

1

Exploring Large Numbers

The world's all-time best-selling copyright book is *Guinness World Records*. From October 1955 to June 2002, 94 767 083 copies were sold.

Suppose the number is written in this place-value chart. Where will the digits 9 and 4 appear?



Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones

- These patterns in the place-value system may help you read and write large whole numbers.
 - From right to left, each group of 3 place values is called a *period*.
 - Within each period, the digits of a number are read as hundreds, tens, and ones.
 - Each position represents ten times as many as the position to its right. For example, 2 hundreds = 20 tens and 4 ten thousands = 40 thousands

This place-value chart shows the number of items in the world's largest collection of matchbook covers, 3 159 119.

Millions Period			Thousands Period			Units Period		
Hundreds	Tens	Ones	Hundreds	Tens	Ones	Hundreds	Tens	Ones
		3	1	5	9	1	1	9
		↑ 3 000 000	↑ 100 000	↑ 50 000	↑ 9000	↑ 100	↑ 10	↑ 9

We read this number as:
three *million* one hundred fifty-nine *thousand* one hundred nineteen

When we read large numbers, we say the period name after each period except the units period.



We leave a space between the periods when we write a number with 5 or more digits.

We can write this number in:

- standard form: 3 159 119
- expanded form: 3 000 000 + 100 000 + 50 000 + 9000 + 100 + 10 + 9
- number-word form: 3 million 159 thousand 119

► The place-value chart can be extended to the left to show greater whole numbers. This place-value chart shows the approximate number of cells in the human body.

One thousand million is one **billion**.
One thousand billion is one **trillion**.

Trillions			Billions			Millions			Thousands			Units		
H	T	O	H	T	O	H	T	O	H	T	O	H	T	O
	5	0	0	0	0	1	0	0	0	0	0	0	0	0

We write: 50 000 100 000 000

We say: fifty trillion one hundred million



Write each number in standard form.

- a) $20\,000\,000 + 4\,000\,000 + 300\,000 + 40\,000 + 2000 + 500 + 80 + 4$
- b) 6 million 276 thousand 89
- c) two billion four hundred sixty million sixty-nine thousand eighteen

Write the number that is:

- a) 10 000 more than 881 462
- b) 100 000 less than 2 183 486
- c) 1 000 000 more than 746 000
- d) one million less than 624 327 207

Tell how you know.

China is the most populated country in the world. In 2007, it had an estimated population of one billion three hundred twenty-one million eight hundred fifty-one thousand eight hundred eighty-eight.

Write this number in standard form and in expanded form.

The largest known prehistoric insect is a species of dragonfly.

It lived about 280 000 000 years ago.

Write this number in words.



The population of Canada was about 32 980 000 in July 2007.
Data show that there were about 497 cellular phones per 1000 people in that year.
How many cellular phones were there in Canada in 2007?

- First, find how many groups of 1000 there are in 32 980 000.

To find how many equal groups, divide: $32\,980\,000 \div 1000 = 32\,980$

This is a 2-step problem.

- There are about 497 cellular phones for one group of 1000.

To find how many cellular phones for 32 980 groups of 1000, multiply:
 $32\,980 \times 497 = 16\,391\,060$

The numbers in this problem are large, so I use a calculator.

There were about 16 391 060 cellular phones in Canada in 2007.



Tests of divisibility

Let's investigate

Which of these numbers is divisible by 5 but **not** by 2 or 10?

250 205 502 520

Explain to your partner how you know.

Write down two more numbers that are divisible by 5 but not by 2 or 10.

A number is **divisible** by:

100 if the last two digits are 00

10 if the last digit is 0

5 if the last digit is 0 or 5

2 if the last digit is 0, 2, 4, 6 or 8

Circle three numbers that are divisible by 5.

101 102 103 104 105 106 107 108

109 110 111 112 113 114 115 116

Write down the numbers from the list below that are divisible by 2:

13 42 63 21 48 84 6

How do you know they are divisible by 2?

Shade each number that is divisible by 2, 5 or 10, on your grid.

