Review of
Basic Mathematics

Whole Numbers

Addition and Subtraction

Addition is indicated by $+$. Subtraction is indicated by $-$. Commutative is a special mathematical name we give to certain operations. It means that we can do the operation in any order. Addition is commutative because we know that

$$2+4 \text{ means the same thing as } \ 4+2$$

Subtraction is not commutative since

$$21-6 \text{ is not the same as } 6-21$$

For this reason addition can be done in any order. Generally we calculate from left to right across the page. We can sometimes rearrange the order of a sum involving both additions and subtractions but when we do this we must remember to keep the number with the sign immediately preceeding it. For example

$$3+5+3+4+7+3 = 3+3+3+4+5+7$$

$$6+7-10+2-1-2 = 6+7+2-10-1-2$$

Multiplication and Division

Multiplication is indicated by $\times$ or $*$. Sometimes, as long as there will be no confusion we use juxtaposition to indicate multiplication, particular when we use letters to represent quantities. For example $3a$ means $3 \times a$ and xy means $x \times y$. Multiplication is a commutative operation i.e. we can reverse the order e.g. $3 \times 4 = 4 \times 3$.

Division is indicated by the symbols $\div$, $/$ or $—$. Division is not commutative since $4 \div 2 \neq 2 \div 4$. Multiplication and division should be done from left to right across the page. although you can rearrange the order of an expression involving only multiplications. For example

$$3 \times 4 \times 5 = 5 \times 4 \times 3$$

$$ab3a = 3aab$$

Indices

Like any profession or discipline mathematics has developed short hand notation for a variety of operations. A common shorthand notation that you may be familiar with is the use of indices or powers. The indice indicates how many times a number should be multiplied by itself, so for instance

$$10^3 = \underbrace{10 \times 10 \times 10}_{3} = 1000$$

$$X^4 = \underbrace{X \times X \times X \times X}_{4}$$

A negative index indicates that the power should be on the bottom of a fraction with a 1 on the top. So we have

$$10^{-2} = \frac{1}{10^2} = \frac{1}{10 \times 10} = \frac{1}{100}$$

$$y^{-3} = \frac{1}{y^3} = \frac{1}{y \times y \times y}$$

Additional Rules Associated with Multiplicaton and Division

Zero

Any quantity multiplied by zero is zero, and since we can perform multiplication in any order zero times any quantity is zero. So

$$\begin{aligned} 8 \times 0 &= 0 \times 8 = 0 \\ 0 \times \frac{21}{456} &= \frac{21}{456} \times 0 = 0 \\ 3 \times a \times 0 &= 0 \times a \times 3 = 0 \end{aligned}$$

Zero divided by any quantity is zero. However the operation of dividing by zero is **NOT DEFINED**. So

$$\frac{0}{8} = 0 \quad 0 \div 20 = 0 \quad 0/2a = 0$$

But

$$\frac{35}{0} \text{ and } 16b \div 0 \text{ are not defined}$$

One

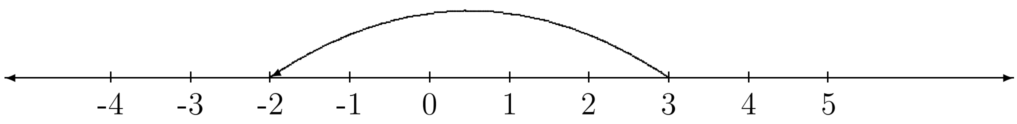
Multiplying any number by 1 leaves it unchanged

$$\begin{aligned} a \times 1 = &\quad a &= 1 \times a \\ 5 \times 1 = &\quad 5 &= 1 \times 5 \\ \frac{478}{1098} \times 1 = &\quad \tfrac{478}{1098} &= 1 \times \frac{478}{1098} \end{aligned}$$

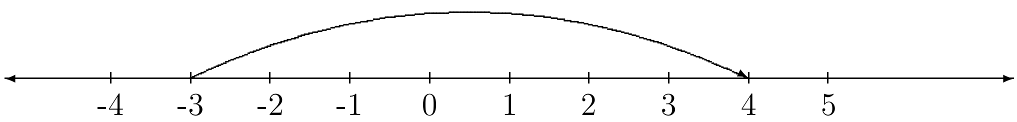
Negative Numbers

Addition and Subtraction

Look at the diagram below which we will refer to as the number line. When we subtract a positive number (or add a negative number) we move the pointer to the left to get a smaller number. Represented below is the sum $3 - 5 = -2$.



