# KS2 Maths/Science Teacher Guide

This resource is designed to be delivered as a project alongside the Space Adventures Vlogs, diary entries, literacy resources and computing resources.

The worksheets that make up the resource are associated with the content of each vlog, and it's recommended that they are delivered in that order alongside the other resources sequentially.

This guide outlines the key topics covered in each section, along with some suggestions for delivery, answers where appropriate, and links to other useful web resources.

## Topics covered

| Vlog | Maths | Science |
|---|---|---|
| 1 | • Rounding to whole number<br>• Calculating average speed given distance and time<br>• Plotting distance vs. time graphs and interpreting them<br>• Plotting speed vs. time graphs and interpreting them | • Experimentation<br>• Graphing<br>• Speed, Distance, Time |
| 2 | • Rounding to 100<br>• Calculating Diameters and Circumference | • Microgravity - why do you feel weightless?<br>• Orbits |
| 3 | • Converting units<br>• Multiplication and division using a calculator<br>• Lowest Common Multiples<br>• Adding fractions<br>• Comparing fractions with different denominators | • Key digital file size terminology<br>• Planetary orbits |
| 4 | • Angles<br>• Coordinates | • Computer science - programming<br>• Loops<br>• Properties of materials |
| 6/7 | • Sequences - identifying patterns, extending, identifying missing numbers<br>• Percentage calculations | • Natural gases and atmosphere |

Here is a link to the student site which contains many of the resources below, in a self-marking online format.

# Vlog 1 - Countdown and Take Off

In this session, students will be doing some rounding, calculating speeds and plotting and interpreting line graphs of speed, distance and time. There is a science experiment which involves predicting outcomes and estimating measures, along with accurately recording times.

Link to teacher presentation (Google Slides)
Link to teacher presentation (PowerPoint download)

### Starter

Display the starter challenge on the board, and ask students to come up with their own ideas in groups. There is an extension comparison involving Bradley Wiggins where the time is under 1 hour, so students need to convert which is a little more challenging.

Guide students in a summary to compare by calculating speed by dividing distance by time.

### Mini Task 1

Slide 3 encourages students to identify suitable measures. Explain that when doing science experiments with quick observations every second, it's better to use m/s, whereas longer journeys over many miles might be more suitable to use mph.

*Note: there are some mph - m/s conversions to help students contextualise speeds for the rest of the activity*

### Main Task

Hand students the worksheets.
The first 3 questions involve rounding to the nearest integer and calculating speeds.
Q4-6 require students to first predict what the distance vs time graph would look like. This video of the SpaceX launch on 6th Feb 2018 is a good help. Ask students to think about how much it moves in the first few seconds, compared to 10 seconds in. They should plot as accurately as possible the data on the graphs and then compare with partners.

### Experiment

Give students the experiment worksheets in pairs.
In this experiment each group will need:

- An outdoor space
- An object to throw in the air and land safely (e.g. a ball)
- A stopwatch
- Optional: a device to record video

Part 1
Get students to predict what their graph will look like.

Part 2
Head outside with some devices to film the experiment. This works best when you film next to a building that you know the height of, or have a metre stick in shot to make estimation easier

Part 3
Students need to pause/play their videos back in class to try and accurately draw their graph and make comparisons.

