - What information does it take in? (e.g. Sound, distance etc)

Software - What does it do? (e.g. Vacuum floors, explore space)

Mechanical - What materials is it made out of? How does it move? (e.g. motors, arms and metal frames)

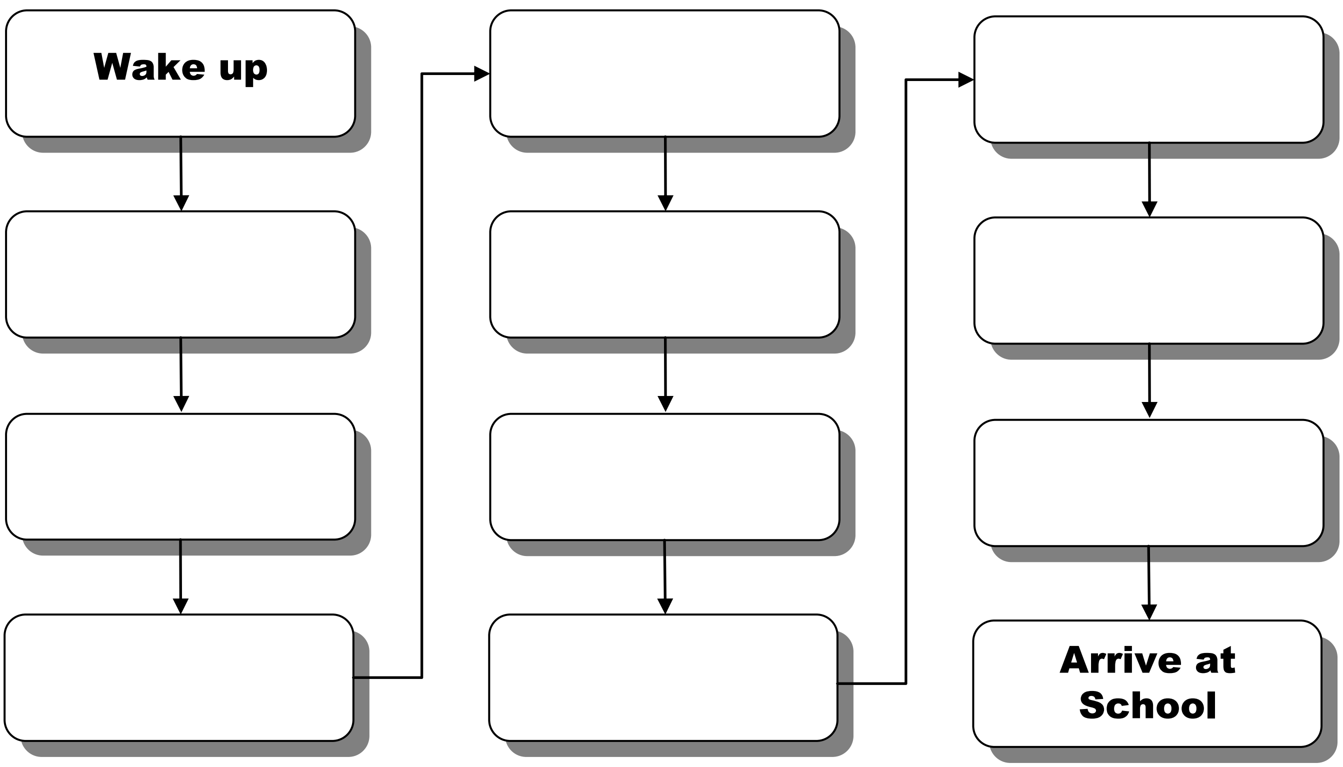
Robot Chosen ________________________ Due Date__________________

Presentation Type______________________ Page / Slide limit____________

Flowcharting

All robots need to have programs to make them run. The easiest way to start a program is to first have a plan. This plan consists of a flowchart of small steps that make up the entire program. Each step is simple enough that the robot can perform it without too much effort.

Task: Using the blank flowchart below, plan out your daily morning routine, from when you wake up until you get to school.



How far?

