https://tinyurl.com/CMACTSphero

COMPUTATIONAL THINKING WITH SPHERO

SECONDARY MATHEMATICS EDITION

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In this session we will...

- **learn** about Sphero and how it can enhance computational thinking in your classroom, and meet the requirements of NZC (CT Progress Outcomes)
- **play** with Sphero and explore Sphero Edu App
- **review** some Sphero activities and resources to help you on your journey

5 things I wish I knew sooner

1. It's never too late to learn how to code
2. You don't have to know everything
3. Your students will teach you
4. There are more than 700 coding languages
5. Coding is exactly like learning any language, you just need to learn to communicate your instructions to a computer instead of another person. The computer can only do what you ask it to do, step by step - It's logical!

LET'S LEARN

Primary, Secondary & Higher Education

Start

Students begin their educational journey with Sphero's entry level bots and activities. Whether they are just getting started with programming and inventing or looking to grow their engineering and computational thinking skills, they'll find themselves at home within the Sphero Edu ecosystem.

Grow

Expand students' knowledge with Sphero bots and curriculum that further their engineering and programming skills. Intermediate learners can utilize advanced sensors and code blocks to learn more complex logic, enabling advanced programming tactics.

Graduate

Sphero offers advanced programming capabilities through the maker-hacker level including advanced blocks, JavaScript, or even our public SDK library. Seasoned programmers and engineers can utilize the diverse suite of sensors to build, customize, and connect third-party hardware.

Meet the Sphero robots

Sphero Mini

Year 0-2

Sphero SPRK+

Year 2-8

Sphero BOLT

Year 2-13

Sphero RVR

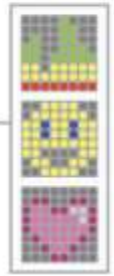
Year 0-13 onwards

SENSORS

Gyroscope
Accelerometer

Motor Encoders
Gyroscope
Accelerometer

Motor Encoders
Gyroscope
Accelerometer
8x8 Matrix
Infrared
Compass
Light Sensor



Motor Encoders

Full 9-axis IMU, includes Accelerometer, Gyroscope, Magnetometer, IR sensors,

RGB Color sensor w/ normalizing LED and focus lens
10 individually addressable RGB LEDs
High-resolution 20-pole magnetic encoders

Sphero BOLT Sensors

- **Light Sensor:** The light sensor reads the light intensity (luminosity) in your environment from 0 - 100,000 lux, where 0 lux is full darkness and 30,000-100,000 lux is direct sunlight. Keep in mind that if you are running a program with a luminosity condition, you may need to adjust it for different environments, as light intensity can vary significantly between rooms.
- **Infrared (IR) Sensors:** Infrared (IR) is invisible light with longer wavelengths than visible light, and it is commonly used in TV remote controls to transmit small amounts of data. IR is used in Sphero BOLT to send data such as relative distance and heading between robots, and custom messages. There are four IR emitters and receivers (pairs) for 360° awareness assuming there is a clear line of sight between two or more BOLT robots. The valid range is up to about 4 meters.
- **Compass:** The compass sensor (it's really a "magnetometer") allows BOLT to know it's orientation on earth, just like a normal compass. This sensor can be used to write a program that moves in real-world directions around a room, or even in relative directions if placed on a map oriented correctly. The compass also enables "Auto-Aiming" on BOLT, where the robot syncs it's offset from North with the compass inside your phone or tablet, so you don't need to aim manually. You can find the Auto-Aim feature on the drive screen of the Sphero Edu app.

What is Computational Thinking (CT)?

CT is a problem solving process that includes (but is not limited to) the following characteristics:

- **Formulating problems** in a way that enables us to use a computer or other tools to help solve a problem
- **Logically organising** and **analysing data**
- **Representing data** through abstractions such as **models** or **simulations**
- Automating solutions through **algorithmic thinking** (a series of ordered steps)
- **Identifying** , **analyzing**, and **implementing possible solutions** with the goal of achieving the most efficient and effective combination of steps and resources
- **Generalizing** and **transferring the problem solving process** to a wide variety of problems

Source: ISTE_CT_Teacher_Resources_2ed.pdf

CT skills are also supported and enhanced by the following dispositions or attitudes:

