Numeracy Help

Estimation & Rounding

Rounding helps estimate answers to calculations and shorten answers that have too many decimal places.
Money should always be rounded to **two** decimal places.

Rules for Rounding

If the number that follows the digit that is being rounded is five or greater, we round UP.
Otherwise, the digit that is being rounded stays the same.

Example

328·045 → *300 to the nearest 100*

330 to the nearest 10

328 to the nearest whole number

328·0 to 1 decimal place

328·05 to 2 decimal places

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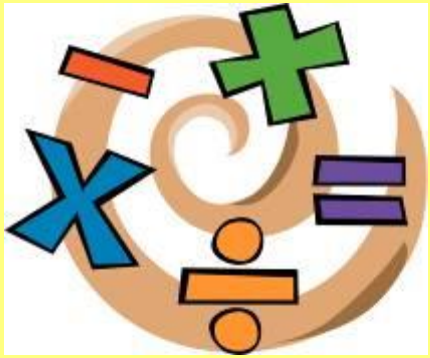
Order of Operations

Calculations have to be carried out in a certain order.



❶ **BRACKETS**

❷ **MULTIPLY or DIVIDE**

❸ **ADD or SUBTRACT**

Examples

1. $3 + 4 \times 6$

$= 3 + 24$

$= 27$

2. $4 \times (2 + 11)$

$= 4 \times 13$

$= 52$

3. $12 + 24 \div 3 - 7$

$= 12 + 8 - 7$

$= 13$

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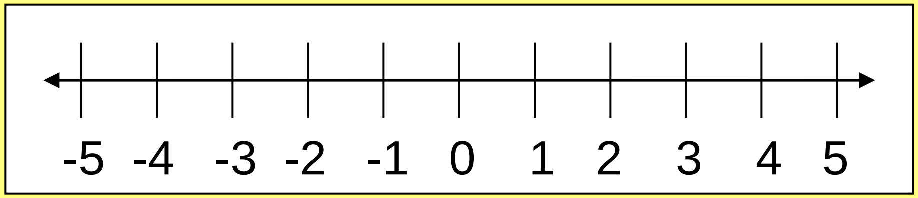
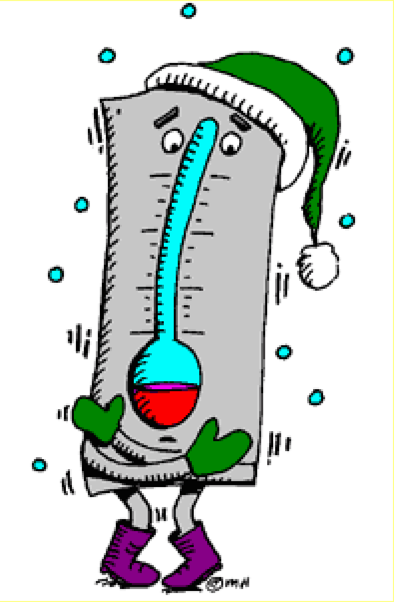
Negative Numbers 1

Negative numbers can occur when using money, temperature, coordinates, sea level, etc.

It is sometimes helpful to use a number line.





Adding a negative number is the same as subtracting.

Subtracting a negative number is the same as adding.

Examples: Adding and Subtracting

1. $3 - 7$

$= -4$

2. $4 + (-6)$

$= 4 - 6$

$= -2$

3. $7 - (-12)$

$= 7 + 12$

$= 19$

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Negative Numbers 2

Multiplying a positive number by a negative number (and vice versa) gives a negative answer.

Multiplying two negative numbers gives a positive answer.

Dividing a positive number by a negative number (and vice versa) gives a negative answer.

Dividing two negative numbers gives a positive answer.

Examples: Multiplying and Dividing

1. $3 \times (-6)$

$= -18$

2. $(-7) \times (-4)$

$= 28$

3. $(-120) \div 10$

$= -12$

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Fractions

When finding a fraction of a quantity the rule is "divide by the bottom, times by the top".