Group Name______________________ Group Members_________________________

Project: In the initial construction of the robot the travelling characteristics are required. After characterising the properties, NASA have asked that you use your data to make predictions about the distance your robot will travel given specific time constraints.

Your group will be assigned a random power level to be assessed.

Power Level Assigned ____________

For this experiment you will need to measure how far the robot travels for different time values (eg. 1 second, 2 seconds, 3.5 seconds etc). The more data you gather, the more accurate your graph will be.

Plot the results either on the graph below or in a graphing software package.

(Hint: you will need to know the smallest and largest times you tested for, as well as the smallest and largest distances so that you can determine the horizontal and vertical axis scales)

Once you have plotted your data, can you see a relationship between the time taken and the distance travelled?

By looking at the graph, can you determine how many seconds your robot would need to travel exactly 30cm (12 inches)? _____________ seconds

How about 1.5m (59 inches)? _____________ seconds

Your teacher will assign you a test distance. How long does your robot need to travel this particular distance?

Test Distance = _______________ Time required = _____________ seconds

Distance Travelled vs Time Taken

Distance Travelled

Time Taken

How fast?

Group Name______________________ Group Members_________________________

Project: To accurately be able to command the robot, you need to understand how fast it can go and what properties may change its performance. NASA have requested a detailed report, supported by data that you have gathered from your robot.

Make your robot drive forward for 1 meter at 50% power

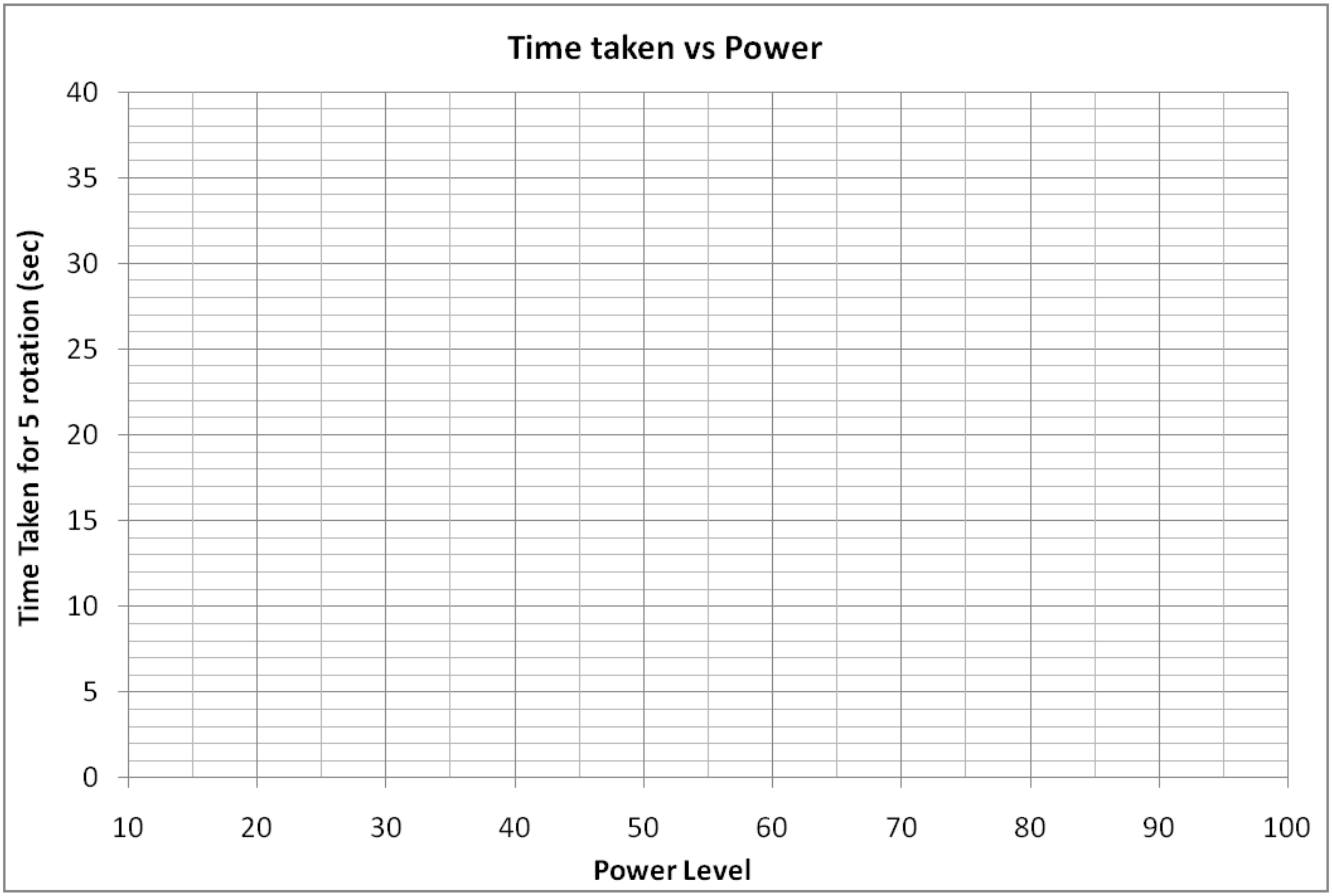
How long did it take to go 1 meter? ______________ sec

