Warrnambool’s Longest Lunch

Brauer College

Delia Jenkins

Year 7, 2015

The context

- Brauer College
- Year 7
- Maths - Algebra
- Improving Student Collaboration Skills and using algebra for Problem Solving

Background:

Students were working on a Year 7/8 algebra unit and were ready to learn about linear graphs. This task gave them the opportunity to learn independently using a real world scenario. This group of students had also had a major focus on collaboration this year (and were involved in the Rube Goldberg Challenge) and this was an opportunity to reflect on the skills developed previously and to work towards specific personal goals for improvement.

The task

What was done:

- Students were to work in groups of three – self selected based on what they had learnt about collaboration from previous work. The aim was to ensure each group was a strong group.
- From the information provided they were to learn what was needed to solve the linear equation and use this information to find a solution to the Warrnambool's longest lunch scenario.

Length:

- 10 periods over two weeks (which included group presentations to the class) for the Longest Lunch. This was after a three week unit on algebra.

Warrnambool's Longest Lunch

I need your help please.

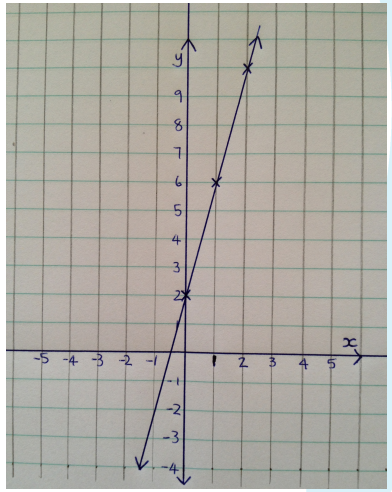
I have this idea of doing a 'longest lunch', to raise money for Cancer research and I thought a good place to do it would be on the Warrnambool Breakwater.

I have done a bit of research to see what other people have done and I found this graph, (below) which is supposed to be the formula for working out how many people can sit on each table.

We can find out how long the Breakwater is and we will have to decide on what people can eat and how we are going to organise all that, but that doesn't sound too difficult.

If you work in groups and each groups can come up with a solution. Then we can look at all the solutions and see which one we think is the best and raises the most amount of money.

Can you help?



The task - continued

There were three members to each group. Each member was given a different piece of information to research prior to working in their teams.

One member from each team had to research the following:

1. What is y = mx + c and how is it used?
2. What is the y intercept and how does it relate to the rule y = mx + c?
3. What is the gradient and how is it calculated? How does it relate to the rule y = mx + c?

The students sat in larger groups comprised of members with the same question to research. They had to work together until they all agreed on their answer and that all members understood the answer to their question.

When all three groups were confident they knew the answer the students then sat in their teams of 3 to begin working on solving the Warrnambool's Longest Lunch.

They were to use the Solution Fluency to plan (using the 6D's – Define, Discover, Dream, Design, Deliver and Debrief) how they were going to come up with their solution and each team member was to ensure they had taught the other two the answer to their question. Between them they had to use their knowledge to solve the graph, which would determine their final result.

The task continued …

Content goals (AusVELS):

- Given coordinates, plot points on the Cartesian plane, and find coordinates for a given point.
- Solve simple linear equations.
- Investigate, interpret and analyse graphs from authentic data.

- Plot linear relationships on the Cartesian plane with and without the use of digital technologies.
- Solve linear equations using algebraic and graphical techniques.
- Verify solutions by substitution

Process goals:

Students will work collaboratively, leveraging individual strengths and recognising and resolving individual weaknesses to produce a solution to the scenario.

Pedagogical practices –

- Developing students as independent learners.
- Providing challenging real world scenarios to engage students in their learning.

DEPTH – There are three depth elements:

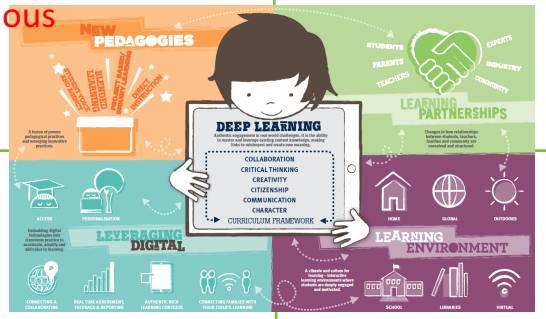
1 – To apply their knowledge of self directed learning to discover what is needed for the task and then teach each other.