Similarly, when we add a positive number (or subtract a negative number) we move the pointer to the right to get a larger number. The diagram below represents $-3 + 7 = 4$.



Notice that subtracting a positive number and adding a negative number result in the same action, a move to the left on the number line. Adding a positive number and subtracting a negative number also result in the same action, a move to the right on the number line. So

$$10 - 4 \text{ gives the same result as } 10 + -4$$

$$\text{and } 2 + 6 \text{ gives the same result as } 2 - -6$$

Multiplication and Division

Multiplication and division of negative numbers is almost exactly the same as multiplication of the counting numbers. The only difference is what happens to the sign. It is easy to see that $4 \times -5 = -20$ and logical to then assume that $-4 \times 5 = -20$ But what about -4×-5? This is equal to 20. So we have the following:

$$\begin{array}{lll}
(+a) \times (+b) = +ab & \text{e.g.} & 3 \times 2 = 6 \\
(+a) \times (-b) = -ab & \text{e.g.} & 3 \times -2 = -6 \\
(-a) \times (+b) = -ab & \text{e.g.} & -3 \times 2 = -6 \\
(-a) \times (-b) = +ab & \text{e.g.} & -3 \times -2 = 6
\end{array}$$

Similarly

$$
\begin{aligned}
(+a) \div (+b) &= +\frac{a}{b} \quad \text{e.g.} \quad 8 \div 4 = 2 \\
(+a) \div (-b) &= -\frac{a}{b} \quad \text{e.g.} \quad 8 \div -4 = -2 \\
(-a) \div (+b) &= -\frac{a}{b} \quad \text{e.g.} \quad -8 \div 4 = -2 \\
(-a) \div (-b) &= +\frac{a}{b} \quad \text{e.g.} \quad -8 \div -4 = 2
\end{aligned}
$$

Generalising the above result we have:

- Multiplying or dividing two quantities with the **Same** sign will give a **Positive** answer.
- Multiplying or dividing two quantities with **Unike** signs will give a **Negative** answer.

Powers of 10

Our number system increases by powers of 10 as we move to the left and decreases by powers of 10 as we move to the right. Given the number **1**23 **4**56.**7**8, the **1** tells us how many 100,000's there are, the **4** indicates the number of 100's and the **7** indicates the number of tenths. Similarly when we multiply two numbers together such as 200×3000 we can use our knowledge of the place value system to represent this as $(2 \times 100) \times (3 \times 1000)$. Since the order is not important in multiplication (i.e. $2 \times 3 \times 4 = 4 \times 3 \times 2$) we can rewrite this as:

$$
\begin{aligned}
200 \times 3000 &= (2 \times 100) \times (3 \times 1000) \\
&= (2 \times 3) \times (100 \times 1000) \\
&= 6 \times 100000 \\
&= 600000
\end{aligned}
$$

Some calculator information

Sometimes calculators give us the answer to questions in something called scientific notation. Scientific notation is a way of writing very big or very small numbers. It consists of writing the number in two parts, the first part is a number between 1 and 10 and the second part is a power of 10. So 2 million (2 000 000) would be written as 2×10^6. Similarly 0.00345 would be written as 3.45×10^{-3}. Our calculators will revert to using scientific notation if the answer calculated is very small or very large. Try this exercise

$$1 \div 987654321$$

Notice that the answer given by most of your calculators (there may be small variations here depending on the model calculator you have) is

$$1 \div 987654321 = 1.0125^{-09}$$

What this actually means is that the answer to the sum is 1.0125×10^{-9} in other words 0.0000000010125. Keep a watch out in that top right hand corner for this kind of notation.