What about 10% power? ______________ sec

70% power? ______________ sec

Fill in the time taken to complete 5 rotations on this table and plot your average on the graph

Power Level (%)	Run 1	Run 2	Run 3	Run 4	Run 5	Average
10						
20						
30						
40						
50						
60						
70						
80						
90						
100						



Draw a line of best fit through the data you have taken.

Based on this data, make a prediction as to how long it will take to do 1 meter at 65% power. ______________ seconds

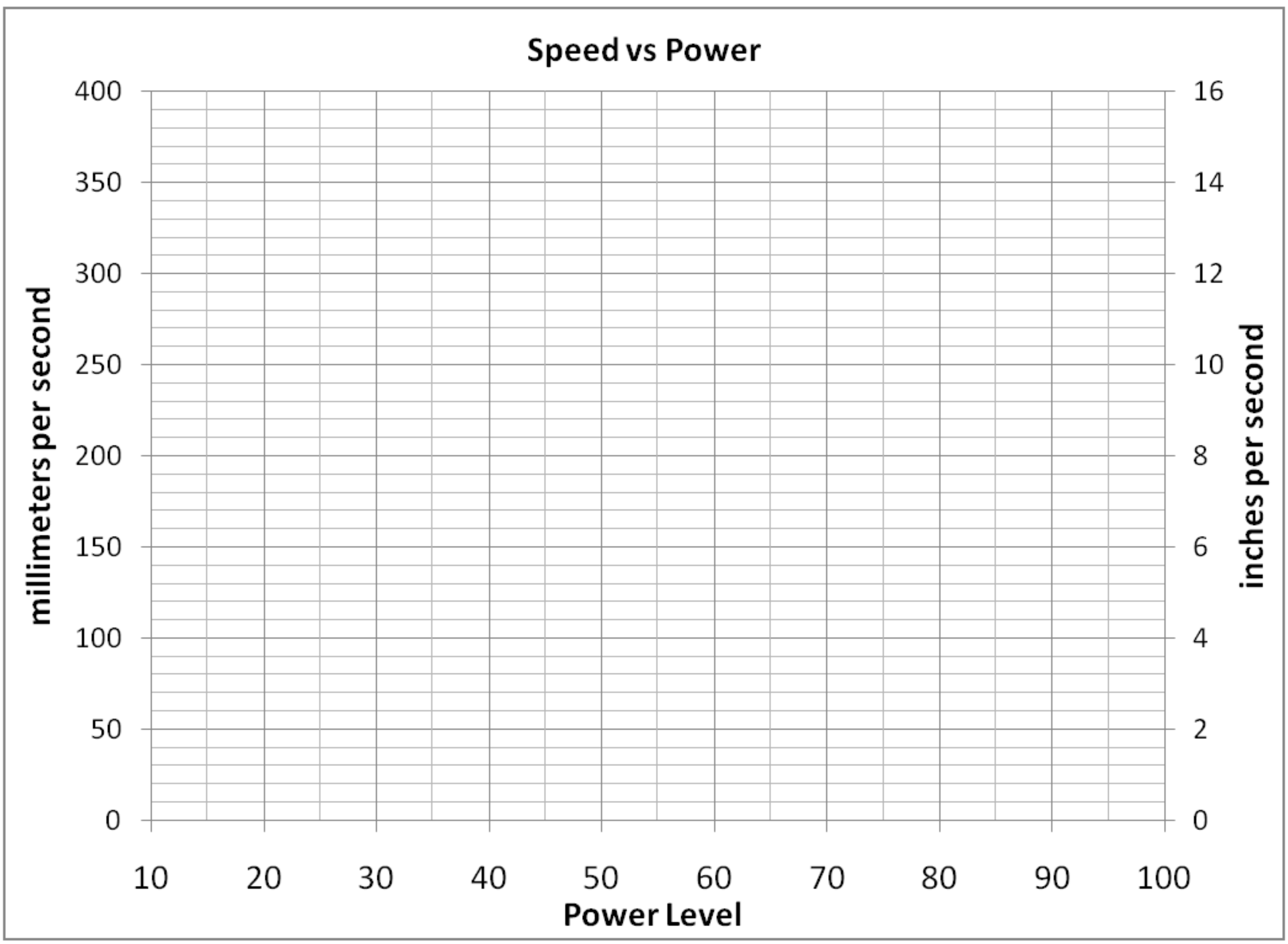
Mark your prediction on your graph in a different colour. Program your robot and see what happens. How close were you?