2 – Apply their algebra knowledge to a real world scenario.

3 – Deepening their skills as a collaborator by reflecting on previous performance and setting goals to make improvements.

Learning partnerships -

- Collaborative work amongst the students.
- IT staff and Learning Commons staff support in the MakerSpace when using Sphero.
- Telstra – Funding for Sphero programmable robotic balls.



Leveraging digital –

- Padlet for class brainstorm.
- Each group used a Google doc for planning.
- Socrative formative assessment quiz.
- Using Sphero programming to learn Linear relationships.
- Some groups chose to use Google presentations so they could collaborate on their presentation.
- Groups used different presentation tools.

Learning environments –

- Open space in the Library
- Regular classroom
- Online collaboration

Warrnambool's Longest Lunch – Assessment Rubric.

Team Members: _____

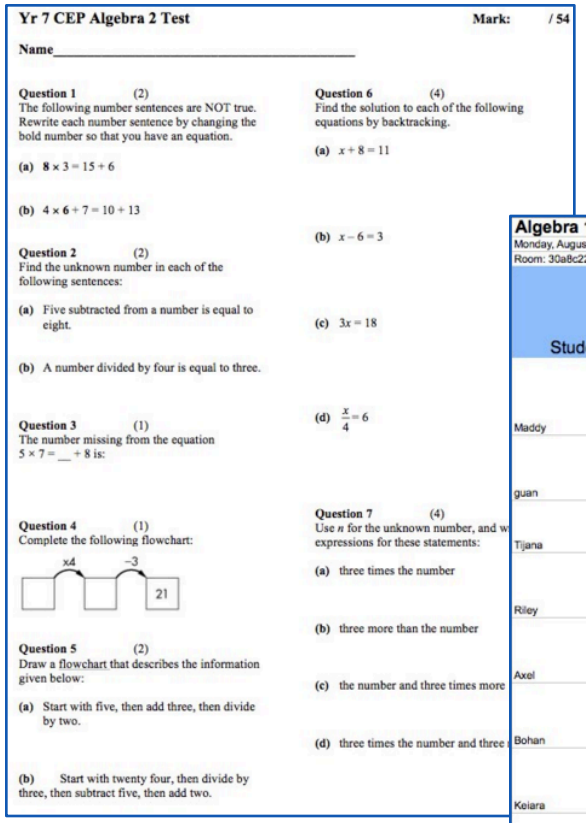
The task score

Criteria	Feedback				
Accurate use of the graph to find the information needed, showing all algebraic working out and results.					
	Not Shown		Partially completed		Competently completed
	1	2	3	4	5
The Solution Fluency was used collaboratively to ensure all aspects of planning have been considered and completed.					
	Not Shown		Partially completed		Competently completed
	1	2	3	4	5
The presentation shows a clear sequential process has been used and all considerations have been made clear.					
	Not Shown		Partially completed		Competently completed
	1	2	3	4	5
The amount raised is clear and how it was calculated is accurate.	**Total Raised $**				
	Not Shown		Partially completed		Competently completed
	1	2	3	4	5
Collaboration between all members of the group was evident.					
	Not Shown		Partially completed		Competently completed
	1	2	3	4	5

Assessment approaches used

Assessment to [inform practitioners in planning and delivering](#) progressive learning opportunities.

- Students had already completed surface learning in algebra where they completed a number of formative assessments and a unit test. It was evident that all students had the basic knowledge needed to progress to this activity.



Yr 7 CEP Algebra 2 Test Mark: / 54

Name_____

Question 1 (2)
The following number sentences are NOT true. Rewrite each number sentence by changing the bold number so that you have an equation.

(a) $8 \times 3 = 15 + 6$

(b) $4 \times 6 + 7 = 10 + 13$

Question 2 (2)
Find the unknown number in each of the following sentences:

(a) Five subtracted from a number is equal to eight.

(b) A number divided by four is equal to three.

Question 3 (1)
The number missing from the equation $5 \times 7 = \_\_ + 8$ is:

Question 4 (1)
Complete the following flowchart:

x4 → −3 → 21

Question 5 (2)
Draw a flowchart that describes the information given below:

(a) Start with five, then add three, then divide by two.

(b) Start with twenty four, then divide by three, then subtract five, then add two.

Question 6 (4)
Find the solution to each of the following equations by backtracking.