- **Confidence** in dealing with complexity
- **Persistence** in dealing with difficult problems
- **Tolerance** for ambiguity
- The ability to deal with **open ended problems**
- The ability to **communicate and work with others** to achieve a common goal or solution

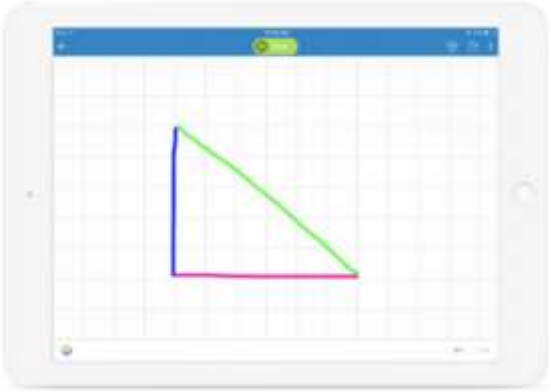
Examples of how Sphero helps to teach computational thinking, with or without code.

Computational Thinking Fundamentals	What This Means	Examples in Sphero Activities
Decomposition	Does the activity encourage the student to break a larger problem into smaller problems to come up with a solution?	Students solve complex problems through smaller, more manageable tasks.
Pattern Recognition	Does the activity encourage the student to identify common patterns?	Students identify common patterns like movement, speed, light, time, or direction of the Sphero.
Pattern Generalization and Abstraction	Does the activity encourage the student to make connection about common patterns?	Students connect concepts, such as speed & direction to how far Sphero traveled.
Algorithm Design	Does the activity encourage the student to create logical steps that can be automated based on those patterns and connections?	Students create programs to control the Sphero. These often require using patterns like loops, which can be used to automate repeated behavior.

INTRODUCTION TO

SPHERO EDU

Canvases



Draw -

Uses a drawing interface. Best suited for grades K-5 and all class types.

Block -

Uses a drag-and-drop block interface and teaches the logical structure of code. Best suited for grades 3-12 and all class types.

Text -

Uses the programming language JavaScript. Best suited for grades 8-12 and classes that focus on computer science and programming.

Visual Block Programming Categories

Connect with Bluetooth

When you are ready to connect your robot, open the Sphero Edu app on a compatible mobile device with bluetooth on and sign in to your account.

1. From the home screen, select 'Connect Robot'

2. Hold your robot right next to the device:

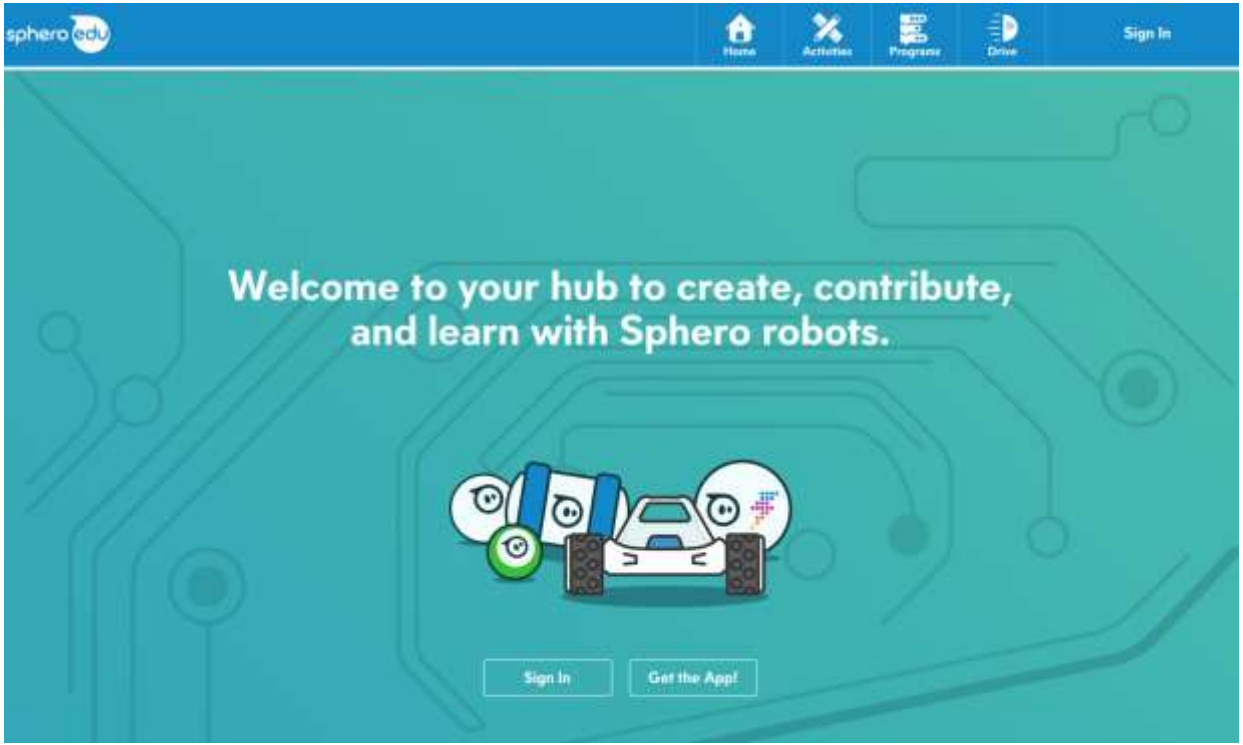
3. Select your robot type and look for the robot with the strongest bluetooth signal.