Let us now convert this time taken into a speed. Remember that Speed = Distance / Time

Convert each of these times and distances into a speed for each different power level. Fill in your answers in the table over the page.

Power Level (%)	Time for 1 meter	Speed (m/sec OR inches/sec)
10		
20		
30		
40		
50		
60		
70		
80		
90		
100		

Plot the speed of your robot against the power level on the following graph.



NASA have indicated that in some parts of Zezuno, the loose sand will make it difficult to drive quickly. They have calculated that the robot cannot exceed a maximum speed of 250 mm/s OR 100 inches/sec.

What power level is required to meet this speed? ________________ % power level

Mark the speed on your graph in a different colour. Program your robot to travel for 10 seconds and check to make sure your robot stays within the guidelines.

What would happen if we were to run the same experiment on carpet?

What was the most difficult part of this challenge?

How did you go about solving it?

How Many Sides?

Group Name______________________ Group Members_________________________

Overview: Once on Zezuno, your robot will be required to identify interesting aspects for later analysis. Your robot will be required to mark off an area such that a passing satellite can easily identify the item in question. Initially you will be required to draw a square, but will then move onto other shapes and designs.

Build a drawing attachment and fix it to your robot and program your robot drive in a square.

- How many sides does a square have?
- How many angles?
- How many degrees in each angle?
- Could you use the Repeat block to make the program simpler?

Fill in the following table for other common shape

Shape	Number of sides	Internal angle	External angle	Turn Angle required by the robot
Octagon				
Hexagon				
Triangle				

What was the most difficult part of this challenge?

How did you go about solving it?

Help! I'm Stuck

Group Name______________________ Group Members_________________________

Overview: Whilst on Zezuno, your robot will undoubtedly come up against obstacles in its path. NASA is worried about a particular cliff wall that is blocking the robot's progress. They have asked that you demonstrate your robot's ability to detect such obstacles and navigate away from them. It is important that your robot does not physically touch these obstacles as we do not wish to damage the robot. Connect the Sensor Stack to the robot and ensure a Smart Cable is connected from the use the Distance Sensor to the VEX IQ Robot Brain.

There are several progressive steps we would like to make in order to solve this problem. Each program should be done individually and demonstrated to a teacher before moving on.

We would like our robot to drive forward until it encounters an obstacle.

- Drive until object is detected, then stop.
- Turn around when you detect the object.
- Repeat this action until you find your way around the obstacle.

What was the most difficult part of this challenge?

