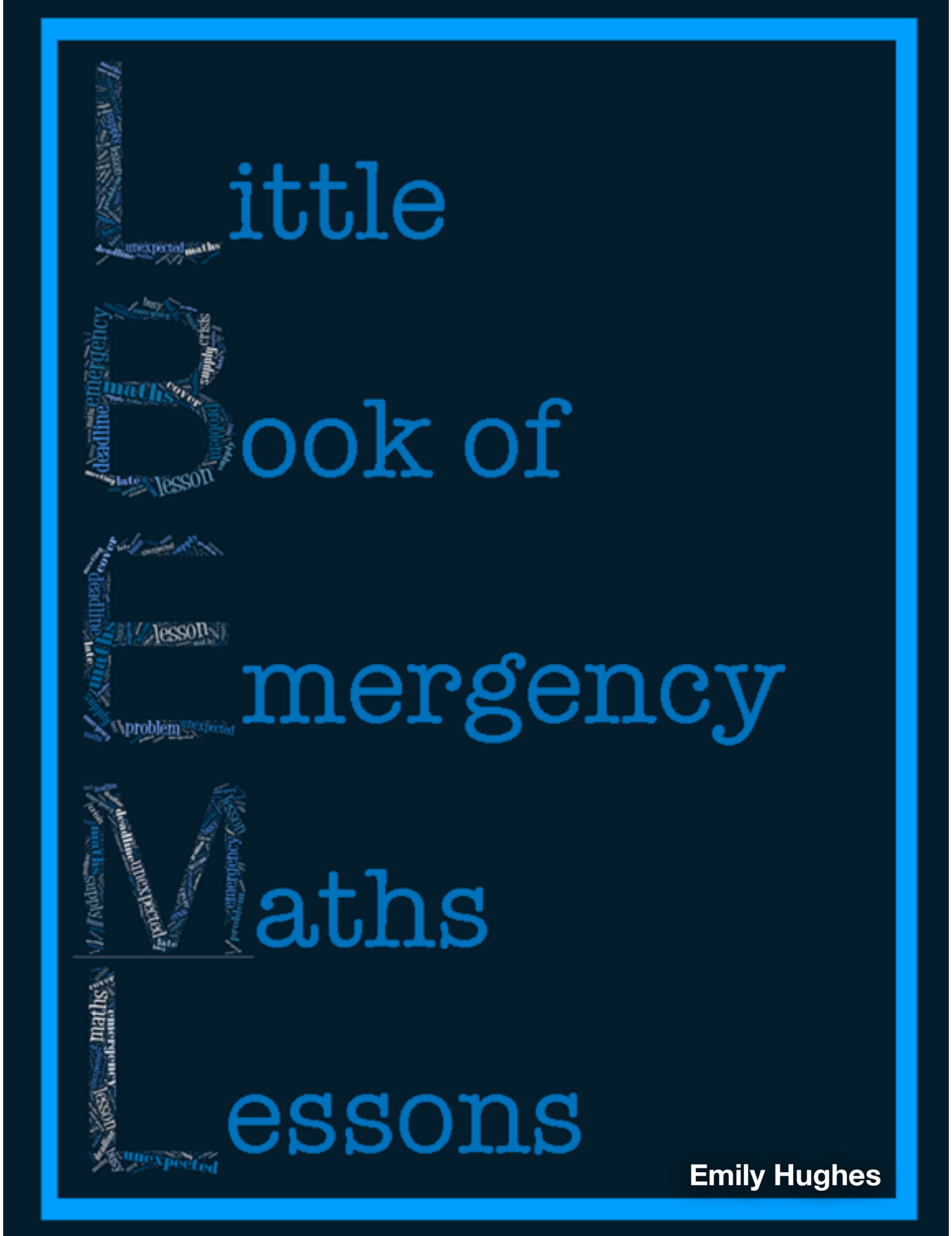

Little
Book of
Emergency
Maths
Lessons
Emily Hughes

Chapter 1

# Algebra

# Co-ordinates (1 quadrant)

**Learning outcomes:** **I can plot co-ordinates in the first quadrant (all positive numbers) Level 3**

**I can plot co-ordinates in all four quadrants (including negative numbers) Level 6**

## REQUIREMENTS / TEACHER NOTES

**Materials required:**

**Pen**

**Pencil**

**Ruler**

**Teacher notes:**

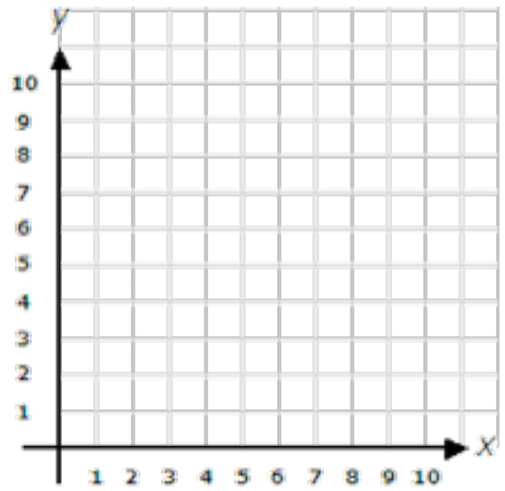
**Remind students that co-ordinates go along first, then up/down.**