Examples

1. $^{1}/_{3}$ of £360

$= 360 \div 3$

$=$ £120

2. $^{4}/_{7}$ of 35 kg

$= 35 \div 7 \times 4$

$=$ 20 kg

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Decimals 1

When adding and subtracting decimals, calculations should be set out in exactly the same way as for whole numbers. Care should be taken to line up decimal points. Any gaps in the calculation can be filled with a zero.

When multiplying and dividing decimals, calculations look exactly the same as for whole numbers. In multiplication the answer usually has the same number of decimal places as in the calculation.

<u>Examples</u>

1. 6•2 - 3•16 **2.** 1•72 × 3 **3.** 3•68 ÷ 4

$$\begin{array}{r} 6\cdot20 \\ -\;3\cdot16 \\ \hline 3\cdot04 \\ \hline \end{array} \qquad \begin{array}{r} 1\cdot72 \\ \times\quad\;\; 3 \\ {\scriptstyle 2}\qquad\; \\ \hline 5\cdot16 \\ \hline \end{array} \qquad \begin{array}{r|l} & 0\cdot92 \\ \hline 4 & 3\cdot{}^{3}68 \end{array}$$

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Decimals 2

When multiplying decimals by 10 all the digits move one place to the <u>left</u>. Multiplying by 100 moves all digits two places to the <u>left</u>, etc.

When dividing decimals by 10 all the digits move one place to the <u>right</u>. Dividing by 100 moves all the digits two places to the <u>right</u>, etc.

<u>Examples</u>

1. 31•65 × 10 **2.** 12•7 × 100 **3.** 58•32 ÷ 10 **4.** 9•3 ÷ 100

31 · 65 × 10
= 316 · 5

12 · 7 × 100
= 1270

58 · 32 ÷ 10
= 5 · 832

9 · 3 ÷ 100
= 0 · 093

Percentages 1

Finding a percentage of a quantity without a calculator

Some percentages can be dealt with more easily as fractions.

$50\% = \frac{1}{2}$	$20\% = \frac{1}{5}$
$25\% = \frac{1}{4}$	$5\% = \frac{1}{20}$
$75\% = \frac{3}{4}$	$33\frac{1}{3}\% = \frac{1}{3}$
$10\% = \frac{1}{10}$	$66\frac{2}{3}\% = \frac{2}{3}$

In these cases, to find the percentage of a quantity, you would change the percentage to the equivalent fraction and use the rule "divide by the bottom and times by the top".

Examples

1. Find 20% of £60

$\frac{1}{5}$ of £60

$= 60 \div 5$

$=$ £12

2. 75% of 32 kg

$\frac{3}{4}$ of 32

$= 32 \div 4 \times 3$

$= 24$ kg

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Percentages 2

<u>Finding a percentage of a quantity without a calculator</u>

Most percentages can be built up using 1% and 10%.

Examples

1. Find 15% of £80

10% of £80 = £8

5% is half of 10%

5% of £80 = £4

So 15% of £80 = £12

2. 7% of $300

1% of £300 = $3

7% is 7 times 1%

7% of $300 = $3 × 7

= $21

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Percentages 3

Finding VAT of a quantity without a calculator

VAT (at 20%) can be calculated by building it up from 10%.

Example

Calculate the price of a freezer costing £130 plus VAT.

10% of £130 = £13

$\times 2$

20% of £130 = £26

Total price = £130 + £26 = £156

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Percentages 4

Multiples of 2.5% without a calculator

2.5% can be another useful percentage that can be found quite easily.

Example

Calculate 17.5% of £16.

10% of £16 = £1.60

Halve it

5% of £16 = £0.80

Halve it

2·5% of £16 = £0.40

So 17·5% of £16 = £1.60 + £0·80 + £0·40

= £2.80

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Percentages 5

Finding a percentage of a quantity with a calculator

To find a percentage, divide the percentage by 100 and multiply by the quantity in the question.