(a) $x + 8 = 11$

(b) $x - 6 = 3$

(c) $3x = 18$

(d) $\frac{x}{4} = 6$

Question 7 (4)
Use n for the unknown number, and w
expressions for these statements:

(a) three times the number

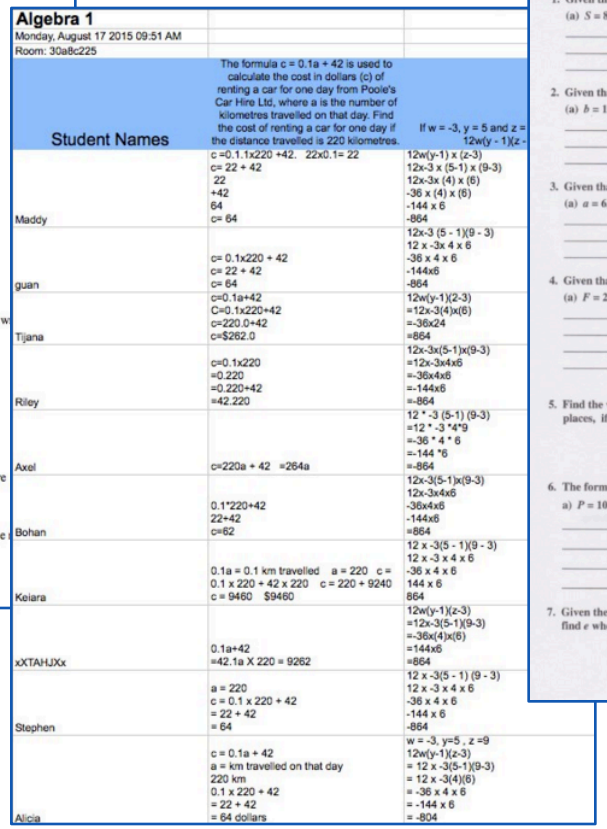
(b) three more than the number

(c) the number and three times more

(d) three times the number and three

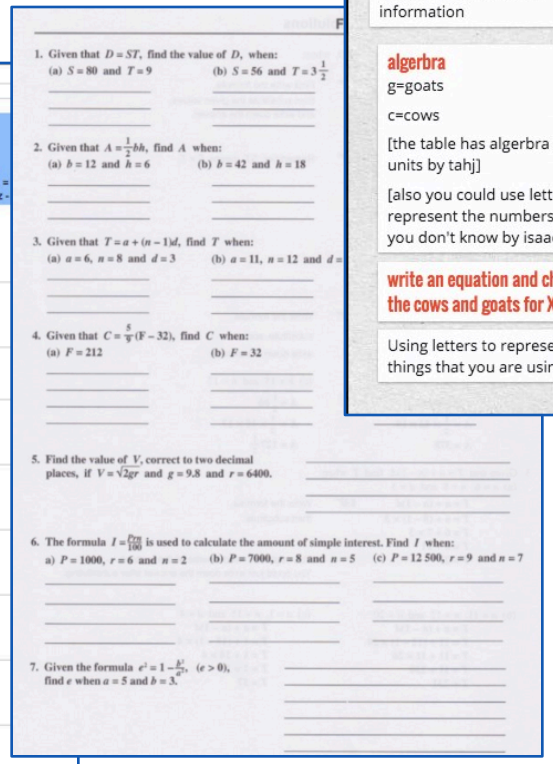
Pre and post unit test

Socrative online quiz



Algebra 1
Monday, August 17 2015 09:51 AM
Room: 30a8c225

Student Names	The formula c = 0.1a + 42 is used to calculate the cost in dollars (c) of renting a car for one day from Poole's Car Hire Ltd, where a is the number of kilometres travelled on that day. Find the cost of renting a car for one day if the distance travelled is 220 kilometres.	If w = -3, y = 5 and z = 12w(y - 1)(z -
Maddy	c =0.1.1x220 +42. 22x0.1= 22 c= 22 + 42 22 +42 64 c= 64	12w(y-1) x (z-3) 12x-3 x (5-1) x (9-3) 12x-3x (4) x (6) -36 x (4) x (6) -144 x 6 -864
guan	c= 0.1x220 + 42 c= 22 + 42 c= 64	12x-3 (5 - 1)(9 - 3) 12 x -3x 4 x 6 -36 x 4 x 6 -144x6 -864
Tijana	c=0.1a+42 C=0.1x220+42 c=220.0+42 c=$262.0	12w(y-1)(2-3) =12x-3(4)x(6) =-36x24 =864
Riley	c=0.1x220 =0.220 =0.220+42 =42.220	12x-3x(5-1)x(9-3) =12x-3x4x6 =-36x4x6 =-144x6 =-864
Axel	c=220a + 42 =264a	12 * -3 (5-1) (9-3) =12 * -3 *4*9 =-36 * 4 * 6 =-144 *6 =-864
Bohan	0.1*220+42 22+42 c=62	12x-3(5-1)x(9-3) 12x-3x4x6 -36x4x6 -144x6 =864
Keiara	0.1a = 0.1 km travelled a = 220 c = 0.1 x 220 + 42 x 220 c = 220 + 9240 c = 9460 $9460	12 x -3(5 - 1)(9 - 3) 12 x -3 x 4 x 6 -36 x 4 x 6 144 x 6 864