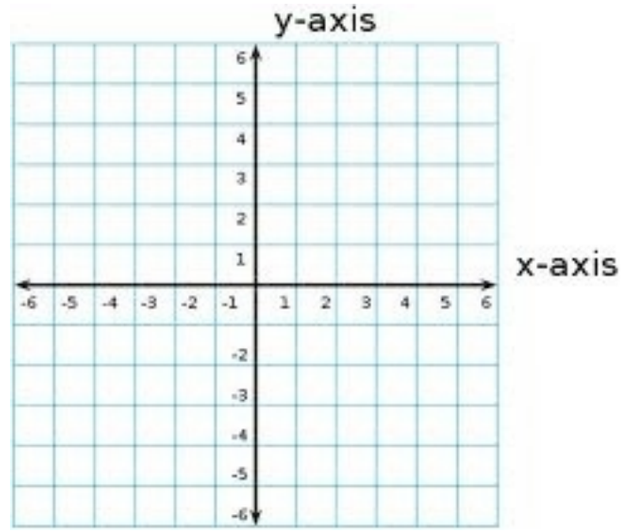
**Eg:**

**(3,4) means go 3 right, 4 up.**

**(-2,-5) means go 2 left, 5 down.**

**Draw a co-ordinate grid from either 0 to 10 or -6 to 6**




**Now create a picture by joining up co-ordinate points. Try to only use straight lines.**
**When you have finished designing your picture, write out instructions for how to draw your picture from scratch, by describing which co-ordinates to join up, in which order.**

**Now find someone else who has finished, and take it in turns to read out your instructions to see if their finished picture matches yours (don't show them until they're finished!!)**

# Simple Equations

**Learning outcomes:**

**I can use problem solving skills  Level 3**
**I can show my understanding by finding examples  Level 3**
**I can try my own ideas to find solutions  Level 4**
**I can substitute into simple expressions  Level 4**
**I can form an expression from words  Level 5**
**I can use symbols to discuss a problem  Level 5**
**I can justify my solution by extending it to a new set of rules  Level 7**

## REQUIREMENTS / TEACHER NOTES

**Materials required:**

**Pen**

**Pencil**

**Ruler**

**Teacher notes:**

**Display/write on board the picture shown.**
**Students to try with different numbers (calculators if needed!).**
**Does it still work with negative numbers? Decimals?  Fractions? Square roots?**

**Can they find a way to explain why it works?  They might find it helpful to represent their number somehow, either with a picture or symbol...**

**Can they make up their own set of rules to end up with a different number?**

Think of a number

Add 6

Double it

Take away 4

Halve it

Take away the number you started with.

The answer is 4!

WHY???