If you are having connection troubles, try the following strategies:

If the robot does not connect to Sphero Edu, charge your robot (or RVR battery) for 15 seconds to ensure it's not in deep sleep, then try again.

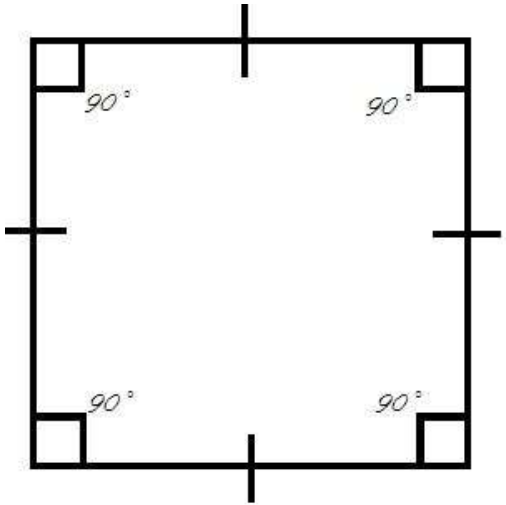
If your robot is disconnecting often and you are in a room with a lot of users, try turning off wifi and bluetooth on the devices that are not being used with a robot. Limiting a room to about 20 robots and programming devices or less is a good rule of thumb.