xXTAHJXx	0.1a+42 =42.1a X 220 = 9262	12w(y-1)(z-3) =12x-3(5-1)(9-3) =-36x(4)x(6) =144x6 =864
Stephen	a = 220 c = 0.1 x 220 + 42 = 22 + 42 = 64	12 x -3(5 - 1) (9 - 3) 12 x -3 x 4 x 6 -36 x 4 x 6 -144 x 6 -864
Alicia	c = 0.1a + 42 a = km travelled on that day 220 km 0.1 x 220 + 42 = 22 + 42 = 64 dollars	w = -3, y=5 , z =9 12w(y-1)(z-3) = 12 x -3(5-1)(9-3) = 12 x -3(4)(6) = -36 x 4 x 6 = -144 x 6 = -804



1. Given that $D = ST$, find the value of D, when:
(a) $S = 80$ and $T = 9$ (b) $S = 56$ and $T = 3\frac{1}{2}$

2. Given that $A = \frac{1}{2}bh$, find A when:
(a) $b = 12$ and $h = 6$ (b) $b = 42$ and $h = 18$

3. Given that $T = a + (n-1)d$, find T when:
(a) $a = 6$, $n = 8$ and $d = 3$ (b) $a = 11$, $n = 12$ and $d =$

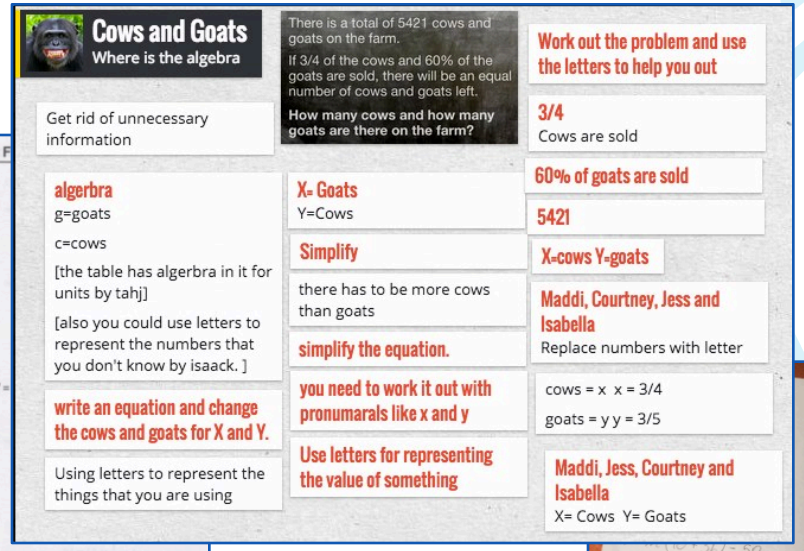
4. Given that $C = \frac{5}{9}(F - 32)$, find C when:
(a) $F = 212$ (b) $F = 32$

5. Find the value of V, correct to two decimal places, if $V = \sqrt{2gr}$ and $g = 9.8$ and $r = 6400$.

6. The formula $I = \frac{Prn}{100}$ is used to calculate the amount of simple interest. Find I when:
a) $P = 1000$, $r = 6$ and $n = 2$ (b) $P = 7000$, $r = 8$ and $n = 5$ (c) $P = 12\,500$, $r = 9$ and $n = 7$

7. Given the formula $e^2 = 1 - \frac{b^2}{a^2}$, $(e > 0)$, find e when $a = 5$ and $b = 3$.

Homework sheets



Cows and Goats
Where is the algebra

There is a total of 5421 cows and goats on the farm.
If 3/4 of the cows and 60% of the goats are sold, there will be an equal number of cows and goats left.
How many cows and how many goats are there on the farm?