# Trial and Improvement

**Learning outcomes:**

**I can use maths when problem solving, and apply it Level 4**

**I can present information in a a clear, organised way Level 4**

**I can check whether answers are sensible Level 5**

**I can solve problems using trial and improvement Level 6**

## REQUIREMENTS / TEACHER NOTES

**Materials required:**

**Pen** **Calculator**

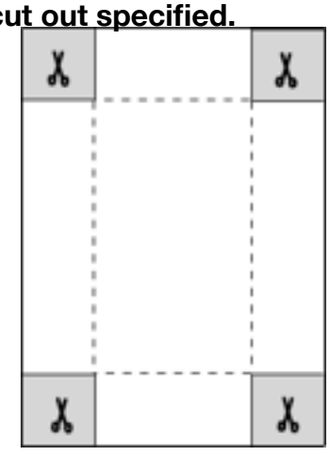
**Pencil**

**Ruler**

**Teacher notes:**

**Get students to try it out first with actual paper, to ensure that the edges of their box meet up.**

**The final working should show a diagram like this, with the size of square to cut out specified.**



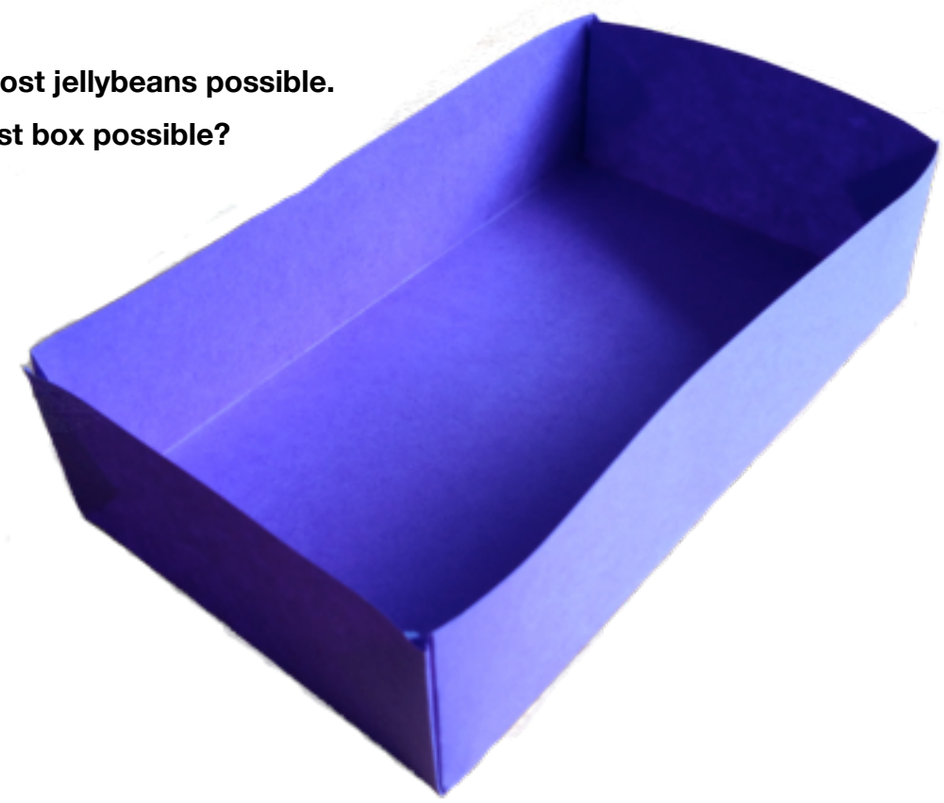
**Bob is in trouble. He has forgotten to buy anything for his mum's birthday, and the shops have shut.**

**He decides to use a piece of card that he has found to make a box with no top, which he will decorate and fill with jellybeans.**

**He wants to make sure that the box holds the most jellybeans possible.**

**How can he fold/cut the card to make the biggest box possible?**

**The card is A4 size (30cm x 21cm)**



**Answer on next page, just in case you're putting this on the board....!**

# Real-life graphs

**Learning outcomes:** I can describe features on a graph Level 6

I can draw graphs arising from real life situations Level 6

REQUIREMENTS / TEACHER NOTES

Materials required:

Pen

Pencil

Ruler

Teacher notes:

Creativity makes this much more interesting!

Suggestions for possible graphs:

Happiness against time of day

Hunger against time of day

Laughter against an episode of Spongebob Squarepants

**Create a graph of a journey, or day, along with the story of what is happening. You probably want to start with something simple like distance from home on the vertical axis, and time on the horizontal axis.**

**Marks awarded for:**

- **creativity (eg not 'I walked for 2 metres, then I stopped for 1 minute, then I..... blahblah .. boring...boring...)**
- **accuracy of the graph in relation to the story.**

**Your graph should be checked against your story regularly to make sure that each event is properly graphed.**

**The idea is to get the information across to the audience clearly.**

**Try giving your graph to a partner, and giving them an event to find. Can they identify that event on the graph from your description?**

**You score bonus creativity marks for inclusion of the following words:**

**Apocalypse**

**Shark**

**Unicorn**

**Wedding**



Answer to 'trial and improvement' is x = 4.0559027913 to 10dp! This gives a volume of 1144 cubic cm (to the nearest cubic cm)

# Graph transformations

**Learning outcomes:** I can draw lines of the form y = 2x + 1 Level 5

I can find equations of and draw parallel lines Level 6

I understand the effect on a graph of addition or multiplication by a constant Level 8

## REQUIREMENTS / TEACHER NOTES

**Materials required:**

Pen

Pencil

Ruler

**Teacher notes:**

Students should start with linear equations like y = 2x + 3.

They should not move on to the next section until they have fully explained what effect changing the numbers in a linear equation has on the graph.

You will need to draw a quick sketch set of axes for each set of graphs, but you should still use a pencil and ruler.

To draw the graph of a linear equation, you need to find 2 pairs of co-ordinates that solve the equation, then join them with a line that goes through both.

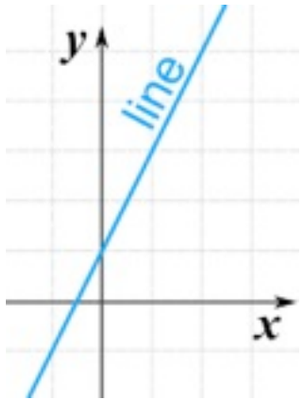
Usually plotting the co-ordinates (0, something) and (1, something) will do.

