Now try these:

1. Estimate $\dfrac{23 \times 6{,}453}{31}$

2. Estimate $\dfrac{2{,}877 \times 62}{12}$

3. Estimate $\dfrac{324 \times 979}{0.23}$

Simplifying Expressions

You may be asked a question which asks you to simplify an expression, or it could be that you need to do it at the end as part of a bigger question. This is important as there could be several marks for this on a paper.

If you are given an algebraic expression you need to gather terms together, this is what simplifying means. If the expression has different unknowns then they will not be put together. Different unknowns could be x, y, x^2, y^3, z, etc.

It is helpful to think of these questions as if they are objects. If you think of each of the unknowns as an object you can just add up the 'objects'.

For example:

Simplify $5x - 2x + 3x - x$

You need to think of each x as an apple on a shopping list.

You could say you need to get 5 apples, take away 2 apples, add another 3 apples and take off one apple.

How many apples do you have? 5 apples ($5x$)

If there are other unknowns in the expression you must keep them separate.

For example:

Simplify $6y + 5x - 2y + x$

You can now introduce y as being a banana. You need to get 6 bananas and 5 apples, take away 2 of the bananas and add another apple.

What do you have? $4y + 6x$

You may be asked to expand or factorise expressions.

To factorise generally means to put at least one bracket into the expressions. Take the value that appears in all parts of the expression outside of a bracket as this can then be multiplied by the bracket in order to get back to the original expression.

For example:

Factorise $2x + 8$

$= 2(x + 4)$

The number 2 goes into both $2x$ and 8 so take this outside the bracket. You can then put the values that would be required to get back to the original expression in the inside of the bracket.

To expand means to remove the brackets by expanding the expression. If the bracket has been placed next to the number, this will multiply the contents of the bracket.

For example:

Expand $6(t – 5)$

$= 6t – 30$

The 6 is multiplied by the 't' and then the ' – 5' in turn to remove the brackets.

Now try these:

1. Simplify:

   a) $5x + 7y - 3y + x$

   b) $t^2 + 6t + 5t^2 - 2t$

   c) $2g^3 + 8g^2 - 7g - 5g^2 + 3g$

2. Factorise:

   a) $4y + 20$

   b) $3x^2 + 9x$

   c) $5xy + 15x^2 - 10xy^2$

3. Expand:

   a) $9(t + 5)$

   b) $2f(3 - g)$

   c) $3y(x + 6 - y)$

Solving Equations

When you see the phrase 'solve' you are trying to find an exact value.

For example: Solve $6x + 9 = 81$

> It would be very easy for you to input different numbers to see which one works and get the right answer, however you would not get full marks. You should bear in mind that method marks are just as important, if not more important than the correct answer.

You are therefore trying to find a value for x. The general rule is to leave the unknown (x) where it is and move everything else from around it.

In order to find the unknown it is a good idea to think of a popular computer game where you control the characters' lives ensuring that they are sociable, eat, sleep, etc. If you think of the unknown as the character you are controlling, when it is with another character it means that they are talking and therefore boosting their sociability levels. You should therefore leave the 'other characters' next to the unknown as long as possible and not move them until you need to.

If you relate this to an equation, when the unknown is multiplying or dividing it is seen as being with the other character. You therefore need to move anything that is not touching the unknown first.

You need to move everything away from the unknown. Anything that is moved will always move to the other side of the equals sign.

Think of a man sitting in the equals sign, when something crosses him he gives a high five to make it the opposite of what it was. So when it changes side, it also changes sign. The sign becomes the opposite of what it was, so a multiplication will become a division. An addition will become subtraction, squared becomes square rooted, etc.

When other figures are moved you should ensure that they do not 'jump the queue' when going to the other side. They will always join the back of the line.

For example: $6x + 9 = 81$

The aim is to get x on its own as it is the unknown

The 6 is 'talking' to it so you should move this last, therefore you need to move the 9. At the moment the 9 is adding, this means it needs to move to the other side and become subtraction.

$$6x = 81 - 9$$

By simplifying this we get $6x = 72$

The next step is to move the 6 which is currently multiplying the x, so it will go to the other side and become a division.

$$x = 72 \div 6$$

By simplifying, the result is $x = 12$. This makes sense because putting 12 back into the equation does equal 81.

For example:

Solve $5y - 12 = 28$

$$5y = 28 + 12$$
$$5y = 40$$
$$y = 40 \div 5$$
$$y = 8$$

Solve $t^2 + 7 = 43$

$$t^2 = 43 - 7$$
$$t^2 = 36$$
$$t = \sqrt{36}$$
$$t = 6$$

There is an exception to the rule as when the unknown is not on the same level as the rest of the equation (it is dividing). An example of this is when it is on the bottom of the fraction:

$$9 = \frac{27}{x}$$

gutter

You then need to think of our character as not being on ground level, she is hanging off a cliff. This means she needs to move first before anyone else to get her to safety.