Examples

1. Find 38% of £48

$38 \div 100 \times 48$

$= £18 \cdot 24$

2. 7·3% of 120 kg

$7 \cdot 3 \div 100 \times 120$

$= 8 \cdot 76$ kg

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Percentages 6

Finding a percentage

To convert a test score to a percentage divide the score by the total marks and multiply by 100.

Example

Max scored 34 out of 61 in a test. Convert his score to a percentage.

$$\% \text{ score} = \frac{34}{61} \times 100$$

$$= 55 \cdot 7377\ldots$$

$$= 56\% \text{ (to nearest whole number)}$$

Percentages 7

Percentage profit/loss

To find a percentage profit/loss you divide the actual profit/loss by the starting amount. Multiplying the resulting decimal by 100 gives the percentage profit or loss.

Example

A car was bought in 2007 for £12000. In 2010 it was sold for £5400. Calculate the percentage loss.

$$\text{Actual loss} = 12000 - 5400$$
$$= 6600$$

$$\%\ \text{loss} = \frac{\text{Actual loss}}{\text{Original cost}} \times 100$$
$$= \frac{6600}{12000} \times 100$$
$$= 55\%$$

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Percentages 8

Finding an original amount

After a percentage (for example VAT) has been added on to something there is a set process for removing that extra amount.

Example

A car servicing bill is £470, including VAT at 17·5%.
Calculate the cost excluding VAT.

There are two methods:

a) Cost + VAT = 117·5%

= 1·175

Cost = 470 ÷ 1·175

= £400.

b) Cost + VAT = 117·5%

1% of cost = 470 ÷ 117·5

= £4

100% of cost = £400

Ratio 1

Ratios can be used to compare different quantities.

Example

The ingredients for humous are as follows:

2 garlic cloves, 200 grammes of chick peas, 150 grammes of olive oil, 5 ml of Tahina paste and 4 tablespoons of olive oil.

Write the ratio of chick peas to olives.

chick peas : olives

200 : 150

4 : 3

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Ratio 2

Ratios can be used to compare different quantities.

Example (continued)

A chef makes more humous than normal.

If he uses 800 grammes of chickpeas how many grammes of olives will he need?

	chick peas	*olives*	
	4	3	
× 200			× 200
	800	600	

The chef will need 600 grammes of olives.

Direct Proportion

Two related quantities are in direct proportion if an increase in one causes a proportional increase in the other.

<u>Example</u>

Three Mars Bars cost £1·53. Calculate the cost of 5.

	Mars Bars	Cost	
	3	£1·53	
÷ 3	1	£0·51	÷ 3
× 5	5	£2·55	× 5

Five Mars Bars will cost £2·55

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Inverse Proportion

Two related quantities are in inverse proportion if an increase in one causes a proportional decrease in the other.

<u>Example</u>

It takes two painters six days to completely paint a house. How long would it take if they employ an extra painter?

	Painters	Days	
	2	6	
÷ 2	1	12	× 2
× 3	3	4	÷ 3

It will take three painters four days to paint the house.

Time 1

Time can be written in "12-hour" or "24-hour" form.

Examples

Change 4 a.m. to 24 hour time. *0400 hrs*
Change 10.42 a.m. to 24 hour time. *1042 hrs*
Change 8 p.m. to 24 hour time. *2000 hrs*
Change 1.15 p.m. to 24 hour time. *1315 hrs*

Change 1132 hrs to 12 hour time. *11.32 a.m.*
Change 2359 hrs to 12 hour time. *11.59 p.m.*
Change 0600 hrs to 12 hour time. *6 a.m.*

Time 2

Time intervals are easier to find if you split up the calculation.

<u>Example</u>

Find the time difference between 0946 hrs and 1232 hrs.

14 mins *2 hours* *32 mins*

0946 1000 1100 1200 1232

Total Time = 2 hours + 14 mins + 32 mins

= 2 hours and 46 mins

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Time 3

Decimal time needs to be used in calculations. Final answers are stated in hours and minutes.