1	70	20	80	3	13	60	17	43	52	54	90	31
27	4	63	32	69	39	44	19	29	75	9	14	59
67	62	46	10	53	22	70	25	7	12	28	55	73
63	8	17	34	29	77	32	71	43	59	49	62	79
41	30	38	34	73	33	50	51	69	53	57	105	87


Geometry

Parallel and perpendicular

1 Look around you.




Vocabulary

parallel: lines that are always the same distance apart. 

perpendicular: lines that intersect (cross over) at right angles.



right angle: an angle measuring 90° . 

Describe five pairs of **parallel lines** that you can see. Use a ruler to check that the distance between the lines is always the same.

Describe five pairs of **perpendicular lines** that you can see. Use a right-angle checker to check that the lines meet at 90° .

2 Which of the letters below have pairs of parallel lines?

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Describing Shapes



Quick Review

Here are some attributes of shapes.

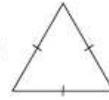
- The lengths of the sides:

This shape has some sides the same length.



We use hatch marks to show equal lengths.

This shape has all sides the same length.



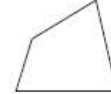
- The direction of the sides:

This shape has 2 pairs of **parallel** sides.

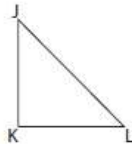


We use arrows to show parallel lines.

This shape has no parallel sides.



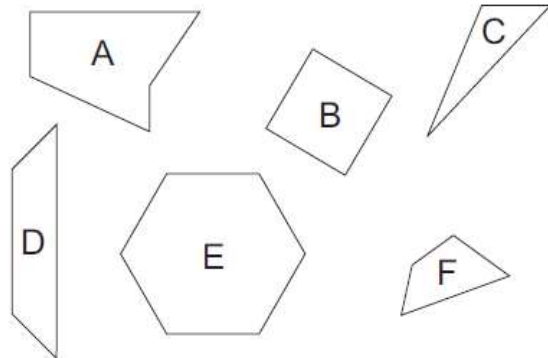
- We can label each vertex and then name the shape by its vertices.



This is triangle JKL.
It has 3 sides:
JK, JL, and KL

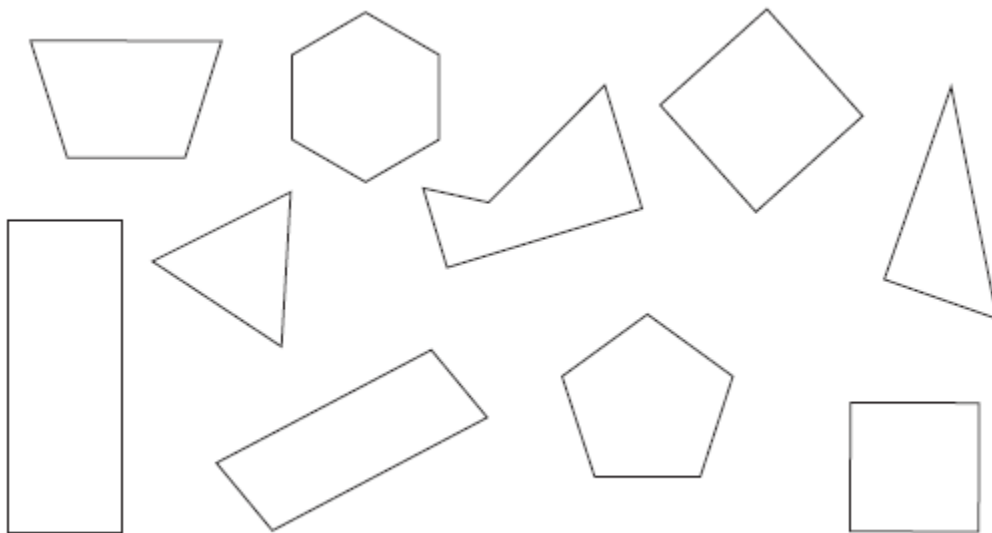
1. Tell which shapes have:

- a) no parallel sides _____
- b) all sides different lengths _____
- c) all sides the same length _____
- d) some parallel sides _____



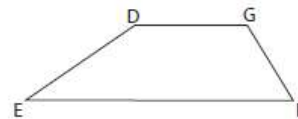
1. Find the shapes below that have each of these attributes.
Label the shapes with the letters.