For example, for the equation y = 2x + 1:

y = 2 lots of x, plus 1.

so, if x = 0, y = 2 lots of 0, plus 1. That means x=0, y=1, or (0,1)

If x = 1, y = 2 lots of 1, plus 1. That means x=1, y=3, or (1,3)




Plot (0,1) and (1,3) on your graph, and join them up like this

Your job is to investigate what happens to the graph when you change the numbers in your equation.

You should start by changing the number at the end.

What happens if you plot y=2x+3 instead? How about y=2x-2?

On a new set of axes, try changing the number in front of the x instead, eg y=3x+1.

Can you work out and write down what effect changing each part of the equation has on the graph?

What if you multiply the whole of the right side of the equation by something - what happens to the graph?

Chapter 2

# Number

# Place value

**Learning outcomes:**

**I can show my understanding by finding examples Level 3**

**I can use written methods to add and subtract Level 4**

**I can try my own ideas to find solutions Level 4**

**I can draw conclusions from my answers Level 5**

**I can justify my solutions by showing how they apply to other situations Level 7**

## REQUIREMENTS / TEACHER NOTES

**Materials required:**

**Pen**

**Pencil**

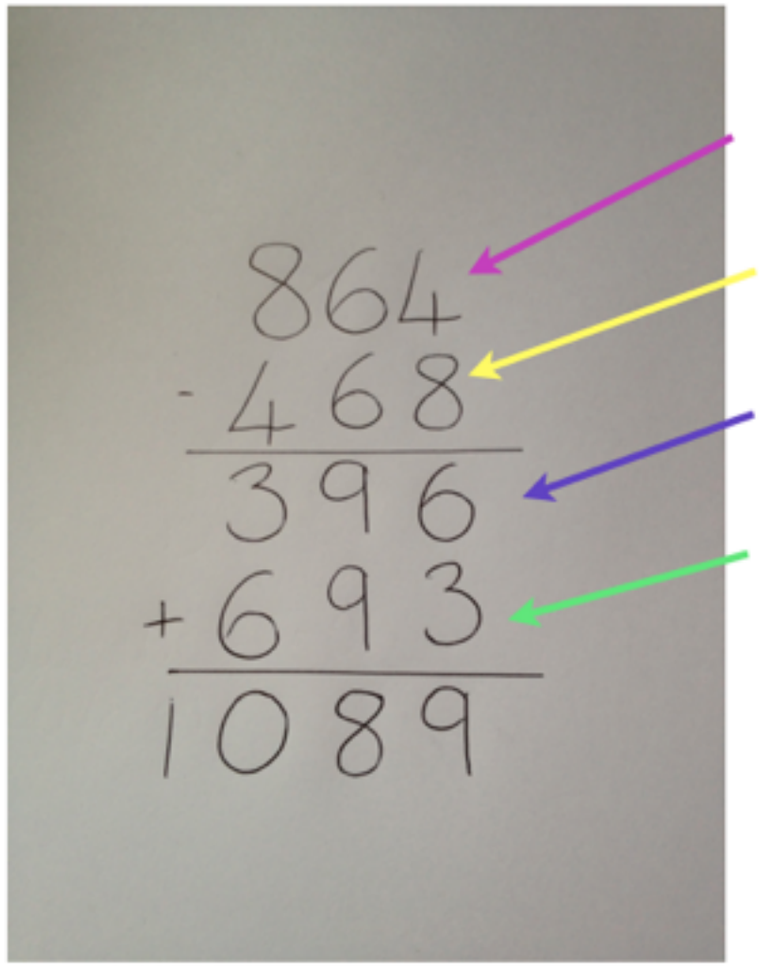
**Ruler**

**Teacher notes:**

**Can they find any numbers that DON'T fit the rule?**

**Some may be able to look at the structure of the sum to start to prove why it works.**

**NO calculators!**



# Ratio and recipes

**Learning outcomes:**

**I can check my solutions by estimation Level 5**

**I can solve problems using my knowledge of ratios Level 6**

**I understand that I can use fractions or decimals to solve problems Level 6**

**I can explain my reasoning and solutions Level 7**

## REQUIREMENTS / TEACHER NOTES

Materials required:

**Pen** **Calculator**

**Pencil**

**Ruler**

Teacher notes:

**How many more cookies are needed? How does this number relate to the original number of cookies?**

**Discussion points: Can you have a fraction of an egg?**

**Would you just make more than you need to round off the numbers? (For the purposes of the maths, no! For real life, maybe.)**