Examples

Change 4•1 hours into hours and minutes.

0•1 hours = 0•1 × 60 = 6 minutes.

4•1 hours = 4 hours and 6 minutes.

Change $5^1/_3$ hours into hours and minutes.

$^1/_3$ of an hour = $^1/_3$ of 60 = 20 minutes.

$5^1/_3$ hours = 5 hours 20 minutes.

Change 7 hours 24 minutes into hours (decimal form).

24 minutes = 24 ÷ 60 = 0•4 hours

7 hours 24 minutes = 7•4 hours.

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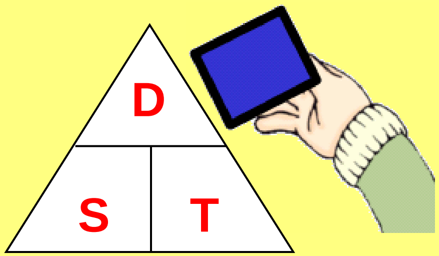
Time 4

Distance, speed and time are related using a set of formulae.



To remember a formula cover up the letter you need to find out.

<u>Example</u>

A van travels for 2 hours and 15 minutes at an average speed of 48 m.p.h.. Calculate the distance it has travelled.

$S = 48$ m.p.h

$D = ?$

$T = 2h\ 15min = 2\cdot25$ hrs

$D = S \times T$

$\quad = 48 \times 2\cdot25$

$\quad = 108$ miles

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Measurement 1

1 cm = 10 mm

1 m = 100 cm

1 km = 1000 m

$$\text{km} \xrightarrow{\times 1000} \text{m} \xrightarrow{\times 100} \text{cm} \xrightarrow{\times 10} \text{mm}$$

$$\text{km} \xleftarrow{\div 1000} \text{m} \xleftarrow{\div 100} \text{cm} \xleftarrow{\div 10} \text{mm}$$

<u>Examples</u>

Convert 3·2 km to metres.

3·2 × 1000 = 3200 m

Convert 2500 mm to cm.

2500 ÷ 10 = 250 cm

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Measurement 2

1 kg = 1000 g

1 tonne = 1000 kg

$$\text{tonne} \underset{\div 1000}{\overset{\times 1000}{\rightleftarrows}} \text{kg} \underset{\div 1000}{\overset{\times 1000}{\rightleftarrows}} \text{g}$$

<u>Examples</u>

Convert 9·3 kg to grammes.

$9 \cdot 3 \times 1000 = 9300$ g

Convert 6120 g to kilogrammes.

$6120 \div 1000 = 6 \cdot 12$ kg

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Measurement 3

$1\ cm^3 = 1\ ml$

$1000\ cm^3 = 1000\ ml = 1$ litre

1000 litres $= 1\ m^3$

$$m^3 \underset{\div 1000}{\overset{\times 1000}{\rightleftarrows}} \text{litre} \underset{\div 1000}{\overset{\times 1000}{\rightleftarrows}} \begin{matrix} cm^3 \\ ml \end{matrix}$$