- A — has all sides the same length
- B — has no sides the same length
- C — has some sides the same length
- D — has 1 pair of parallel sides
- E — has 2 pairs of parallel sides
- F — has more than 2 pairs of parallel sides
- G — has no parallel sides



2. a) Use letters to name this shape. _____

b) Use letters to name the sides. _____



Investigating Perpendicular Sides



Quick Review

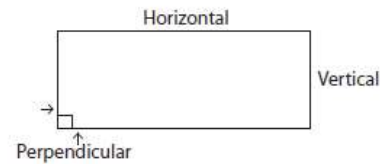
- Look at the chalkboard.

The top and bottom edges are **horizontal**.

The side edges are **vertical**.

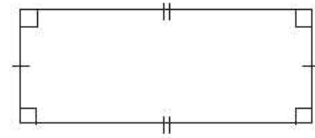
A horizontal edge and a vertical edge are **perpendicular**.

That is, these edges intersect to form a **right angle**.



When 2 sides of any shape make a right angle, we say the sides are perpendicular.

We draw a square to show a right angle.



This shape has 5 sides.

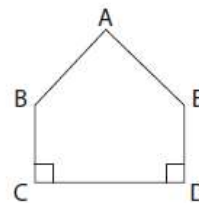
It is a pentagon.

In pentagon ABCDE,

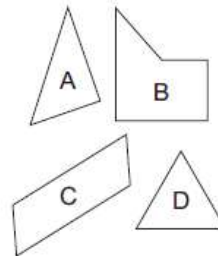
BC is perpendicular to CD.

We write: $BC \perp CD$

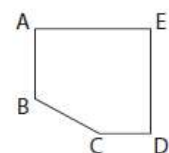
Also, $ED \perp CD$



- Tell which shapes have:
 - three right angles _____
 - no right angles _____
 - one right angle _____



- Look at the shape. Name:
 - horizontal sides _____
 - vertical sides _____
 - perpendicular sides _____



1. Use the dot paper below.
Draw a shape that fits each description.
Label each shape with its letter.

A — has exactly four right angles

B — has only one right angle

C — has exactly 2 pairs of perpendicular sides

D — has no right angles

E — has exactly 3 horizontal sides

F — has exactly 1 pair of perpendicular sides

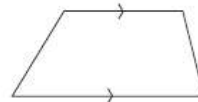
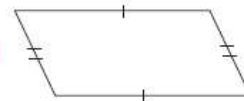
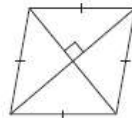
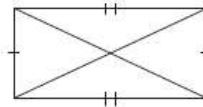
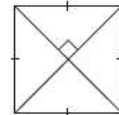


Investigating Quadrilaterals

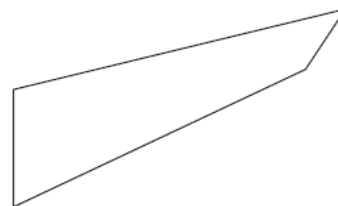


Quick Review

- A square has 4 sides equal.
The diagonals are equal and perpendicular.
- A rectangle has 2 pairs of opposite sides equal.
The diagonals are equal.
- A **rhombus** has 4 sides equal.
The diagonals are perpendicular.
- A **parallelogram** has 2 pairs of opposite sides equal.
- All squares, rectangles, parallelograms, and rhombuses have 2 pairs of parallel sides.
- A **trapezoid** has exactly 1 pair of parallel sides.

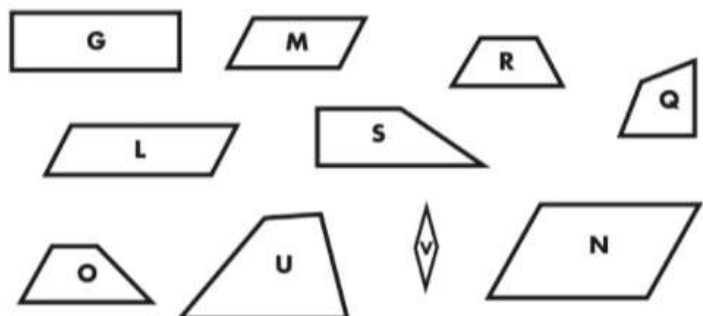


Explain why this quadrilateral cannot be called a square, a parallelogram, a rectangle, a rhombus, or a trapezoid.