## Answers

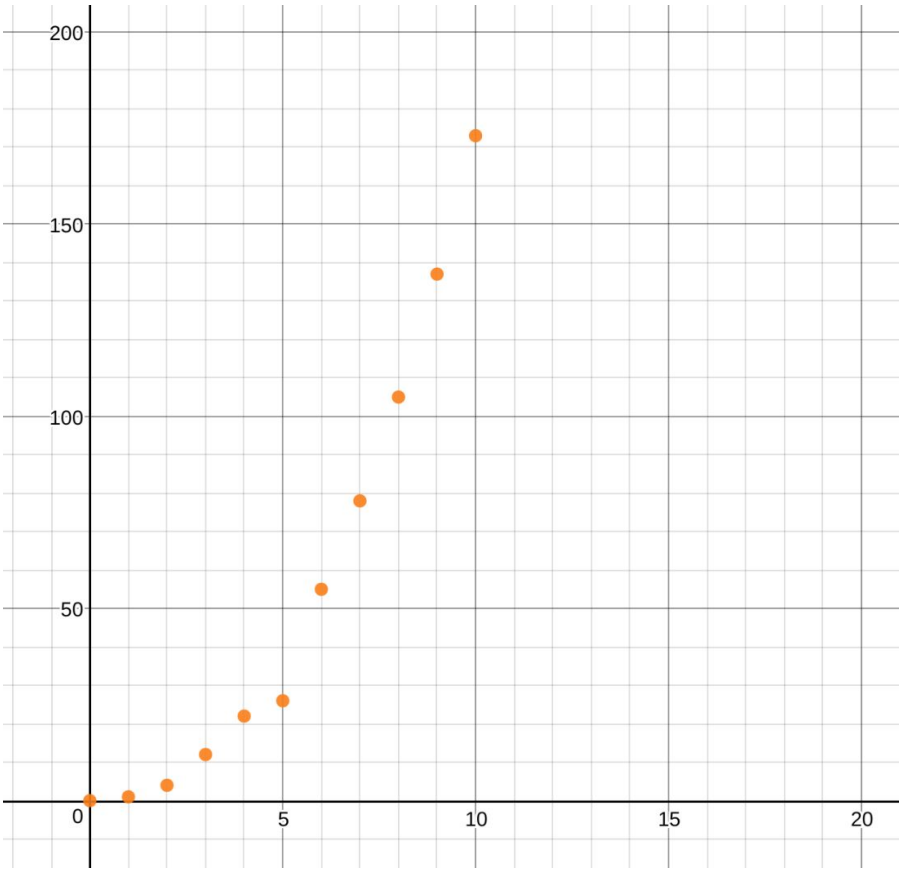
1)

| Time (secs) | Distance (m) | Speed (m/s) | Speed (m/s) |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 1 | 1 | 1.8 | 2 |
| 2 | 4 | 5.13 | 5 |
| 3 | 12 | 7.67 | 8 |
| 4 | 22 | 11.09 | 11 |
| 5 | 26 | 14.4 | 14 |
| 6 | 55 | 16.823 | 17 |
| 7 | 78 | 21.4 | 21 |
| 8 | 105 | 24.01 | 24 |
| 9 | 137 | 27.49 | 27 |
| 10 | 173 | 31.3 | 31 |
| 11 | 215 | 34.01 | 34 |
| 12 | 261 | 38.34 | 38 |
| 13 | 312 | 41.57 | 42 |
| 14 | 369 | 45.49 | 45 |
| 15 | 430 | 48.67 | 49 |
| 16 | 497 | 53.009 | 53 |
| 17 | 570 | 57.12 | 57 |
| 18 | 648 | 60.04 | 60 |
| 19 | 731 | 63.5 | 64 |
| 20 | 820 | 68.39 | 68 |
| 60 | 9600 | 237.53 | 238 |
| 180 | 114000 | 834.3 | 834 |

2) 17.3 m/s

3) 60.5 m/s

5)