Work out the problem and use the letters to help you out

Get rid of unnecessary information

3/4
Cows are sold

algebra
g=goats
c=cows
[the table has algerbra in it for units by tahj]
[also you could use letters to represent the numbers that you don't know by isaack.]

X= Goats
Y=Cows

60% of goats are sold

5421

Simplify

there has to be more cows than goats

X=cows Y=goats

Maddi, Courtney, Jess and Isabella
Replace numbers with letter

write an equation and change the cows and goats for X and Y.

simplify the equation.

you need to work it out with pronumarals like x and y

cows = x x = 3/4
goats = y y = 3/5

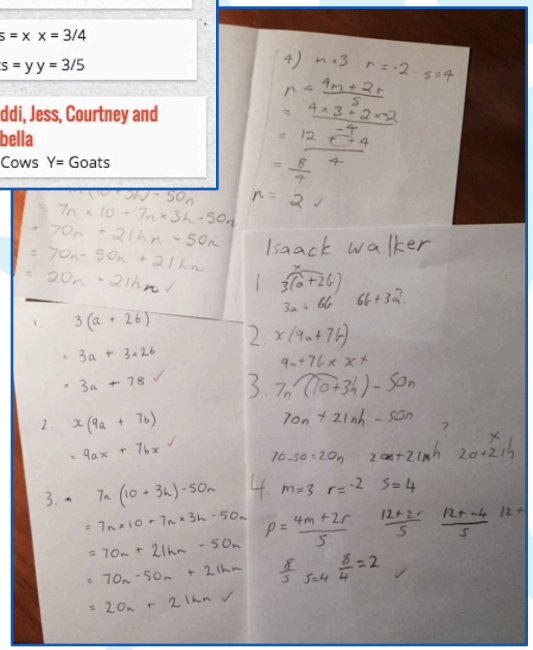
Using letters to represent the things that you are using

Use letters for representing the value of something

Maddi, Jess, Courtney and Isabella
X= Cows Y= Goats

Padlet class brainstorm

Exit tickets



Continued….

Assessment to inform practitioners in planning and delivering progressive learning opportunities.

Using all formative assessments and this rubric, it is easy to determine competency levels for each student. Prior to beginning the Warrnambool's Longest Lunch task is was essential that all students could show competency for all criteria 1 and 2 and at least up to 3.1.4.

At the completion of the task the aim would be for students to be able to show competency in all criteria.