She is currently dividing the 27, so she will go to the other side, get a high five by the man in the equals sign and become a multiplication.

$$9 \text{ x } x = 27$$
$$9x = 27$$

The 9 can now move away from the unknown. The 9 is currently multiplying so it will go to the other side and become a division.

$$x = 27 \div 9$$
$$x = 3$$

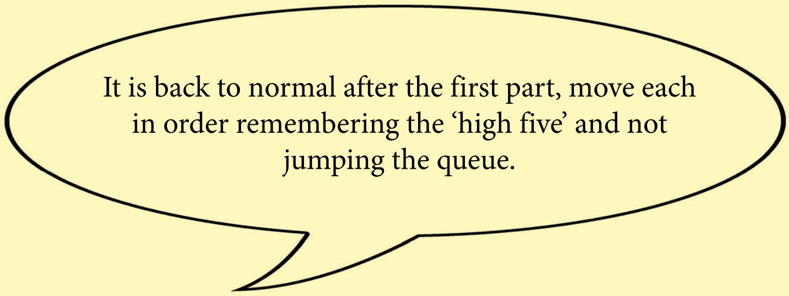
However there is another exception to this rule, as you could be given the following equation:

$$\frac{3}{x} + 7 = 19$$

If this was the case you have somebody hanging off the cliff but someone standing on their own on the same side. If this is the case you need to get rid of the person standing on their own as they can go and get help. They therefore move to the other side first, then you can move the person hanging off the cliff.

For example:

$$\frac{3}{x} + 7 = 19$$



$$\frac{3}{x} = 19 - 7$$

$$\frac{3}{x} = 12$$

$3 = 12x$

$x = 3/12$

$x = 0.25$

Hopefully you are now happy with the one unknown but what happens if the unknown appears more than once?

For example:

$8x + 3 = 3x + 13$

If this is the case, think of the x as being our person but the number next to it as representing how many pies have been eaten.

In the example there would have been eight pies on one side and three pies on the other side.

The side that has the most pies is the heaviest and therefore that person will stay where they are. The other pies will move to this side and all the integers to the opposite side. You can then 'tidy up' and get the unknown on its own.

For example:

$12t - 4 = 8t + 36$
$12t - 8t = 36 + 4$
$4t = 40$
$t = \frac{40}{4}$
$t = 10$

Now try these:

1. Solve $5x + 3 = 28$

2. Solve $7y - 9 = 3y + 27$

3. Solve $\frac{t}{3} + 7 = 11$

Indices

Indices are powers, for example ^{3} or ^{2}. You may be asked to multiply or divide numbers in index form. If you have questions with indices, look to see if the numbers are on the same level as the multiplication or division sign.

When multiplying or dividing, pretend it is really windy so the signs get blown around.

The multiplication sign goes up in the air to join the higher numbers but it is windy and it twists to become a plus. Therefore, you need to add the powers.

$$V^{a} \times V^{b} = V^{a+b}$$

When there is a division sign, it goes up in the air to join the numbers at the higher level but it is windy and it loses its dots. Therefore, it becomes a subtraction sign.

$$V^{c} \div V^{d} = V^{c-d}$$

For example:

Simplify $y^4 \text{ x } y^5$
$= y^{4+5} = y^9$

Simplify $j^8 \div j^2$
$= j^{8-2} = j^6$

Simplify $t^2 \text{ x } t$
$= t^{2+1} = t^3$

Remember: 't' is t^1, hence why $t^2 \text{ x } t = t^3$

When numbers are inserted before the unknowns, you need to look at the different levels.

$cx^a \text{ x } dx^b = cdx^{a+b}$

As *c* and *d* are on the same level as the multiply, they will be multiplied together. The *a* and *b* are the same level as the addition sign so will be added together.

$gx^e \div hx^f = \frac{g}{h} x^{e-f}$

As *g* and *h* are on the same level as the divide, *g* will be divided by *h*. The *e* and *f* are the same level as the subtract sign so *f* will be subtracted from *e*.

Further examples:

Simplify $5t^3 \text{ x } 4t^6$
$5t^3 \text{ x } 4t^6 = 20t^9$

Simplify $42y^5 \div 7y^2$
$42y^5 \div 7y^2 = 6y^3$

Now try these:

1. Simplify:

   a) t^5 x t^7
   b) $x^{10} \div x^6$
   c) g^8 x g

2. Simplify:

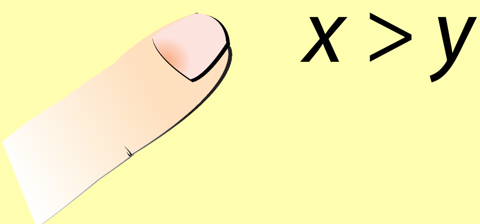
   a) $6k^2$ x $5k^9$
   b) $32f^8 \div 4f$
   c) $7r^3$ x $3r^6$

Inequalities

Inequalities (symbols like >, ≤, <, etc) will probably appear in these questions so you need to ensure you understand them.

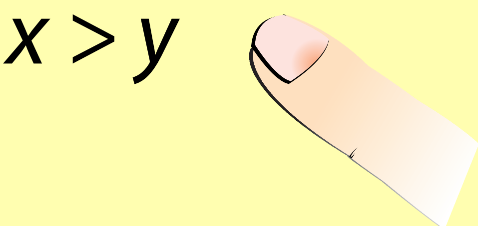
Read the inequality across with your finger. If you touch the larger opening of the inequality you would say greater than but if you touched the small point first it would be less than.

For example:



This would be x is greater than y ……

or ……… y is less than x (reading across the other way).



$r < t$

This would be r is less than t ……..

or ……… t is greater than r (reading across the other way).