Distributive Law

Suppose you have four children and each child requires a pencil case (\$2.50), a ruler (\$1.25), an exercise book (\$2.25) and a set of coloured pencils (\$12) for school.

One way we can calculate the cost is by multiplying each item by 4 and adding the result:

$$(4 \times \$2.50) + (4 \times \$1.25) + (4 \times \$2.25) + (4 \times \$12) = \$10 + \$5 + \$9 + \$48 = \$72$$

This took quite a bit of effort so perhaps there might be a simpler method. Why not work out how much it will cost for one child and then multiply by 4?

$$(\$2.50 + \$1.25 + \$2.25 + \$12) \times 4 = \$18 \times 4 = \$72$$

The fact that

$$4 \times (2.50 + 1.25 + 2.25 + 12) = 4 \times 2.5 + 4 \times 1.25 + 4 \times 2.25 + 4 \times 12$$

is called the distributive law in mathematics. When we do a calculation involving brackets we generally do the calculation inside the brackets first. When that is not possible, for example if you have an algebraic expression then you can use the distributive law to expand the expression. Sometimes we leave out the times symbol when multiplying a bracket by a quantity, this is another example of mathematical shorthand, so the above could be written

$$4(2.5 + 1.25 + 2.25 + 12)$$

Order of Operations

Consider the following situation. You have worked from 2 p.m. to 9 p.m. on a major proposal. As you were required to complete it by the following day you can claim overtime. The rates from 9 a.m. to 5 p.m. are \$25 per hour and from 5 p.m. to midnight rise to \$37.50 per hour.

Mathematically, this can be expressed as $3 \times \$25 + 4 \times \$37.50$. How much do you think you earned? Which attempt below is most reasonable?

Attempt 1	**Attempt 2**
$3 \times 25 + 4 \times 37.50$	$3 \times 25 + 4 \times 37.50$
$= 75 + 4 \times 37.50$	$= (3 \times 25) + (4 \times 37.50)$
$= 79 \times 37.50$	$= 75 + 150$
$= 2962.50$	$= 225$

Mathematical expressions can be read by anyone regardless of their spoken language. In order to avoid confusion certain conventions (or accepted methods) must be followed. One of these is the order in which we carry out arithmetic.

Brackets:	Evaluate the expression inside the brackets first eg. $(3 + 5) = 8$
Indices:	Evaluate the expressions raised to a power eg. $(3 + 5)^2 = 8^2 = 64$
Division:	Divide or multiply in order from left to right.
Multiplication:	eg. $6 \times 5 \div 3 = 30 \div 3 = 10$
Addition:	Add or subtract in order from left to right.
Subtraction:	eg. $4 + 5 - 2 + 4 = 9 - 2 + 4 = 7 + 4 = 11$

This can easily be remembered by the acronym **BIDMAS**.

Some more calculator information

Modern calculators have been programmed to observe the order of operations and also come equipped with a bracket function. You just enter the brackets in the appropriate spots as you enter the calculation. Some older calculators with a bracket function will tell you how many brackets you have opened, they do this by having on the display **(01** or **[01**.

Calculations involving Decimals

Zeroes to the right of a decimal point with no digits following have no value. Thus

$$10.4 \quad 10.40 \quad 10.400000$$

are all equal in value. There is however a concept of significant figures in the sciences and when we look at the numbers above they are viewed slightly differently. This has to do with the significance of the figures, i.e. to what level of precision do we measure something. In that case 10.4 is telling us that we measured to the nearest tenth and 10.400000 is telling us that the measurement is to the nearest millionth.