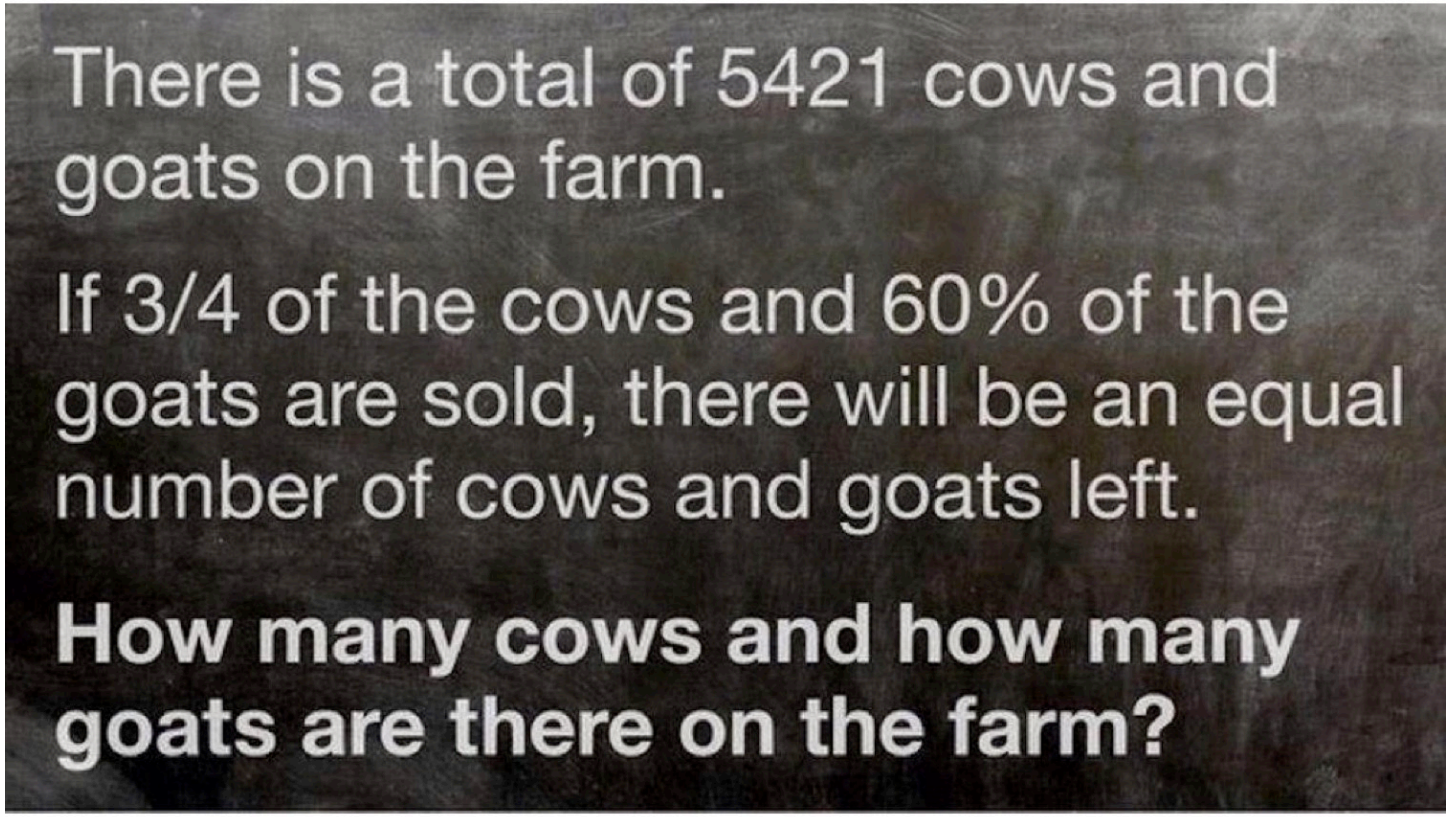
Rubric – Competency with Algebra

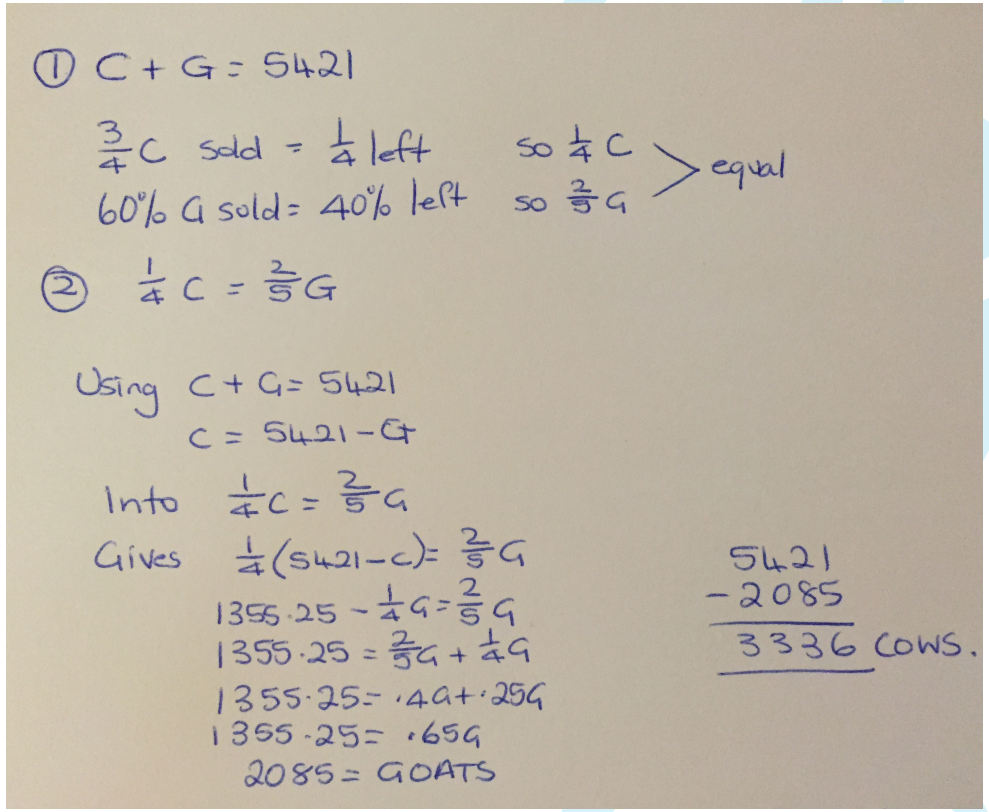
Quality Criteria Success Criteria	1.1.5 Create rules to solve problems	2.1.6 Utilise algebra to solve real world problems	3.1.7 Solve linear equations using algebraic and graphical techniques	
			3.1.6 Determine linear rules from tables and graphs	
		2.1.5 Solve linear equations using inverse operations and use substitution to check answers	3.1.5 Determine gradient and axis intercepts of linear points	
	1.1.4 Substitute both positive and negative numbers into algebraic expressions	2.1.4 Connect the laws and properties of number to algebra	3.1.4 Sketch linear graphs using coordinates of 2 points	3.2.4 Describe rules using words
	1.1.3 Create tables from patterns and write rules	2.1.3 Simplify algebraic expressions involving the four operations	3.1.3 Represent linear relationships as a table of ordered pairs	3.2.3 Classify as linear or non-linear
	1.1.2 Represent arbitrary numbers using variables	2.1.2 Express a written statement as an equation	3.1.2 Assign ordered pairs to given points on the Cartesian plane and find coordinates to a given point	3.2.2 Investigate, interpret and analyse graphs from authentic material
	1.1.1 Insufficient Evidence	2.1.1 Insufficient Evidence	3.1.1 Insufficient Evidence	3.2.1 Insufficient Evidence
Indicators Learning Intention	1.1 Demonstrates knowledge of pronumerals, algebraic patterns and rules.	2.1 Demonstrate the ability to manipulate equations to find an unknown value.	3.1 Understand the relationship between patterns, tables and linear graphs.	3.2 Apply knowledge about linear relationships to real world problems.
Capabilities	**1** **Discovers Variables and Rules**	**2** **Constructs Equations**	**3** **Develops Linear Relationships**	