**This is a recipe for Chocolate Chip Cookies:**

By Antony Worrall Thompson

## Ingredients

350g/12¼oz unsifted flour

1 tsp bicarbonate of soda

1 tsp salt

225g/8oz butter

175g/6¼oz caster sugar

175g/6¼oz soft brown sugar

1 tsp vanilla extract

2 eggs

350g/12¼oz dark chocolate, crumbled

**The recipe makes 12 cookies, but you need 15 cookies for a party.**

**How can you adjust the recipe to make the right number of cookies?**

**Write a how-to guide on how to adjust a recipe for a different number of servings, being as general as you can.**

**Give examples of the maths involved.**

**Think about eating cookies while you do so.....**

# Multiplying and dividing by a number between 0 and 1

**Learning outcomes:**

I can present information in a clear and organised way Level 4
I can draw conclusions from answers, and explain them Level 5
I can use a calculator, but estimate to check my answer Level 5
I can break large problems into smaller ones Level 6
I can give full answers to problems Level 7
I understand what happens when you multiply or divide by a number between 0 and 1 Level 7

## REQUIREMENTS / TEACHER NOTES

**Materials required:**

Pen
Pencil
Ruler
Calculator

**Teacher notes:**

A large part of this investigation is the ability to record your working clearly, and make observations on patterns that you spot, and how you think they link to the question. Students should focus on the presentation of their findings.

**Try multiplying the numbers from 1-10 by 0.1. Can you describe what is happening?**

**Now multiply by 0.2. What happens now?**

**You might want to set this up in a table, and keep notes of what effect each one has.**

**What about when you divide by numbers between 0 and 1, such as 0.25, or 0.3**

**Investigate and record your findings.**

**Make a note of any links you find with other areas of maths too!**

**Can you use your findings to predict what will happen before you try the next number?**

# Working with fractions

**Learning outcomes:**

I can add and subtract fractions with the same denominator  Level 5

I can change between mixed numbers and improper fractions  Level 5

I can find fractions of quantities in harder cases  Level 6

I can add, subtract, multiply and divide fractions  Level 7

## REQUIREMENTS / TEACHER NOTES

**Materials required:**

Pen  Colours

Pencil

Ruler

**Teacher notes:**

Students should start with a topic they feel confident with, but can use textbooks / their books if needed as a reminder.  They can also use worked examples from the book, but should also create one of their own.

**Write a how-to guide for working with fractions.  You could include:**

- How to multiply fractions
- How to divide fractions
- How to multiply a fraction by a whole number
- How to change between mixed numbers and improper fractions
- How to add and subtract fractions (step-by-step)

**You could also include any other methods of working with fractions, or a description of when fractions are useful.**

**Make sure you include examples for each method.  If it helps, imagine you are writing it for people learning it for the first time.**

# Recurring decimals

**Learning outcomes:**

I can present information in a clear and organised way Level 4
I can draw conclusions from answers, and explain them Level 5
I can use a calculator, but estimate to check my answer Level 5
I can give full answers to problems Level 7
I can change recurring decimals to fractions Level 8

## REQUIREMENTS / TEACHER NOTES

**Materials required:**

Pen
Pencil
Ruler
Calculator

**Teacher notes:**

A large part of this investigation is the ability to record your working clearly, and make observations on patterns that you spot, and how you think they link to the question. Students should focus on the presentation of their findings.

**Try dividing the numbers from 1-9 by 9. What do you notice?**

**Now try dividing some 2 digit numbers by 99. What do you notice?**

**Now try dividing 3 digit numbers by 999. What do you notice?**

**Can you make a prediction about other recurring decimals?**

**Can you find a way to prove why it works?**

**Write down everything you notice, including your working.**

Chapter 3

# Shape, Space & Measures

# Scale drawings

**Learning outcomes:** **I can draw to scale accurately Level 4**

REQUIREMENTS / TEACHER NOTES

Materials required:

**Pen**

**Pencil**

**Ruler**

Teacher notes:

**I recommend periodic peer checking of scale. If you have time, it's also nice to share final designs.**

**Dr Apocalypse is designing a new evil lair, the previous one having been destroyed by Captain Amazing.**
**Help him to place his various evil items by creating a scale drawing of his new lair.**

**You should choose an appropriate size for his lair, bearing in mind that the smallest volcano on Earth has a diameter of 23m (unless you have a better site...)**

**You should then choose the scale to draw your diagram in.**

**Rooms/doors/passages should all be clearly labelled, and should be an appropriate size.**
**A good way to check your scale is to draw in the toilet. If your toilet measures 1cm on your diagram, and that's 1m on your scale, then he'd probably fall in. Your scale is there for a reason. Use it!**

**Somewhere in your lair, you should have at least one Apocalyptic Weapon of your choice. This should be clearly labelled and drawn to scale.**

**Sharks with laserbeams attached to their heads are always popular too.**

# Angle drawing

**Learning outcomes:**

I can compare the size of angles Level 3

I can measure angles Level 4

I can estimate the size of angles Level 4

REQUIREMENTS / TEACHER NOTES

Materials required:

Pen Protractor

Pencil

Ruler

Teacher notes:

All angles MUST be drawn with a pencil and ruler!