Sphero Edu App



LET'S PLAY

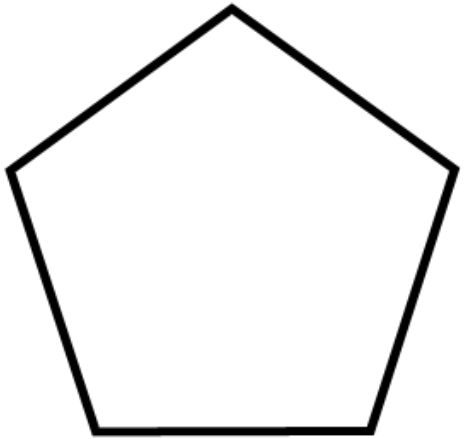
Activity 1 - Drive Sphero in a Square

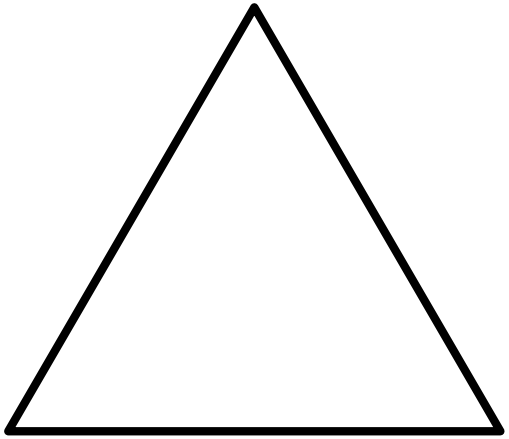


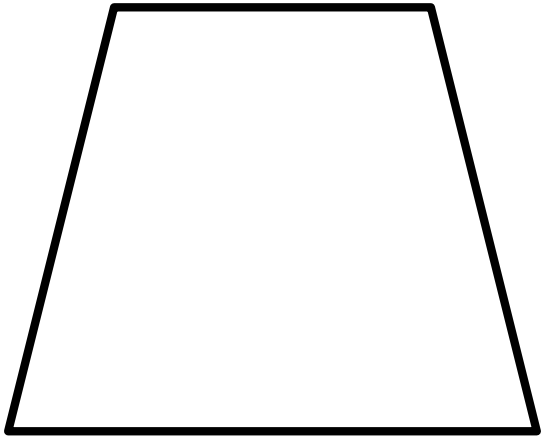
EDUCATOR TIP:

Remember 0 degrees is straight, 90 degrees is right, 180 degrees is backwards and 270 degrees is to the left

Activity 1 - Extension

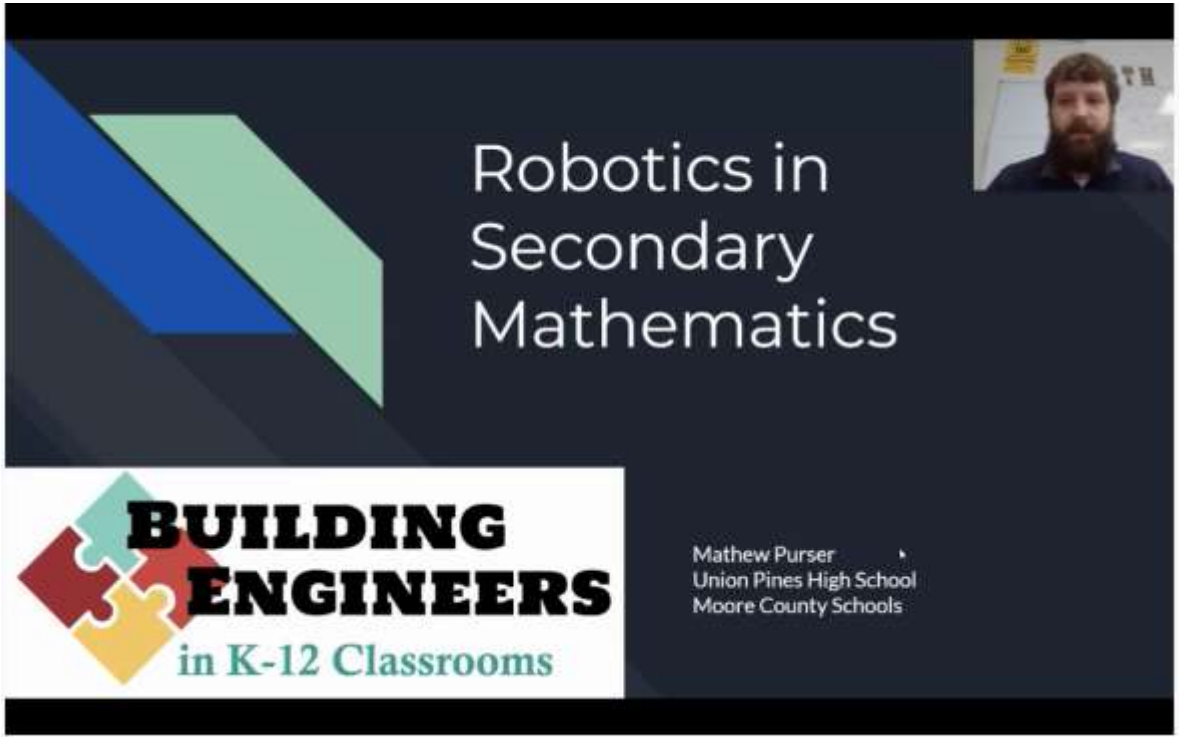






Sphero Secondary Mathematics

Connections related to geometry, trigonometry, and basic algebra and introduce students to basic programming concepts



Activity 2 - Tape Challenge

In this challenge you will code Sphero to complete a series of tasks whilst travelling along the masking tape. You must perform all the tasks in the correct order.