Rounding

When we round decimals to a certain number of decimal places we are replacing the figure we have with the one that is closest to it with that number of decimal places. An example: Round 1.25687 to 2 decimal places

1. Firstly look at the decimal place after the one you want to round to (in our example this would be the third decimal place)

2. If the number in the next decimal place is a 6,7,8 or 9, then you will be rounding up, so you add 1 to the number in the place you are interested in and you have rounded. In our example the number in the third place is a 6 so we round up. We change the 5 in the second place to a 6 and our rounded number is 1.26

3. If the number in the place after the one we are interested in is a 0,1,2,3 or 4 we round down, i.e. we just write the number out as it is to the required number of places.

4. If the number in the place after the one we are interested in is a 5, then we need to look at what follows it. Cover the number from the beginning to the place you are interested in, for example, suppose we are rounding 2.47568 to three decimal places we look at just the 568 and we ask is that closer to 500 or 600. Since its closer to 600 we get a rounded number of 2.47**6**

5. If only a 5 follows the place we are interested in then different disciplines have different conventions for the rounding. You can either round up or down since 5 is exactly half way between 0 and 10.

Addition and Subtraction of Decimals

To add or subtract decimal numbers you should always remember to line up the decimal point and then add or subtract normally. For example:

$$25 + 25.5 + .025 + 2.25 \qquad \text{and} \qquad 36.25 - 6.475$$

$$\begin{array}{r} 25.000 \; + \\ 25.500 \\ 0.025 \\ 2.250 \\ \hline \underline{52.775} \end{array} \qquad\qquad \begin{array}{r} 36.250 - \\ 6.475 \\ \hline \underline{29.775} \end{array}$$

Multiplication of Decimals

Two decimals are multiplied together in the same way as two whole numbers are. Firstly, carry out the multiplication ignoring the decimal points. Then count up the number of digits after the decimal point in both numbers and add them together. Finally return the decimal point to the appropriate position in the product by counting back from the right hand digit. For example

$$\text{Evaluate} \qquad 2.6 \times 0.005$$

First multiply 26 by 5: $26 \times 5 = 130$

Now, count up the digits after the decimal point $1 + 3 = 4$

Finally return the decimal point to the product four places back from the right hand digit, adding zeroes in front if necessary

$$.\overbrace{\widehat{0}\,\widehat{1}\,\widehat{3}\,\widehat{0}}^{4}$$

Another way of looking at this is

$$\begin{aligned} 2.6 \times 0.005 &= (26 \times \tfrac{1}{10}) \times (5 \times \tfrac{1}{1000}) &&= (26 \times 5) \times \frac{1}{10} \times \frac{1}{1000} \\ &= (130 \times \tfrac{1}{10000}) = \tfrac{130}{10000} &&= 0.130 \end{aligned}$$

As above we have $2.6 \times .005 = 0.0130$

Division of Decimals

When dividing numbers with decimals by whole numbers, the only essential rule is to place the decimal point in the answer exactly where it occurs in the decimal number. For example:

$$0.238 \div 7 = 0.034 \qquad \begin{array}{r} 0.034 \\ 7\overline{)0.238} \end{array}$$

When the divisor (the number you are dividing by is also a decimal, the essential rule is:

Move the decimal point in the **divisor** enough places to the **right** so that it becomes a whole number. Now move the decimal point in the **dividend** (the number being divided) the same number of places to the **right** (adding zeroes if necessary). Finally carry out the division as in the example above. For example:

$$\begin{aligned} 0.24 \div 0.3 &= 2.4 \div 3 &&= 0.8 \\ 25 \div 0.05 &= 2500 \div 5 &&= 500 \end{aligned}$$

Calculations Involving Fractions

Changing Mixed Numbers to Improper Fractions

$3\frac{4}{5}$ can be expressed as $\frac{19}{5}$ since there are 15 fifths in 3 wholes plus 4 fifths. This can be worked out by multiplying the whole number by the denominator and adding the numerator.