Continued….

Assessment that enables learners to see and appreciate the progress that they have made and promote further learning and development .

- Students had completed a simple task that required their algebra knowledge.





Continued….

Assessment that enables learners to see and appreciate the progress that they have made and promote further learning and development .

Sphero app

Macrolab app

SPRK app

OrbBasic app

Students were able to used Sphero programmable robotic balls to determine the relationship between time, speed and distance. They were then able to graph the relationship from a table of data and calculate the rule to the graph. This was very engaging and the students were able to quickly see the application of algebra in a real world situation. We used

Student work sheet

SPRK
schools parents robots kids

MacroLab Lesson 1
Time, Speed, and Distance: Worksheet

Names:

Part 3 - Time and Distance:

How far did the Sphero travel for Speed: 20% Time: 3000 (3 seconds): _____

How far did the Sphero travel for Speed: 20% Time: 6000 (6 seconds): _____

How far did the Sphero travel for Speed: 20% Time: 9000 (9 seconds): _____

What is the 6 second answer divided by the 3 second answer: _____

What is the 9 second answer divided by the 3 second answer: _____

Part 4 - Speed and Distance:

How far did the Sphero travel for Speed: 20% Time: 3000 (3 seconds): _____

How far did the Sphero travel for Speed: 40% Time: 3000 (6 seconds): _____

How far did the Sphero travel for Speed: 60% Time: 3000 (9 seconds): _____

What is the 40% answer divided by the 20% answer: _____

What is the 60% answer divided by the 20% answer: _____

Part 5 - Challenge:

What dalay value did you use in the challenge: _____

Continued….

Below and on the next page are the instructions for how to program Sphero to complete the Time, Speed and Distance activity and gather data that allows the construction of a table to show the linear relationship of the three variables.

SPRK
schools ϟ parents ϟ robots ϟ kids

MacroLab Lesson 1
Time, Speed, and Distance: Student Guide

You are going to be using Sphero to figure out how time, speed, and distance relate to each other. Sphero can be programmed to roll at a certain speed for a certain amount of time. You are going to be creating programs to do just that, and then measure how far it goes. By changing the speed that Sphero rolls at and the time it spends rolling, you will be able to learn about how time, speed, and distance all relate.