If they get too good, google 'maths angles games'. The first site has a selection of angles games that could be played on the IWB. (Woodlands-junior)

**Draw the following angles using your protractor (angle measurer), a pencil and a ruler.**

**50° 32° 170° 3°**

**Swap with a partner and measure each other's angles. Were they right?**

**Now each of you draw an angle. Swap books, and estimate the size of the other person's angle.**
**Write down your estimate next to it. Now measure it. How close were you?**
**The person who was closest scores 2 points (1 each for a draw).**

**Keep going! See who can win the most points by the end.**
**(At some point, you should agree to do angles bigger than 180°)**

**To add challenge, you could say that the player isn't allowed to touch/rotate the paper when making their estimate.**

# Area and perimeter of rectangles

**Learning outcomes:**

- I know how to find the perimeter of a rectangle Level 4
- I can investigate a problem using maths techniques Level 4
- I can use the formula for the area of a rectangle Level 5
- I can tell the difference between area and perimeter Level 5
- I can use symbols, words and diagrams to discuss a problem Level 5

## REQUIREMENTS / TEACHER NOTES

**Materials required:**

| | |
|---|---|
| Pen | Calculator? |
| Pencil | |
| Ruler | |

**Teacher notes:**

A table is needed to record results efficiently. The important part of this is recording your information so that you can spot patterns.

Algebra could be used to try to find a rule, or it can be described in words.

## What rectangles can you find where the perimeter is the same as the area?

## Can you find a rule for which ones work and which ones don't?

## You need to keep track of which rectangles you've tried, and whether they worked or not, so you can spot patterns.

# Properties of shapes

**Learning outcomes:** I can classify 2D shapes in various ways using mathematical properties Level 3

Use a wider range of properties to classify 2D shapes Level 5

Classify quadrilaterals by their geometric properties Level 6

## REQUIREMENTS / TEACHER NOTES

Materials required:

Pen

Pencil

Ruler

Teacher notes:

Good questions would be:

Does it have 3 equal sides/angles?

Does it have a right angle?

Does it have 2 pairs of parallel sides?

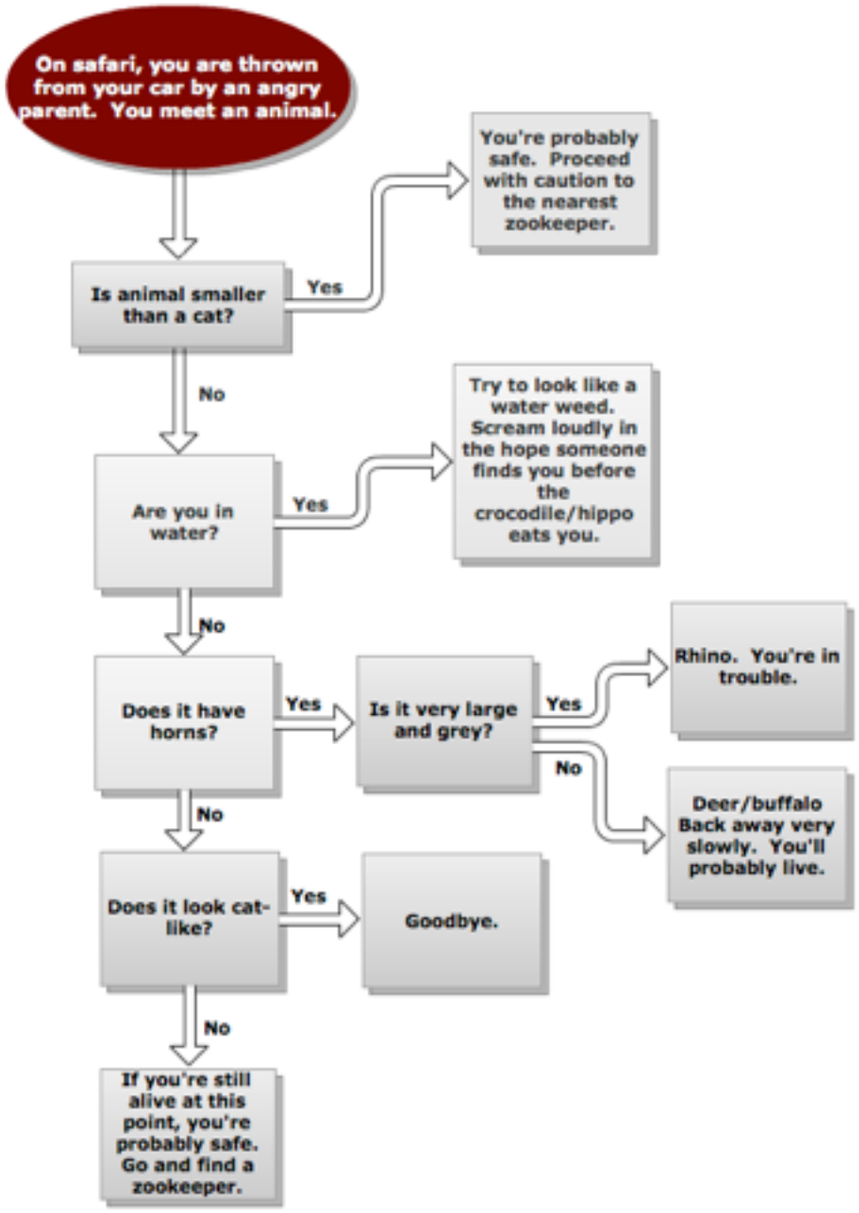
Does it have any right angles?