List the letter of each figure in each group.

Trapezoids	
Parallelograms	
Rectangles	
Squares	
Rhombuses	



Triangles

Let's investigate

Surita has made a triangle using a length of string.

My triangle is equilateral. I measured one side. It is 4 cm long.



How long is her piece of string?

George has made a triangle using a different length of string.



My triangle is isosceles. I measured two sides. One is 4 cm and one is 5 cm.

How long could his piece of string be?

There is more than one answer.



- 1 The noticeboard on the opposite page has been divided into 12 sections labeled A to L. Each section contains a set of three pins. Imagine joining these pins using three straight lines.

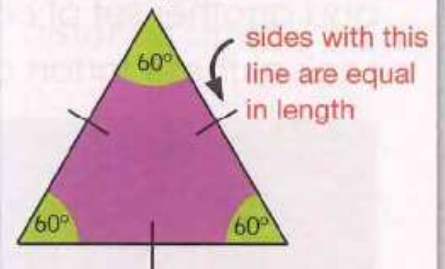
Which sets of pins will make:

- an equilateral triangle?
- a scalene triangle?
- an isosceles triangle?

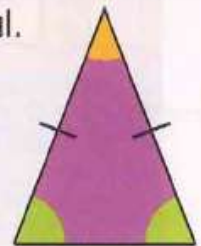
Do any sets of pins **not** make a triangle?

Vocabulary

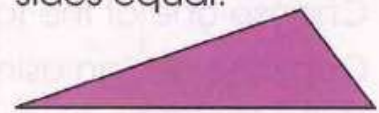
equilateral triangle: a triangle with all angles equal and all sides equal.



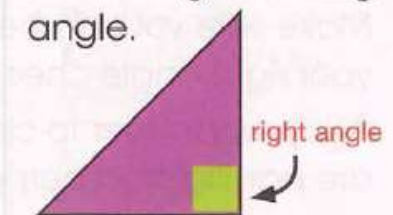
isosceles triangle: a triangle with two angles equal and two sides equal.