Changing Improper Fractions to Mixed Numbers

Improper fractions are fractions in which the numerator is larger than the denominator. For example $\frac{12}{5}$. You can use the fraction key on your calculator to convert these to mixed numbers or you can divide by hand. For example:

$$12 \div 5 = 2 \text{ remainder } 2$$

The remainder can be expressed as the fraction $\frac{2}{5}$. So $\frac{12}{5} = 2\frac{2}{5}$.

Multiplying Fractions

Before performing any operations on fractions always represent it in the form $\frac{a}{b}$ even if this makes it an improper fraction. Once all fractions are in this form simply multiply the numerators together and then multiply the denominators together. For example:

$$\text{One half of } 3\frac{3}{5} = \frac{1}{2} \times \frac{18}{5} = \frac{1 \times 18}{2 \times 5} = \frac{18}{10} = \frac{9}{5} = 1\frac{4}{5}$$

Division of Fractions

Before performing any operations on fractions always represent it in the form $\frac{a}{b}$ even if this makes it an improper fraction. To divide by a fraction is the same as multiplying by its **reciprocal**. The reciprocal of a fraction $\frac{a}{b}$ is the fraction $\frac{b}{a}$. So the reciprocal of $\frac{3}{4}$ is $\frac{4}{3}$, the reciprocal of $\frac{1}{2}$ is $\frac{2}{1}$ which is just 2 and the reciprocal of 5 is $\frac{1}{5}$. So to divide by $\frac{2}{3}$ is the same as to multiply by $\frac{3}{2}$. For example:

$$\frac{4}{7} \div \frac{2}{3} = \frac{4}{7} \times \frac{3}{2} = \frac{4 \times 3}{7 \times 2} = \frac{12}{14} = \frac{6}{7}$$

Addition and Subtraction of Fractions

To add and subtract fractions you must be dealing with the same kind of fractions. In other words to add or subtract fractions you need to convert the fractions so that both fractions have the same denominator (i.e. the same number on the bottom).

Two fractions are said to be **equivalent** if they represent the same part of one whole. So $\frac{2}{3}$ is equivalent to $\frac{4}{6}$ since they represent the same amount. To find equivalent fractions you multiply the top and the bottom of the fraction by the same amount. For example:

$$\frac{2}{7} = \frac{2 \times 2}{7 \times 2} = \frac{4}{14} = \frac{12}{42} = \frac{6}{21}$$

are all equivalent fractions. To add or subtract fractions you need to find equivalent fractions to each part of the sum so that all the fractions in the sum have the same denominator and then you simply add or subtract the numerators (i.e. the top numbers). So

$$\frac{2}{7} + \frac{1}{3} = \frac{2 \times 3}{7 \times 3} + \frac{1 \times 7}{3 \times 7} = \frac{6}{21} + \frac{7}{21} = \frac{6+7}{21} = \frac{13}{21}$$

$$\frac{3}{4} - \frac{1}{3} = \frac{3 \times 3}{4 \times 3} - \frac{1 \times 4}{3 \times 4} = \frac{9}{12} - \frac{4}{12} = \frac{9-4}{12} = \frac{5}{12}$$

Percentages

Percentages are fractions with a denominator of 100. Often there will not be 100 things or 100 people out of which to express a fraction or a percentage. When this is the case you will need to find an equivalent fraction out of 100 by multiplying by 100% which is the same as multiplying by 1.

$$\frac{1}{20} = \frac{1 \times 5}{20 \times 5} = \frac{5}{100} = 5\% \quad \text{or} \quad \frac{1}{20} = \frac{1}{20} \times 100\% = \frac{100}{20}\% = 5\%$$

$$\frac{3}{10} = \frac{3 \times 10}{10 \times 10} = \frac{30}{100} = 30\% \quad \text{or} \quad \frac{3}{10} = \frac{3}{10} \times 100\% = \frac{300}{10}\% = 30\%$$

$$\frac{2}{5} = \frac{2 \times 20}{5 \times 20} = \frac{40}{100} = 40\% \quad \text{or} \quad \frac{2}{5} = \frac{2}{5} \times 100\% = \frac{200}{5}\% = 40\%$$

Therefore you can either find out how many times the denominator goes into 100 and multiply the top and bottom of the fraction by this number **or** multiply the numerator by 100, then divide through by the denominator.