200
150
100
50
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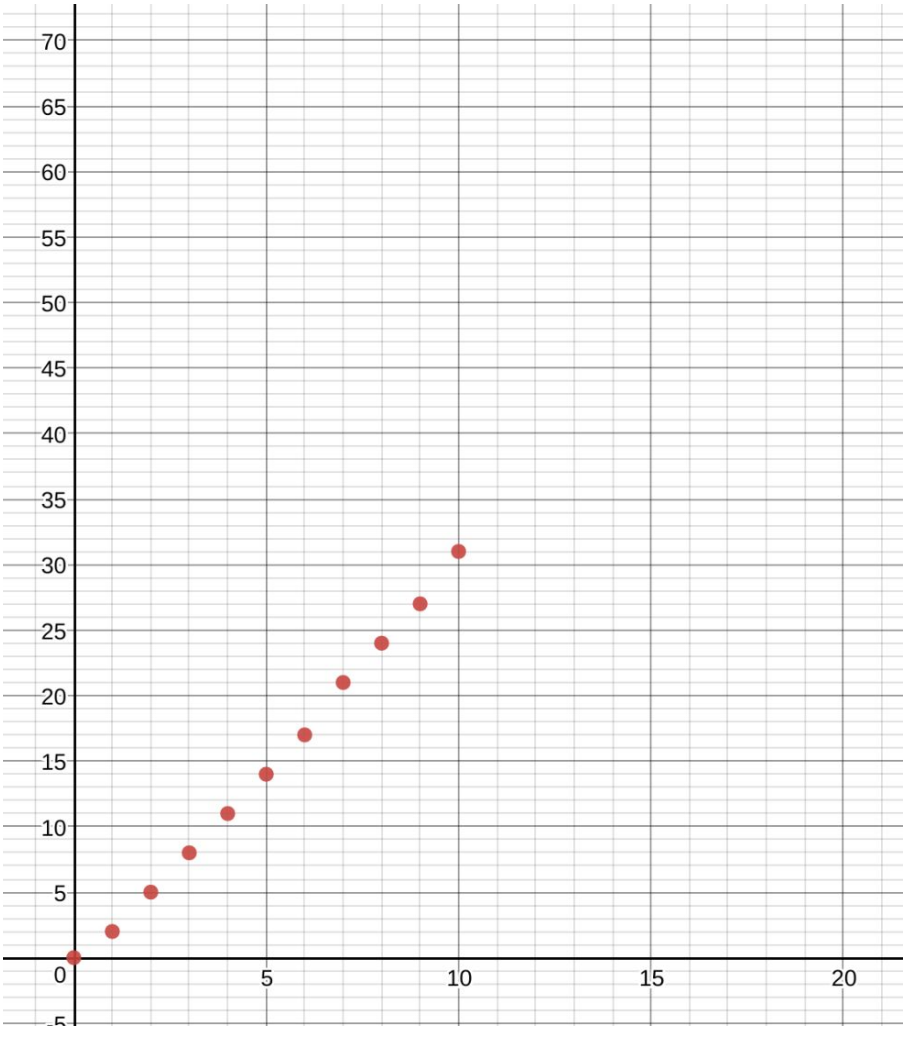
8)


70
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55
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25
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# Vlog 2 - In Space

In this session, students will be calculating diameters and circumferences of circles. They will also be learning the concept of micro-gravity, and understanding why people feel weightless in orbit, even though there is still a large gravitational pull from the Earth.

Link to teacher presentation (Google Slides)
Link to teacher presentation (PowerPoint download)

### Starter

Students discuss and identify different parts of the circle. You could print slide 2 out and give to students to write on.

### Mini Task 1

Slide 3 asks students to find the circumference/perimeter of 3 shapes. It is assumed that by this point you have done some investigations to discover pi. A really nice way to do this is to get students to measure the circumference and diameter of various cylindrical objects and get them to record the values. They can then divide the circumference by the diameter for each and get a pretty close value to pi!

Answers:
Green = 31.4
Blue = 50.3
Orange (EXTENSION) = 23.1

### Mini Task 2

Watch the OK Go video on slide 4 and prompt students to think about how they might have filmed it?
Then watch the behind the scenes video (slide 5) showing how they do it by 'dropping' the plane in a series of parabolas.
Finally, ask students to think about why people feel weightless in space (slide 6) and importantly why they feel weightless in orbit where Earth's gravity is really strong. You are trying to get students to discover that the reason they feel weightless is because they are in a permanent state of free fall inside the rocket. Useful comparisons on Earth are when you go over a small bridge in a car, or when a lift initially starts dropping.

### Main Task

Hand students the worksheets.
Questions 1-3 are all about calculating diameters and circumferences.
Questions 4 and 5 ask students to explain why the rocket orbits Earth first, and also to explain the feeling of weightlessness in orbit.

## Answers

1) 12,742 km
2) 40,000 km
3) 41,200 km

EXT: roughly 6.3m

# Vlog 3 - The Moon

In this task students will be using calculators to carry out complex conversions. They are also introduced to binary code and the concepts of bits and bytes and calculations involving file storage. They also use understanding of lowest common multiples to solve problems.

Link to teacher presentation (Google Slides)
Link to teacher presentation (PowerPoint download)

## Starter

The starter activity on slide 2 gets students thinking about converting values and are large enough to warrant effective use of a calculator.
Answers:

1) 416
2) 780
3) 17
4) EXT: 13

## Mini Task 1

Slide 3 introduces what a bit is in computing (0 or 1) and the concept of binary. Note - exploring different base systems is a really nice activity to do with students another time
Slide 4 introduces the task of finding out the total number of patterns possible with increasing numbers of bits.
Slide 5 gives students a hint for the first two. Encourage students to complete the table to find out how many possible patterns are available in a byte (8 bits).