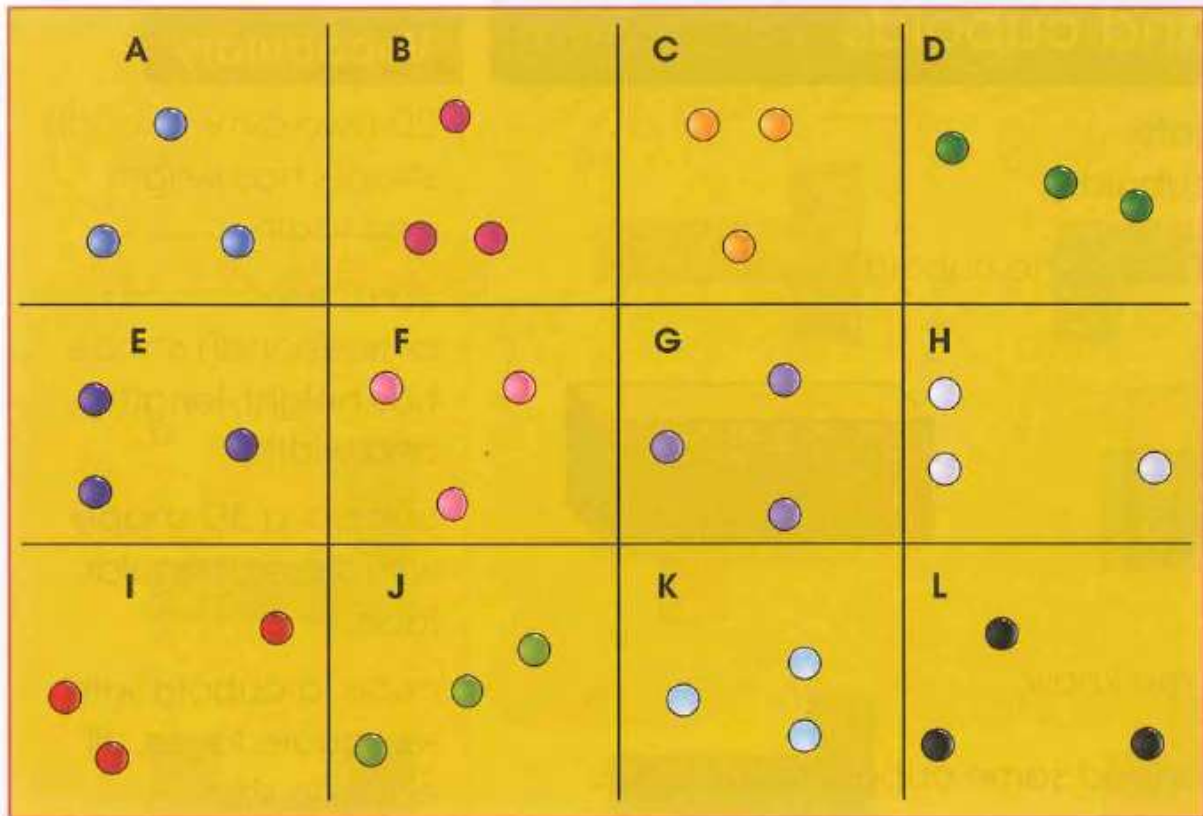


scalene triangle: a triangle with no angles equal and no sides equal.



right-angled triangle: a triangle where one of the angles is a right angle.





Which of the following correctly describes the triangles? Select all that apply.



- Both triangles have a right angle.
- Only one triangle is a right triangle.
- Only one triangle has an acute angle.
- Both triangles have an obtuse angle.
- Both triangles have at least two acute angles.

Decimals

Remember

Place value – the position of a digit in a number gives its value. The decimal point separates whole numbers from decimal places.

T	U	t	h
4	3	9	8

Read as forty-three point nine eight.

When **comparing decimals**, look carefully at what zeros mean in decimal numbers.

These are all worth the same: 9 9.0 9.00

These are not worth the same: 9 0.9 0.09

Vocabulary

tenth: a tenth is 1 part in 10 ($\frac{1}{10}$) of a whole and can be written as 0.1

H	T	U	t	h
		0	1	

hundredth: a hundredth is 1 part in 100 ($\frac{1}{100}$) and can be written as 0.01

H	T	U	t	h
		0	0	1

Write down the value of the digit 3 in each of these numbers:

(a) 72.3

(b) 84.03

(c) 5.53

Write these numbers in figures:

(a) fifteen point three seven

(b) one hundred and five point zero five

(c) thirty-four point three four

(a) Write these five numbers in a place value chart.

0.7 0.13 0.4 0.08 0.67

H	T	U	t	h
		0	7	

The first one has been done for you.

(b) Which of the five numbers are greater than 0.5?

Write the correct sign $>$ or $<$ between each pair of numbers.

(a) 3.4 ? 3.04

(b) 4.5 ? 4.55

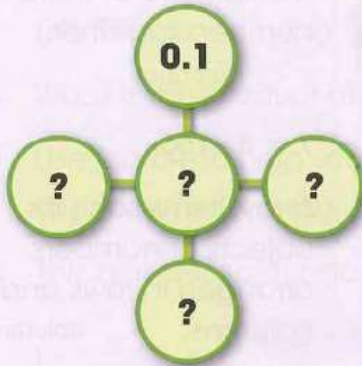
(c) 3.83 ? 3.38

(d) 1.14 ? 1.2

Decimal facts

Let's investigate

Copy the diagram below.



Place the numbers 0.2, 0.3, 0.4 and 0.5 in the circles so that the total down and across is 1.

Find the missing numbers.

(a) $0.7 + \boxed{?} = 1$

(b) $0.6 + \boxed{?} = 1$

(c) $1 - \boxed{?} = 0.3$

(a) What is the total of 0.6 and 0.4?

(b) What is the difference between 1 and 0.9?