When you are asked to find a percentage you must find the fraction first. For instance if there are 15 men, 13 women and 22 children in a group, the fraction of men in the group is $\frac{15}{50}$ since there are $50 = 15 + 13 + 22$ people in the group altogether. You can either multiply by 100 % (if you have a calculator) or find the equivalent fraction out of 100. In both cases you will reach an answer of 30%.

Interchanging Fractions, Decimals and Percentages

Changing Fractions to Decimals

Using your calculator divide the top number (numerator) by the bottom number (denominator) to express a fraction as a decimal. If you do not have a calculator we can do it manually. Be sure to put a decimal point after the numerator and add a few zeros.

$\frac{3}{4}$ can be expressed as $3.00 \div 4 = 0.75$

Changing Fractions to Percentages

Express the fraction as a decimal (as shown above) then multiply the result by 100%. This can be done easily by shifting the decimal point two places to the right.

$$\frac{3}{8} = 3.000 \div 8 = 0.375 = 37.5\%$$

When the denominator of the fraction to be converted goes evenly into 100, the percentage can be found using equivalent fractions.

$$\frac{3}{5} = \frac{\quad}{100}$$

$$\frac{3}{5} \times \frac{20}{20} = \frac{60}{100} = 60\%$$

Converting Percentages to Decimals

In order to convert a percentage into a decimal, divide be 100. This can be done easily by shifting the decimal point two places to the left. If there is no decimal point be sure to place a decimal point to the right of the whole number.

$45.8\% = 0.458$ and $0.5\% = 0.005$ and $7\% = 7.0\% = 0.07$

Ordering Fractions, Decimals and Percentages

In order to compare numbers they must all be presented in the same form with the same number of decimal places. It is usually easiest to convert everything to decimals. Once you have done this, write the numbers underneath each other lining up the decimal points. Fill in any blanks with zeros. Compare the whole number side first. If there is a match, then compare the fractional side. For example: Express the following numbers in order from smallest to largest.

$$0.5,\ 5.3\%,\ 0.54,\ 47\%,\ \frac{3}{5},\ \frac{46}{100},\ 3$$

1. Convert all the numbers to decimals:

$$0.5, \;\; 0.053, \;\; 0.54, \;\; 0.47, \;\; 0.6, \;\; 0.46, \;\; 3$$

2. Line the numbers up

$$\begin{array}{l} 0.5 \\ 0.053 \\ 0.54 \\ 0.47 \\ 0.6 \\ 0.46 \\ 3 \end{array}$$

3. Fill in all of the blanks with zeros

$$\begin{array}{l} 0.5\mathbf{00} \\ 0.053 \\ 0.54\mathbf{0} \\ 0.47\mathbf{0} \\ 0.6\mathbf{00} \\ 0.46\mathbf{0} \\ 3.\mathbf{000} \end{array}$$

4. Compare the whole numbers. If there is a match, compare the fractional side. Since six of the numbers begin with a 0. we must compare the right hand side. Clearly

$$53 < 460 < 470 < 500 < 540 < 600$$

5. Express the numbers from smallest to largest

$$5.3\%, \;\; \frac{46}{100}, \;\; 47\%, \;\; 0.5, \;\; 0.54, \;\; \frac{3}{5}, \;\; 3$$

Ratio

Any fraction can also be expressed as a ratio. $\frac{15}{50}$ can be written as 15:50. However be careful of the wording of these types of questions. The ratio of men to the total number in the group is 15:50 but the ratio of men to women is 15:35.