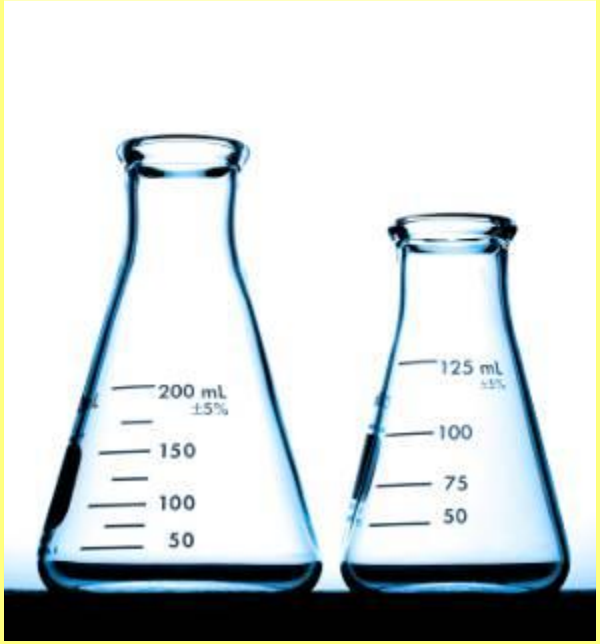
<u>Examples</u>

Convert $1{\cdot}7\ m^3$ to litres

$1{\cdot}7 \times 1000 = 1700\ \ell$

Convert $3245\ cm^3$ to litres.

$3245 \div 1000 = 3{\cdot}245\ \ell$



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Area & Volume

Simple formulae are used to find Area or Volume of 2D and 3D shapes.

Area of a rectangle = length × breadth $A = lb$

Area of a triangle = half of base × height $A = \frac{1}{2}bh$

Area of a circle = pi × radius × radius $A = \pi r^2$

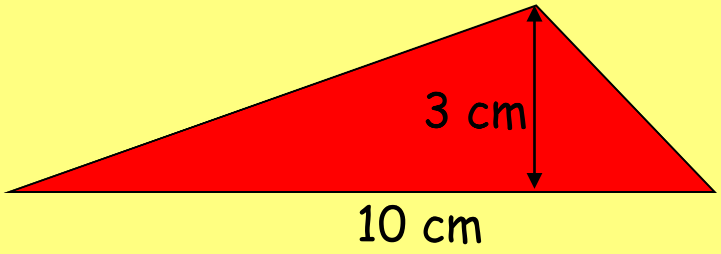
Volume of a cuboid = length × breadth × height $V = lbh$

Volume of a prism = Area of cross-section × height $V = Ah$

<u>Example</u>

Find the area of the triangle shown.

$$\begin{aligned} A &= \tfrac{1}{2}bh \\ &= 0\cdot 5 \times 10 \times 3 \\ &= 15\ \text{cm}^2 \end{aligned}$$