How did you go about solving it?

Let's go Prospecting

Group Name______________________ Group Members_________________________

Project: NASA are very impressed with your robot's ability to navigate the surface. They are hoping that you can use a Smart Sensor on your robot to help them detect some mineral deposits of Itrium they believe are on the surface. These minerals are easy to spot due to their bright blue appearance. Your task is to navigate a geological section, locate the mineral, stop and announce that a mineral has been found.

Connect the Colour Sensor from the Sensor Stack to the VEX IQ Robot Brain.

There are several progressive steps we would like to make in order to solve this problem. Each program should be done individually and demonstrated to your teacher before moving on.

- Drive until blue is detected then stop.
- Display 'BLUE' on the VEX IQ Robot Brain LCD screen when you reach the Itrium.
- Drive off the blue and go looking for more Itrium.

What was the most difficult part of this challenge?

How did you go about solving it?

Stay away from the Edge

Group Name______________________ Group Members_________________________

Project: Another challenge the robot faces is staying safe whilst navigating on top of a large plateau. Get too close and over you'll go! NASA has asked that you prove your robot is capable of staying away from the edge of a cliff.

NASA has discovered that the Colour Sensor attachment, as well as being excellent for detecting Itrium, can also reliably inform us when there is any object 'near' to the Smart Sensor. Modify your program so that the robot does not go over the edge.

There are several progressive steps we would like to make in order to solve this problem. Each program should be done individually and demonstrated to your teacher before moving on.

- Drive until the edge is detected then stop.
- Drive away from the edge and continue looking for the next edge.

What was the most difficult part of this challenge?

How did you go about solving it?

Prospecting and Staying Safe

Group Name______________________ Group Members_________________________

Project: NASA are very impressed, but they note with your last program, while the robot is looking for the edge of the plateau, it is not doing any prospecting. Is there a way to do both at the same time?

There are 3 different scenarios that the Colour Sensor could detect during this challenge, what are they and what action should the robot do when it encounters each of these?

Scenario (what does the Colour Sensor see?)	Action (what should the robot do?)

Going Up and Going Down

Group Name______________________ Group Members_________________________

Project: NASA have discovered a good deposit of minerals in a valley far below. Your robot design can only safely ascend slopes of 20 degrees, any more and there is a very real risk that the robot will topple over. Devise a program that will enable the robot to drive along a slope, but stop and reverse if it becomes too steep.

Ensure the Gyro Sensor on the Sensor Stack is connected to the VEX IQ Robot Brain.

There are several progressive steps we would like to make in order to solve this problem. Each program should be done individually and demonstrated to your teacher before moving on.

- Drive until the angle changes by more than 20 degrees and stop.
- Reverse away from the incline until the robot is back on level ground.

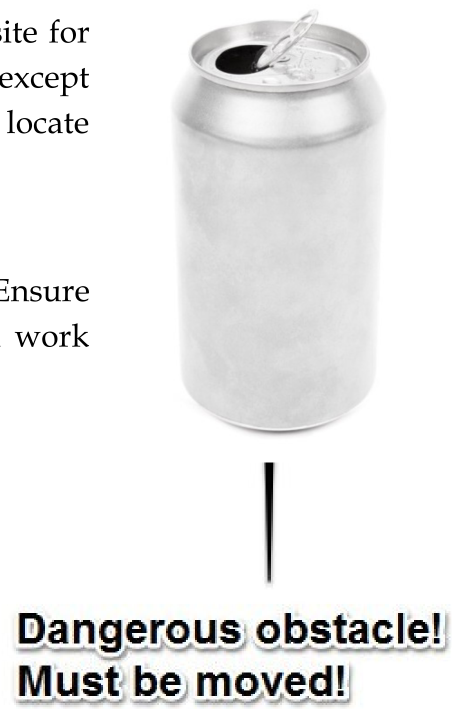
Extra Challenge

When your robot reaches a slope, have it slow down for safety reasons. Once it is back on level ground, have it return to normal speed.