Bob is rubbish at shapes. He can never remember the names of them.

Can you help him by making a flowchart for him to follow?

Start with triangles, and then do quadrilaterals separately, using their properties to end up at the right shape.

I have made an example flowchart for meeting new animals to demonstrate:



# Converting areas

**Learning outcomes:** I can solve problems involving the conversion of units Level 5

I can calculate the volume of a cuboid Level 6

## REQUIREMENTS / TEACHER NOTES

**Materials required:**

Pen Calculator

Pencil

Ruler

**Teacher notes:**

Ideally, we're looking for some realisation that there's a short-cut to convert from one to the other. Suggest they try comparing a 2cm square's area in cm and mm too.

**Bob is measuring for a carpet. Trouble is, there are two carpet shops that he could use, and he wants to compare the cost between them. One charges by the square metre, one by square centimetres. Can you help him?**

**First work out the area in metres. The room is 2.94m by 4.15m.**

**Now work out the area in cm.**

**(Hint - change the original measurements to cm).**

**If the first shop charges £7.99 per square metre, and the second shop charges 0.079p per 100 square cm, then which shop is better value?**

**Bob also wants to fill his swimming pool with water. It is 15m by 6m.**

**What is the volume of the pool in cubic metres?**

**What is the volume of the pool in cubic centimetres?**

**Use what you have found to write 'an idiot's guide to converting areas'.**

**It should contain examples (and probably pictures - Bob's not very clever.)**

# Surface Area and spatial reasoning

**Learning outcomes:**

- I can check whether my answers are sensible Level 5
- I can use diagrams to discuss a problem Level 5
- I can explain my diagrams and why I used them Level 6
- I can justify my solutions Level 7
- I can comment on the processes I used Level 8
- I can present a convincing, reasoned answer Level 8

## REQUIREMENTS / TEACHER NOTES

**Materials required:**

**Pen**

**Pencil**

**Ruler**

**Teacher notes:**

**Answers on the next page.**

**Diagrams often prove helpful!**

**Painted cube problem**

**This cube (3cm by 3cm) is made up of smaller 1cm cubes.**

**If the whole cube was dipped in red paint, how many of the smaller cubes would have:**

**0 faces painted?**

**1 face only painted?**

**2 faces only painted?**

**3 faces only painted?**

**4 faces only painted?**

**When you think you have an answer, compare your answers with someone else. Do you agree?**
**If not, you have to decide which of the two answers is correct.**
**Now join another pair and repeat the process.**
**By the end, you should all be able to agree on one final answer to each question.**

**Now do the same for a 4cm cube and then a 5cm cube. What patterns can you see?**

Chapter 4

# Handling Data

**Answers for painted cube**

**For 3cm: 1,6,12,8,0 For 4cm: 8,24,24,8,0 For 5cm: 27,54,36,8,0**

# Venn diagrams

**Learning outcomes:** **I can use Venn diagrams to sort information Level 3**

**I can combine maths with humour Level infinity**

## REQUIREMENTS / TEACHER NOTES

### Materials required:

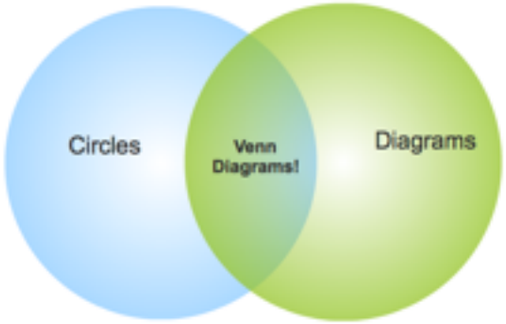
| | |
|---|---|
| **Pen** | **Compasses or** |
| **Pencil** | **something** |
| **Ruler** | **round ideally.** |

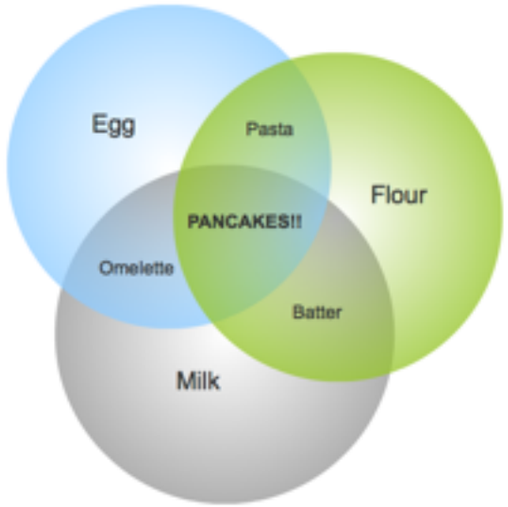
### Teacher notes:

**They can be as creative as they like, so long as they can explain to you why they have placed things where they have.**

**Use peer checking to find any mistakes.**

**While Venn diagrams can be used purely for amusement, they can also be used for maths stuff.**




**Create your own Venn diagrams to show the relationship between two or three things.**

**At least 3 must be showing number properties, like this one:**

# Planning questions

**Learning outcomes:** I can ask questions, plan how they will be answered, and collect the results Level 5

I can design, trial, and if necessary, refine my survey to collect the data I need Level 6

I can identify sources of bias and avoid them Level 7

REQUIREMENTS / TEACHER NOTES

Materials required:

Pen

Pencil

Ruler

Teacher notes:

Worth a discussion of bias, and also of manners when asking questions.... (particularly if the teacher will read the answers!)

**Bob has decided to find out about what other people think about their maths lessons. He wants to make a questionnaire to find out what they think, and hopefully give the teacher some ideas of how to make lessons more enjoyable.**

**What kind of questions could he ask? What kind of questions shouldn't he ask? Why?**

**Design a questionnaire he could use, and a data collection sheet to record the results.**

# Representing data

**Learning outcomes:**

- I can construct bar charts and pictograms Level 3
- I can draw simple line graphs Level 4
- I can draw dual bar charts Level 5
- I can draw pie charts Level 6
- I can draw scatter diagrams Level 6

## REQUIREMENTS / TEACHER NOTES

**Materials required:**

- Pen
- Pencil
- Ruler
- Compasses
- Colours

**Teacher notes:**

Pie chart

Bar chart

Venn diagram

Pictogram

Line graph

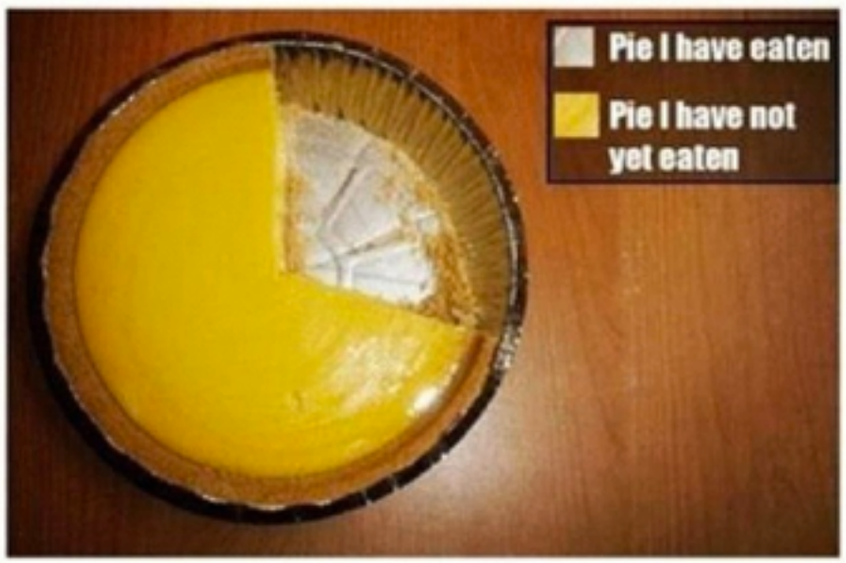
Scatter diagram

Anything else you can find that represents data. Why not google bubble graphs and show it on the IWB?

**Create a poster showing as many of the different methods of representing data as you can.**

**Each diagram should be drawn properly, although you can make up your own data.**

**Try to make it informative and entertaining at the same time.**




**Why not draw a pie chart like this?**

# Listing outcomes

**Learning outcomes:** **I can find and record all possible outcomes for two events**

**Level 6**

**I can compare results from an experiment to theory Level 7**

## REQUIREMENTS / TEACHER NOTES

**Materials required:**

**Pen** **DICE if possible**

**Pencil**

**Ruler**

**Teacher notes:**

**An online simulation of this, along with explanation, can be found here:**

**http://www.ilovemathsgames.com/flashfiles/dice%20roller.swf**

**Bob is playing a game with Fred.**

**They roll 2 dice, and add the numbers together. They bet on what the total will be.**

**What should Bob bet on, and why?**

**The dice are normal, and have numbers from 1 - 6.**

**How can you draw a diagram to show all the possible totals?**

**Are there any other ways you could draw that diagram?**

**If you can find some actual dice, try the game and see if your bet actually does win most often.**

**Think of your own game with dice, cards, coins or a spinner. How can you design your game so that you are most likely to win with a single number?**