The Macrolab commands you are going to use in this lesson are:

- Roll – Makes Sphero roll at a given speed and heading.
- Stop – Makes Sphero stop rolling immediately.

First you have to connect Sphero to the iPad (Part 1), then aim it (Part 2), and then there are two experiments (Part 3 and Part 4), and finally a challenge to see what you've learned (Part 4).

What can we figure out about time, speed, and distance?

If something goes at a certain speed for a certain amount of time, we know that it will go a certain distance. But how are these related? If an object moves faster, we know it will move farther, but do we know how much farther? Same for if it moves for a longer period of time.

The great thing about Sphero is that we can set its speed and we can set how long it should roll for. So then we just need to measure the distance. We can do that by marking the starting and ending points with masking tape, and measuring the distance between them.

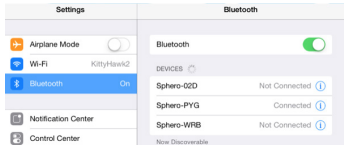
If we want to see how the distance has changed when we change the time or the speed, all we have to do is divide the new distance by the original distance. You'll do this math on your worksheet.

Part 1: Connect the Sphero

First thing you need to do is to connect the iPad to Sphero. Here's how:

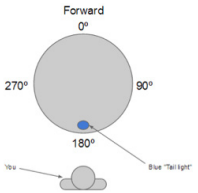
1. Pick up Sphero from its charging station and tap it twice on the logo to wake it up. You may have to tap it hard. It will start flashing colors when it is awakened out of its "sleep" state.
2. On your device, make sure Bluetooth is enabled. From the home page, click on Settings at the bottom. Then choose Bluetooth.
3. You will be shown a list of Spheros. Connect to the appropriate Sphero by tapping it. You can tell which Sphero is which by the names, which relate to the colors the ball is flashing. For example, if it flashes purple, then yellow, then green, then that is ball PYG. Select the one you want. Once successfully connected, it will say "Connected".

Part 1: Connect the Sphero (continued)



Part 2: Aiming Sphero

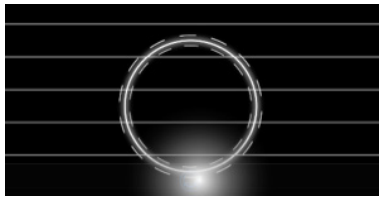
Sphero has a direction built into it that it thinks of as "straight ahead". This is called the orientation. The first thing we want to do is to aim the Sphero so that the orientation is on the path we want it to go. Each Sphero has a blue light inside of it called the "taillight", which is always on the exact opposite side of the straight ahead direction. You are going to set the taillight so that it's pointing right at you when you look down the path you want Sphero to go. Then, when it goes straight ahead, it will be on that path.



Follow these steps to aim the Sphero:

1. Go to the home screen and open MacroLab.
2. Have one of you hold the Sphero and stand at the beginning of the path you will use for your experiments.
3. Now, you will aim the Sphero in that direction. Have a second member of the group use the iPad. In MacroLab, you will see a circle with two arrows at the bottom center of the screen. Tap on it and hold it.

4. A white circle will appear. Move your finger slightly to rotate the insides of the Sphero. You will see a blue light inside the ball. Move it around until the blue light is directly facing the person holding the Sphero. This is the "taillight", and shows the direction opposite where the Sphero will move when moving straight ahead.



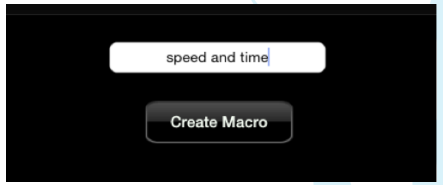
Important: For these experiments, the Sphero will travel a long distance, so be sure to aim the Sphero as accurately as you can to keep it on track. You can also re-aim Sphero anytime!

Part 3: Time and Distance

Now that we have Sphero going in the right direction, follow these steps for the first experiment:

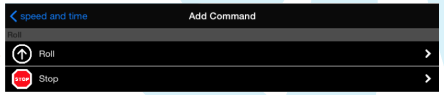
1. Tap the + button at the bottom to create a new macro.

2. Where it says Macro Name, call type speed and time. Click Create Macro.



3. Add a command by tapping the + button at the bottom right.

4. Tap on Roll, the first command in the list.



5. Change the Speed to 20 and the Delay to 3000. It may be easier to use the keyboard than try to get the right values with the slider. Leave the Heading at zero. Click the Create button up top.