You will need:

Sphero	Device

Follow the steps below:

1. Roll 0.5 metres while displaying a red light
2. Stop at corner of tape and play an animal sound
3. Turn right and roll 1 metre while displaying a green light
4. Stop and spin 720 degrees

Activity 2 - Rubric

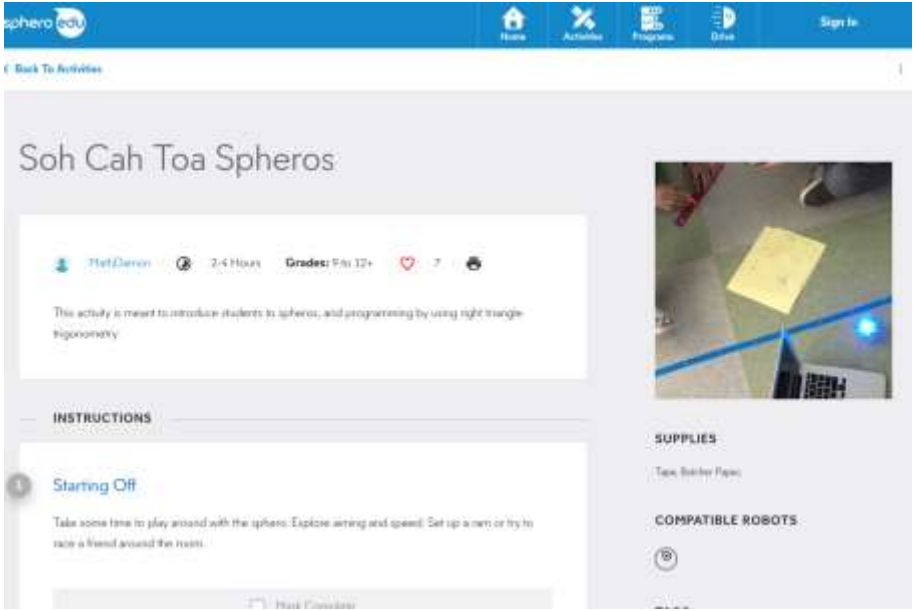
The Great Tape Race

Scoring Rubric

As the robot follows the path of the tape, score how well the robot does. Circle the appropriate point value.

Task	5 points	3 points	1 point
Roll .5 meters staying on tape.	Goes exactly .5 meters (+/-) .1 meters	Goes incorrect distance or veers off the tape.	Goes incorrect distance and veers off tape.
Red light on as it rolls.	Rolls with red light on	Rolls with any light color	Rolls with no color
Stop and make animal sound.	Does both tasks	Does one or the other, or does not make and animal sound	No stopping and no sound.
Turn right and roll one meter.	Goes exactly 1 meter (+/-) .1 meters	Goes incorrect distance or veers off the tape.	Goes incorrect distance and veers off tape.
Green light as it rolls	Rolls with green light	Rolls with any color	Rolls with no color
Stop and spin 720 degrees	Spins twice	Spins but not twice	Does not spin
Speed rating	In the top 3	4th place to 8th place	9th place and below. **These can be adjusted according to number of students in the class

Activity 3 - Soh Cah Toa Spheros



In this activity you will use trigonometry to find the angles of a right triangle.

Follow the steps below:

1. Use a triangle on the floor and measure it.
2. Using trigonometry (SOH CAH TOA), find the angles of the triangle
3. Program Sphero to trace the triangle

Sphero Challenge #1

Group Names:_____

Welcome to your first Sphero Challenge! We will do several of these throughout the semester so it's good to get off on the right foot! (Not the left one!)

First I would open up **SpheroEDU Chrome extension** to start working on your programming. Both you and your partner should be writing the code. Please do the work on two separate computers. When you are done with the code you may sync your robot to either computer and attempt the challenge below. When you believe you have coded the robot correctly please call me over so you can prove it to me! Good Luck! If you need help, don't hesitate to ask!