## Main Task 1

Hand out the worksheet and encourage students to complete questions 1 - 5 in small groups or pairs with the use of a calculator.
Answers:

1) 10 seconds
2) 48 seconds
3) 5MB or 5120KB
4) 3.75MB or 3840KB
5) 3276.8 seconds or 54.6 minutes

## Mini Task 2

Slide 7 gives students a mini challenge word problem involving fruits and 3 friends. Essentially they need to find the lowest common multiplier to establish that they will all have the same fruit again in 12 lunches time. This leads them into the thinking required for the next ain task which is quite challenging

## Main Task 2 - Challenge

This task introduces the idea of planet conjecture in orbit - where planets appear in line in the sky. It encourages students to use their understanding of LCM and apply it to planets in orbit. A really cool tool to show students, or get them to use on devices is solarsystemscope.com
In the task, students are encouraged to find the LCM of 1, ¼ and ⅔ which are the planets orbit times in relation to one earth year. Some may need encouragement to write a list of fractions increasing, and may struggle with adding ⅔ and might benefit from use of visual aids.
The more accurate calculation involving days is best calculated through use of a spreadsheet.

# Vlog 4 - Moon Surface

In this task students will be using calculators to carry out complex conversions. They are also introduced to binary code and the concepts of bits and bytes and calculations involving file storage. They also use understanding of lowest common multiples to solve problems.

Link to teacher presentation (Google Slides)
Link to teacher presentation (PowerPoint download)

### Starter

Pupils need to identify coordinates in all 4 quadrants from slide 2.
Answers

A) (2,5)
B) (-3,4)
C) (-6,-2)
D) (4,-4)

### Intro to Main Task

Go through the slides, or get students to go through the examples on the worksheets and make sure that they understand the programming language and what they are required to do. There is a blank slide on slide 4 with some dysprosium and a mining vehicle where you can show students how to write programs, then dragging the robot and executing them. It's a great way to identify mistakes and correct them.

### Main Task 1

Students need to write the code down for each of the mining tasks, and log the coordinates of each point that the robot has visited. There's no correct answer for these, but there are solutions that minimise the number of lines of codes used, and distance travelled that students should be aiming for.
As students complete these challenges, they should pair up or get into groups to compare their results using the 4 question prompts at the bottom of their worksheet.

You may want to summarise this task by recreating some of the tasks on slide 4 and getting students to share their coding solution, and asking the class to appraise whether it would work or not, before actually 'running' or executing it by moving the robot around.

### Main Task 2

The last task gets students thinking about programming a robot to detect the dysprosium. Based on the image and description they need to set the program to mine elements with the following properties:

| State | Solid | Liquid | Gas |
|---|---|---|---|
| Magnetism | Strongly magnetic | Weakly magnetic | Not magnetic |
| Transparency | Opaque | Semi transparent | Transparent |
| Solid property | Very hard | Malleable | Very soft |
| Reflection | Shiny | Semi-shiny | Dull |
| Electrical type | Conductor | Semiconductor | Insulator |

# Vlog 6/7 - “Make it stop” / Switch to Manual

In this activity, students have to solve a series of problems to help Tazz override controls into manual. They will use skills including sequences, percentages and calculating with decimals

Link to teacher presentation (Google Slides)
Link to teacher presentation (PowerPoint download)

## Starter

Students have to answer the questions on slide 2 involving converting fractions and decimals to percentages

## Main Task 1

This task is all about sequences. Students are required to spot patterns, and then identify missing values. The sequences increase with difficulty. The last sequence is the only non-linear one - in this case the values double each time.

Answers

| | | | | | | |
|---|---|---|---|---|---|---|
| Sequence 1 | 2 | 5 | 8 | 11 | 14 | 17 |
| Sequence 2 | 8 | 17 | 26 | 35 | 44 | 53 |
| Sequence 3 | 29 | 24 | 19 | 14 | 9 | 4 |
| Sequence 4 | 7 | 14 | 21 | 28 | 35 | 42 |
| Sequence 5 | 6 | 11 | 16 | 21 | 26 | 31 |
| Sequence 6 | 2 | 4 | 8 | 16 | 32 | 64 |