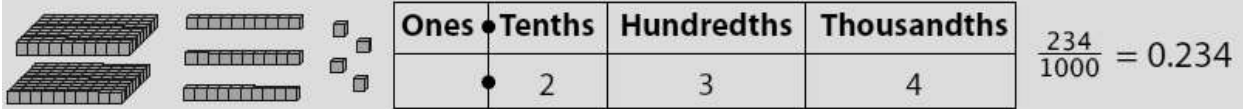
(c) Find the sum of 5.4 and 4.6

Order the decimals in each set from greatest to least.

a) 0.6, 0.24, 0.12 _____ b) 0.8, 0.75, 0.3 _____

c) 0.14, 0.2, 0.35 _____ d) 0.92, 0.1, 0.11 _____

► Numbers with **thousandths** can be shown in different ways.



► We can write decimals in expanded form.

$$4.623 = 4 \text{ ones} + 6 \text{ tenths} + 2 \text{ hundredths} + 3 \text{ thousandths}$$

$$= 4 + 0.6 + 0.02 + 0.003$$

1. Write each number as a decimal.

- a) $\frac{7}{100}$ _____ b) $\frac{14}{1000}$ _____ c) $\frac{19}{100}$ _____
 d) $\frac{6}{1000}$ _____ e) $\frac{374}{1000}$ _____ f) $\frac{108}{1000}$ _____

2. Write each decimal in expanded form.

- a) 0.405 _____
 b) 84.037 _____

1. Record each number in the place-value chart.

- a) 76 thousandths b) 316 and 536 thousandths
 c) 185 thousandths d) 93 and 3 thousandths

	Hundreds	Tens	Ones	•	Tenths	Hundredths	Thousandths
a)				•			
b)				•			
c)				•			
d)				•			

Ratio and proportion

A **proportion** compares **part to whole**. It can be given as a fraction, as a decimal or as a percentage. 'What proportion?' means 'What fraction?', or 'What decimal?', or 'What percentage?'

Example:

1 in every 4 squares is grey

3 in every 4 squares is white



Sometimes fractions are used: $\frac{1}{4}$ of the squares are grey or $\frac{3}{4}$ of the squares are white.

There are 4 squares altogether.

1 out of 4 squares is grey ($\frac{1}{4}$, 0.25, 25%).

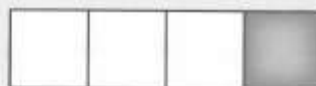
3 out of 4 squares are white ($\frac{3}{4}$, 0.75, 75%).

A **ratio** compares **part to part**.

Example:

For every 3 white squares there is 1 grey square

For every 1 grey square there are 3 white squares



You are not required to use the words 'ratio' and 'proportion' at this stage.

1 Here is a repeating pattern of shapes.

1 in every 4 shapes is a circle.



Use fractions to complete these sentences.

_____ of the shapes are squares.

_____ of the shapes are circles.

Vocabulary

ratio, proportion

Hint: 'In every' may be used when describing a proportion.

2 Draw a repeating pattern to fit each description.

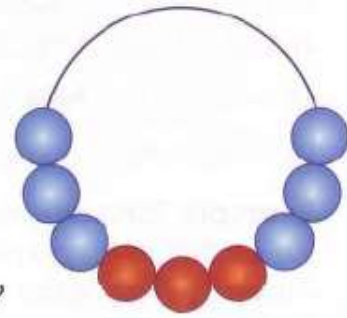
1 in every 3 shapes is a square.

2 in every 3 shapes is a triangle.

3 Draw a repeating pattern to fit each description.

$\frac{1}{3}$ of the shapes are squares.

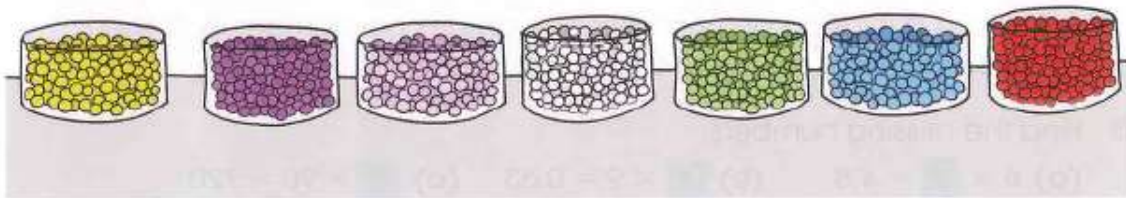
$\frac{2}{3}$ of the shapes are triangles.