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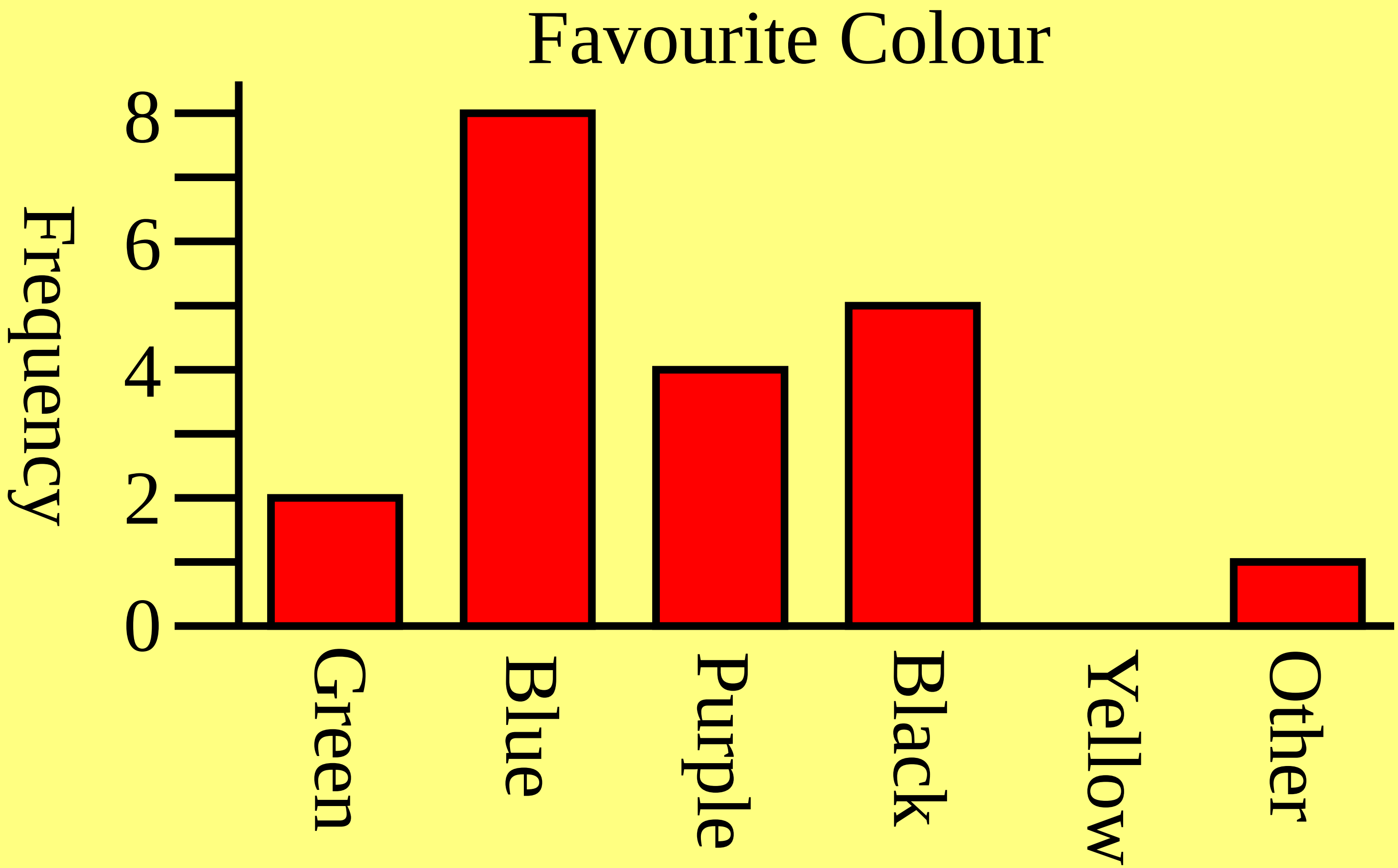
Graphs & Charts 1

Bar charts should have a title, even scale and labelled axes. Bars should be equal widths and have a gap between each one.



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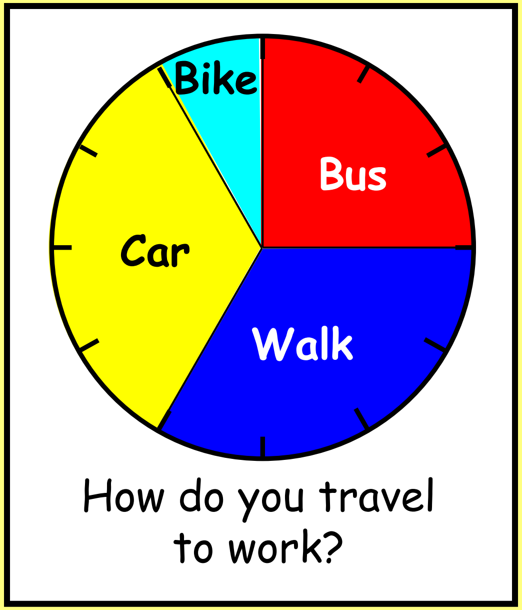
Graphs & Charts 2

Reading information from a Pie Chart (with divisions)

Pie charts are used to display a range of information, for example the results from a survey.

Example

Sixty people were asked how they travel to work. The pie chart on the right was produced.