Landing Area Preparation

Group Name_______________________ Group Members__________________________

Project: Whilst on Zezuno, NASA have determined an excellent site for further spacecraft landings. These sites are perfect in every way, except for several large rock columns scattered about. Your mission is to locate these columns and move them out of the way.



This challenge is best approached as a series of mini-challenges. Ensure you have shown your teacher each intermediate program as you work towards the final solution.

- Open and Close the Gripper
- See an object and grab
- Turn and find the rock column
- Drive up to the rock column and activate Gripper
- Find and move the rock column

Extra Challenge

Multiple obstacles are present, and all need to be removed. The safest place for them to be deposited is the Dangerous Removal of Obstacle Position (DROP). It is located to the side of the Landing Zone and can be identified by the bright yellow floor covering (Hint: You'll need to build in the Colour Sensor somewhere!)

As seen on TV!

Overview: NASA decided on using your design to fly to Zezuno. As a result of the associated publicity, many other people want to buy their own version of the robot. Come up with a marketing promotion to sell your robot.

Your presentation may consist of one or more of the following media formats as notated by your teacher

- School Newspaper article
- Video commercial
- PowerPoint Presentation
- Poster presentation
- Website
- Oral Presentation

Be sure to include the following information in your presentation

- How does it look?
- What can it do?
- How does it move?
- How does it sense its surrounding environment?
- What are the standard missions it can perform?

Look back over your previous activities to help you answer these questions.

Remember, you are now pitching your idea to everyday people, not NASA scientists!

MiniGolf Score Sheet

	Points					
Group Name	**Round 1 Position A**	**Round 2 Position A**	**Round 3 Position B**	**Round 4 Position C**	**Round 5 Position D**	**Total**

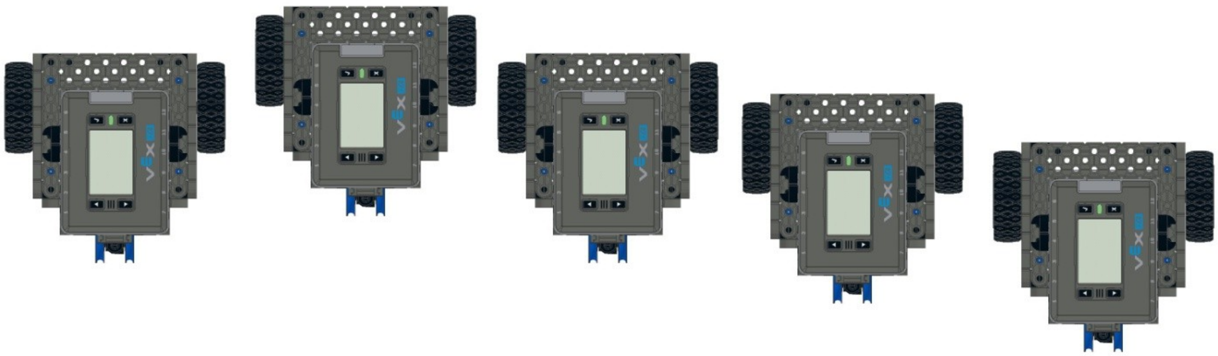
Dancing Robots

Group Name______________________ Group Members_________________________

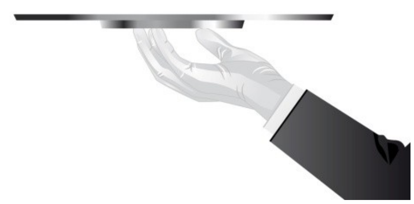
Artist:		**Song Name:**	
Section	*Time*	*Description*	*Intended robot movement*

Additional Projects

Robot Wave: Synchronise a group of robots to perform the Wave, an audience move popular in sporting stadiums around the world. As a class, you will need to determine what order the robots will move and what action they will perform.



Robot Butler: Robots in the household are quickly becoming commonplace, with personal assistance robots widely regarded to become the most prevalent in the near future. Build a robot that can retrieve a drink for someone who is confined to bed.



Meet your Adoring Public: Program your robot to respond in a positive way when somebody gets close. Use movement, sound and words to convey a feeling of happiness.