Some common mathematical notation

Here are a few of the shorthand symbols used in mathematics

Sign	Meaning
$+$	add
$\times$	multiply
$=$	equals
$>$	greater than
$\geq$	greater than or equal to
$\approx$	approximately equal to
$\sqrt{}$	square root

Sign	Meaning
$-$	minus or subtract
$\div$	divide
^{2}	square
$<$	less than
$\leq$	less than or equal to
$\neq$	not equal to
$\therefore$	therefore

Another convention in maths is to leave out the multiplication sign if it will not lead to confusion, so, for example $2a$ means $2 \times a$ and $4(1+2)$ means $4 \times (1+2)$.

Introductory Algebra

Substitution

When we use algebra in maths it is often as a convenient form of shorthand. We want to express a relationship that always holds true for certain things and so we represent these things by letters. For example the length of the perimeter of a rectangle is 2 times the length plus 2 times the height. We can express this as $2l + 2h = P$ where l represents the length, h represents the height and P represents the perimeter.

Substitution is the process of putting numbers in for the letter representatives of quantities. So, if the length of a rectangle is 4 and the height is 7 then $l = 4$ and $h = 7$ and $P = 2 \times 4 + 2 \times 7 = 8 + 14 = 22$. We have substituted $l = 4$ and $h = 7$ into the equation. Another example:

Let $x = 5$, $y = 7$ and find z when

$$z = 3y + 4x^2$$

Then substituting we have

$$z = 3 \times 7 + 4 \times (5)^2 = 3 \times 7 + 4 \times 25 = 21 + 100 = 121$$

Solving Algebraic Equations

When we are asked to solve an algebraic equation for z, say, we are being asked to get z on one side of the equation by itself and the rest of the information on the other side. (Remember that the relationship still holds when both sides of the equation are multiplied or divided by the same thing or when the same quantity is added to or subtracted from each side). In this example we are going to solve for y.

$$\begin{aligned} 3y+4 &= 19 \\ 3y+4-4 &= 19-4 \quad \text{(subtract 4 from each side of the equation)} \\ 3y &= 15 \\ 3y \div 3 &= 15 \div 3 \quad \text{(divide each side of the equation by 3)} \\ y &= 5 \end{aligned}$$

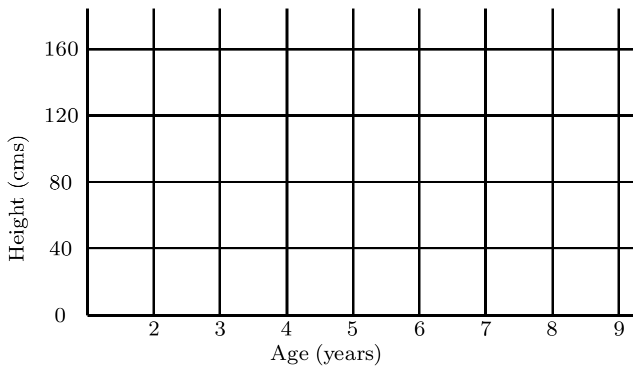
Plotting

To plot the following data on the average height of boys and girls at different ages

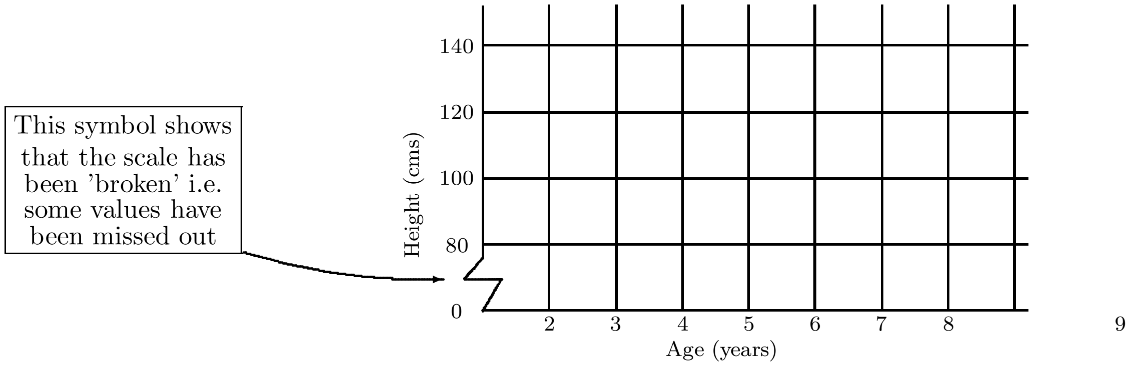
x :	Age (years)	2	3	4	5	6	7	8	9
y :	Height (cms)	85	95	100	110	115	122	127	132