- 1 Look at the beads on the necklace.
 - (a) What fraction of the beads are red?
 - (b) What fraction of the beads are blue?
 - (c) What is the ratio of red beads to blue beads?

- 2 You are a jewellery designer.
Draw designs of jewellery that match these descriptions:

- (a) a necklace where $\frac{1}{4}$ of the beads are yellow.
- (b) a bracelet where for every 5 purple beads there are 2 pink beads.
- (c) a pair of earrings where for every 2 green beads there are 3 blue beads.



Here is a recipe for vegetable soup.

The recipe is enough for 4 people. To make enough for 8 people, you need to double the amount of each ingredient, for example, you would need $300 \text{ g} \times 2 = 600 \text{ g}$ of potatoes.

Work out the quantities of these ingredients:

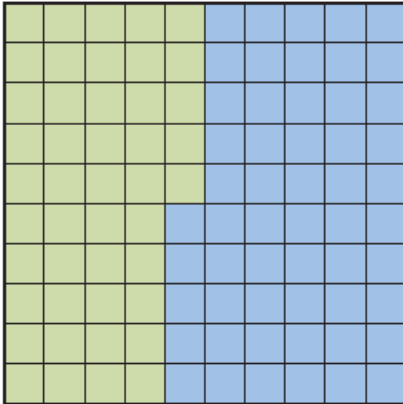
	For 4 people	For 8 people
butter beans		
stock		
mushrooms		
tomatoes		
pumpkin		

Vegetable soup
(serves 4 people)

- 1 large onion
- 300 grams potatoes
- 650 grams butter beans
- 350 ml stock
- 2 carrots
- 250 grams mushrooms
- 400 grams chopped tomatoes
- 850 grams pumpkin

Percentages

The hundredths grid represents 1 whole.



Here are 4 ways to describe the green part of the grid.

- ▶ Compare the number of green squares to the total number of squares:
45 out of 100 squares are green
- ▶ Write a fraction.
 $\frac{45}{100}$ of the grid is green.
- ▶ Write a decimal.
0.45 of the grid is green.
- ▶ Write a **percent**.
45% of the grid is green.
Percent is another name for hundredths.

% is the percent symbol.

Per cent means 'out of 100'.

$$50\% \text{ is } \frac{50}{100} = \frac{1}{2}$$

$$10\% \text{ is } \frac{10}{100} = \frac{1}{10}$$

To **find a percentage** of a quantity, express the percentage as a fraction, multiply the quantity by the fraction.

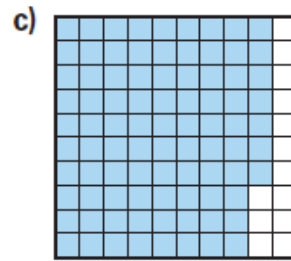
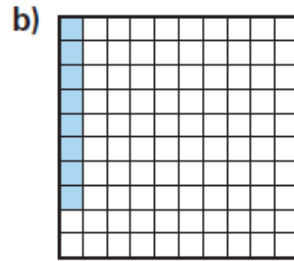
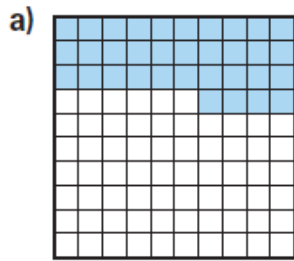
Example: Find 10% of 350

$$10\% = \frac{1}{10}$$

$$350 \div 10 = 35$$

1. Write:

- a fraction with hundredths
 - a decimal
 - a percent
- to name the shaded part of each grid.



Write as a percent. Then write as a decimal.

- a) 64 out of 100 b) $\frac{50}{100}$ c) 1 out of 100 d) $\frac{17}{100}$

Write each percent as a fraction with hundredths. Then write as a decimal.

- a) 13% b) 5% c) 79% d) 64%

Join each box to the correct amount.

50% of 20

10% of 180

100% of 14

14 12 10
16 18 20