	Make a Square - What do you know about side lengths and angles of a square? - Trace the shape using the cup and marker on butcher paper
	Navigate the Maze - Must write a program - It might come in handy if you knew how far the sphero can travel in 1 second at various speeds - Have to go off jump at the end
	Make a 45 - 45 - 90 triangle - You can choose side lengths - What do you know about the side lengths of a 45-45-90 triangle?
	Make a 30 - 60 - 90 triangle - You can choose side lengths - What do you know about the side lengths of a 30-60-90 triangle?
	Do the triangle challenge - Pick one of the triangles and measure it. - Using trigonometry(SOH CAH TOA) find the angles of the triangle. - Dilate the image with a scale factor of 4. - Trace the shape using the cup and marker on butcher paper

LET'S REVIEW

How can you help your students meet the CT progress outcomes of the NZC with Sphero?


Technology
in the New Zealand Curriculum

What is technology about?

Why study technology?

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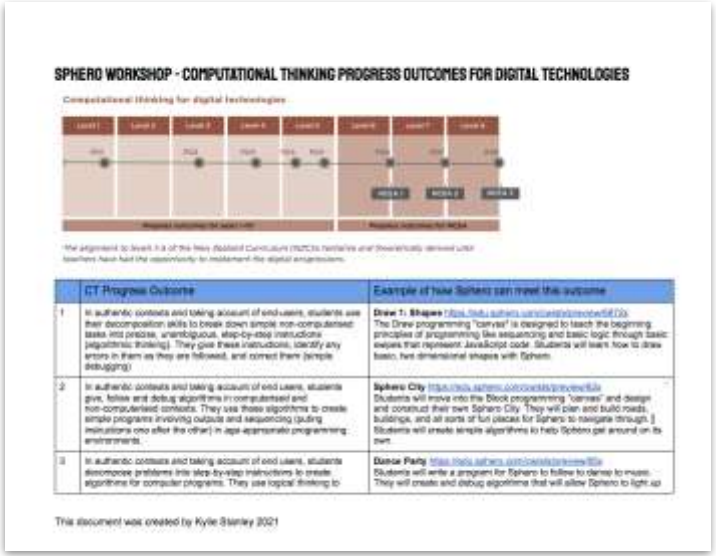

SPHERO WORKSHOP - COMPUTATIONAL THINKING PROGRESS OUTCOMES FOR DIGITAL TECHNOLOGIES

Computational thinking for digital technologies

	CT Progress Outcome	Example of how Sphero can meet this outcome
1	In authentic contexts and taking account of end-users, students use their decomposition skills to break down simple non-computational tasks into precise, unambiguous, step-by-step instructions (algorithmic thinking). They give these instructions, identify any errors in them as they are followed, and correct them (simple debugging)	**Draw 1: Shapes** https://edu.sphero.com/cwists/preview/58f70b The Draw programming "canvas" is designed to teach the beginning principles of programming like sequencing and basic logic through basic swipes that represent JavaScript code. Students will learn how to draw basic, two dimensional shapes with Sphero.
2	In authentic contexts and taking account of end-users, students give, follow and debug algorithms in computerised and non-computerised contexts. They use these algorithms to create simple programs involving outputs and sequencing (putting instructions one after the other) in age-appropriate programming environments.	**Sphero City** https://edu.sphero.com/cwists/preview/60a Students will move into the Block programming "canvas" and design and construct their own Sphero City. They will plan and build roads, buildings, and all sorts of fun places for Sphero to navigate through. Students will create simple algorithms to help Sphero get around on its own.
3	In authentic contexts and taking account of end-users, students decompose problems into step-by-step instructions to create algorithms for computer programs. They use logical thinking to	**Dance Party** https://edu.sphero.com/cwists/preview/60a Students will write a program for Sphero to follow to dance to music. They will create and debug algorithms that will allow Sphero to light up

This document was created by Kylie Stanley 2021

ACTIVITIES

Mathematics links to Sphero

Percentages - mixing colors at different levels to change the color the sphero glows.

Simple Geometry and Angles - make the sphero drive a square, pentagon, or rectangle to recreate learned shapes.

Fractions – provide a specific fraction and have the students calculate how to adjust the sphero to get the exact color.

Math operations – command the sphero to drive in a square, then use a multiplier or divisor to double or halve the square size.

Logic – command the sphero to perform a sequence of steps to navigate a course.