Firstly draw two straight lines at right angles to one another. It is customary to have one horizontal line and the other vertical. The x variable is generally plotted along the horizontal axis and the y variable along the vertical axis. The horizontal axis is usually the independant variable and the vertical axis is the dependant variable.

Next, you need to select a suitable scale for use on each of the two axes. The scales on the axes can be different from each other. Look first at the x values. In the above we are told that age is the x variable. Find the smallest and the largest value. The scale chosen has to be such that it will accommadate both of these values. In the above we have to fit in values for x between 2 and 9. Similarly for the y variable we need to fit in values between 85 and 132.

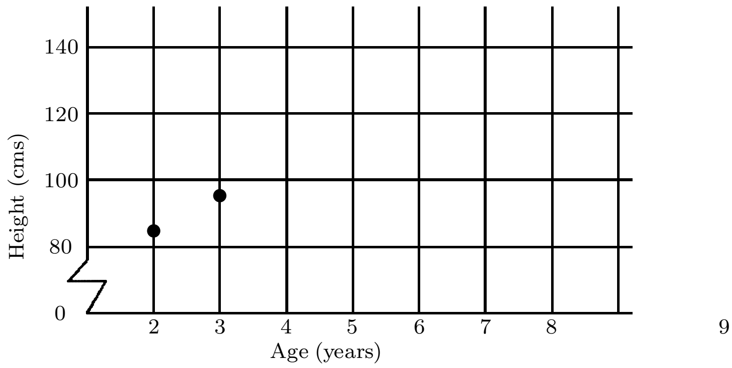


Alternatively a break in a scale can be used if all the values to be shown lie within a small range.

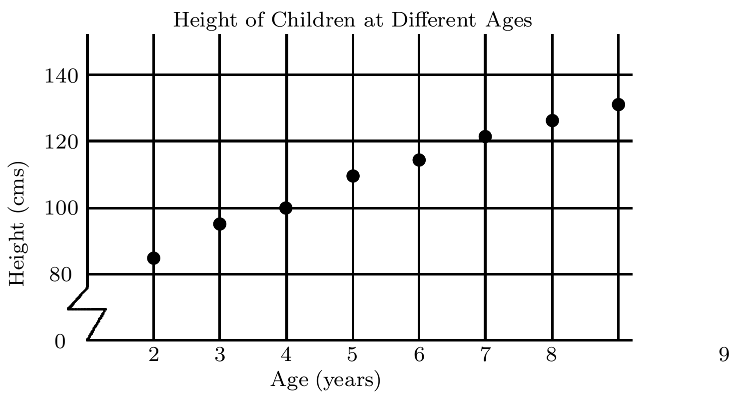


The axes and scale chosen above will satisfy these requirements. At age 2 years the child has a height of 85 cm. To plot this we go along the x-axis to where the 2 is indicated and then go vertically to opposit where the 85 is on the y-axis.

Similarly for a child of 3 years and a height of 95 cm. The shorthand way of indicating these points is $(2, 85)$ and $(3, 95)$. They are plotted together in the diagram below.



Plotting the remaining and labelling the display we get:



Sometimes it is preferable to have the axes intersect at zero for both variables. If we do that with the above data then we get the following graph.