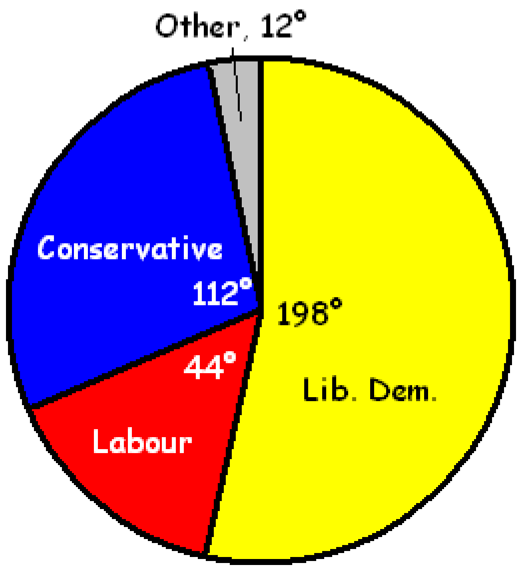
Since there are twelve divisions on the pie chart then each one must be worth five ($60 \div 12 = 5$).

So 15 people caught the bus, 20 walked, 20 drove and 5 cycled.

Graphs & Charts 3

Reading information from a Pie Chart (with angles)

If angles are marked in the centre of a pie chart, you can use them to interpret the pie chart. Remember the angles will add up to 360° in total, so each angle represents a fraction of 360°.



Who did you vote for?

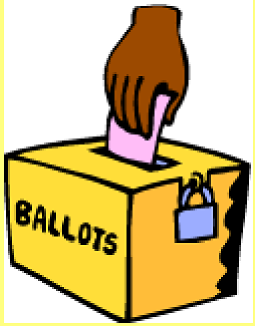
Example

90 people were asked who they voted for in a general election. The pie chart on the right was produced.

How many people voted for Conservative?

$$\frac{112}{360} \times 90$$

$= 28$ *people*



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Graphs & Charts 4

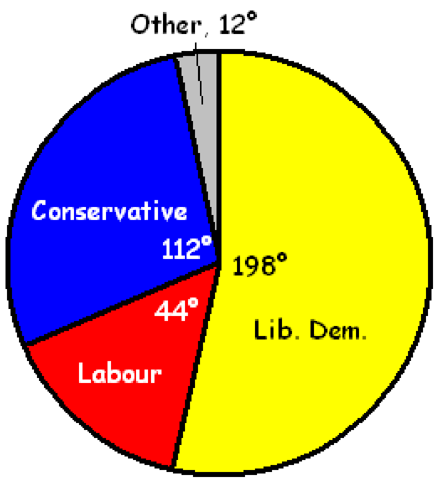
Constructing a Pie Chart

View results as a fraction of 360° and use the angles to construct the sectors.

Example

90 people were asked who they voted for in a general election. The results were as follows:

Party	No. of votes	Angle
Lib. Dem.	48	$^{48}/_{90} \times 360° = 192°$
Labour	11	$^{11}/_{90} \times 360° = 44°$
Conservative	28	$^{28}/_{90} \times 360° = 112°$
Others	3	$^{3}/_{90} \times 360° = 12°$



Who did you vote for?

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Averages & Range

There are three types of average.

Mean: what people would usually think of as "average". For the list, find the total and divide by how many numbers there are.

Median: the middle number in a list *that is in numerical order*.

Mode: the most common number in a list.

The **range** is used as a basic measure of how spread out data is. It is the difference between the highest and lowest numbers in a list.

Example: Consider the list of numbers: 5, 3, 7, 6, 7.

Mean $= 28 \div 5$

$= 5 \cdot 6$

Median: list is 3, 5, 6, 7, 7. Middle number is 6 so median = 6.

Mode: 7 is the most common number so mode = 7.

Range $= 7 - 3 = 4$

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Probability

Probability is measured on a scale from zero to one, using decimals, fractions or percentages.

0	$\frac{1}{2}$	1
impossible	**even chance**	**certain**

The probability of an event occurring is found by:

$$P(\text{event}) = \frac{\text{no. of favourable outcomes}}{\text{no. of possible outcomes}}$$

<u>Example:</u>

When a dice is rolled what is the probability of rolling a 5 or 6?

$$P(5 \text{ or } 6) = \frac{2}{6} = \frac{1}{3}$$

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