Back To Activities

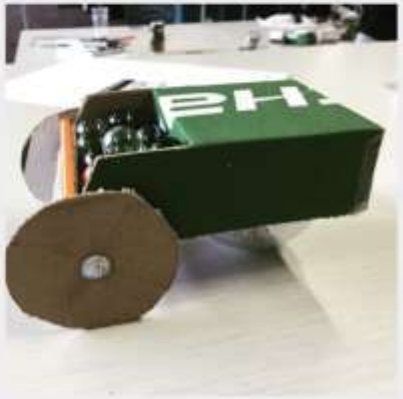
START ACTIVITY

CLASSROOM ASSIGN

Project Vahana

elsubash | Multi-Day | **Grades:** Pre-K to 12+ | 26

Students will build a chariot by purchasing materials from the Instructor's shop. They need to transfer 100 marbles from across two points on a long table or hallway. The aim of this activity is to make the most amount of profit.



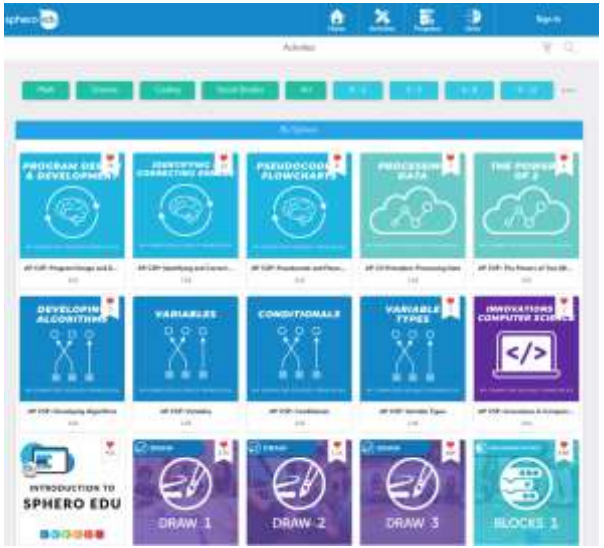
INSTRUCTIONS

SUPPLIES

Cardboard, Tape, Skewers, Straws, Cups, Bluetac, Rubber Bands, Pringles Tube & Toothpicks

PROGRAMMING LEVEL	CONTENT THEME			
	Science	Technology & Engineering	Art	Math
Draw *Manual Movement, Distance, Direction, Speed, and Color*			Draw 2: Spelling	Draw 1: Shapes Draw 3: Perimeter Area of a Rectangle Geometric Transformations
Beginning Block *Roll, Delay, Sound, Speak, and Main LED*	Long Jump Bridge Challenge	Blocks 1: Intro and Loops		
Intermediate Block *Simple Controls (Loops), Sensors, and Comments*	Light Painting Tractor Pull Hydro-Hypothesis	Maze Mayhem	Sphero City Swim Meet Chariot Challenge	
Advanced Block *Functions, Variables, Complex Controls (If Then), and Comparators*	Atom Tracks Helmets for the Win Organ Quiz Planet Quiz	Blocks 2: If/Then/Else Blocks 3: Lights Blocks 4: Variables	What a Character Avoid the Minotaur	
Block-Text Transition *JavaScript Syntax, Punctuation, and Asynchronous Programming*		Text 1: Hello World! Text 2: Conditionals		
Beginning Text *JavaScript Movements, Lights, and Sounds*		Text 3: Lights Text 4: Variables		Morse Code & Data Structures Fun Fun Functions

LOOKING FOR HELP & SUPPORT?



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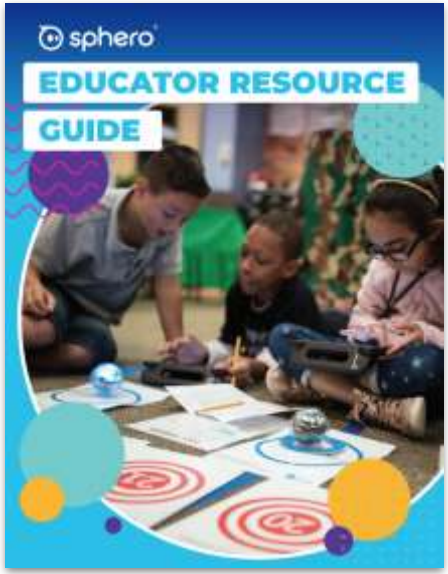

[Sphero & littleBits Self-Service Resources]

[NZC Webinar]

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