MATHS AND STATS

Order of Operations

The order in which maths operations like + or ÷ are completed is very important. All over the world, mathematicians use the same convention. This ensures that everyone obtains the same answer for a given question.

Tip – look at the **WHOLE** expression to decide what to do first**. Don't just start at the left!**

e.g. using the convention, the answer to 2×3^2 is 18 and not 36!

Convention for the order of operations

Note: Each number is associated with the **operation(s) immediately in front** of it.

1st **Brackets**
If more than one set of brackets, work from the inside brackets outwards

eg $2\times(6-3) = 2\times 3$
$= 6$

eg $15-((8+2)\div 5-3) = 15-(10\div 5-3)$
$= 15-(2-3)$
$= 15-(-1)$
$= 15+1$
$= 16$

- We use the 3rd order here too, ÷ before the minus
- Recall, we can substitute the word "opposite" for "-"

–(-1) reads as "the opposite of (-1)" that is +1

2nd **Operators** - things like squares, cubes, powers, roots, trig and other functions
These funtions are worked out first

eg $5\times 3^2 = 5\times 9$
$= 45$

eg $4\sqrt{25} = 4\times 5$
$= 20$

- $3^2 = 3\times 3$
  $3^5 = 3\times 3\times 3\times 3\times 3$
- Recall, no sign or operation between terms implies ×

3rd **Multiplication and/or Division**
If there are only × and/or ÷ in the statement then the order is to work from left to right

eg $60 \div 2 \times 3 = 30\times 3$
$= 90$

eg $\dfrac{5+3\times 3}{6-4} = \dfrac{5+9}{2}$
$= \dfrac{14}{2}$ or 7

the vinculum acts like brackets

Last **Addition and/or Subtraction**

These operations can be performed in any order without changing the answer

eg working from left to right

$$\mathbf{6} - \mathbf{5} + \mathbf{7} - 1 - 5 + 3 = \mathbf{8} - 1 - 5 + 3$$
$$= 5$$

eg cancel the 6 with the $-1 - 5$

$$\underline{6} - 5 + 7\underline{-1 - 5} + 3 = -5 + 7 + 3$$
$$= 5$$

eg work out the positives and the negatives

$$\underline{6} - 5\underline{+7} - 1 - 5\underline{+3} = 16 - 11$$
$$= 5$$

Exercises

- The aim is ALWAYS to **get all the exercises correct** which you will do when you are **using the right strategy correctly** and not makinig silly mistakes.
- Make sure you **understand** if you made a careless error or if you are not using the strategy correctly.
- The more we have to think about, the more likely we are to make careless errors, so write down the answers to steps along the way to **reduce what you have to remember**.
- Repeated mistakes mean you haven't nailed the strategy yet and probably don't quite understand so be sure to **ask for help**

Simplify each of the following

1.
a 15 – 5 + 10 – 2
b 22 + 4 – 16 + 12
c 3 x 2 x 5 ÷ 15
d 18 + 12 ÷ 2
e 5 – 2 + 3 x 10
f 4 x 2 + 3 x 6
g 15 ÷ 3 – 18 ÷ 9
h 14 - 2 x 5 + 3
i 0 x 15 + 22 ÷ 2
j 16 + 12 ÷ 4 + 15

2.
a $\frac{3+4}{21}$
b $\frac{16-4}{12}$
c $\frac{3+22\div11}{14-3+9}$
d $\frac{14\times2\div4}{2+1}$
e $\frac{25+5\times6}{11}$
f (4 x 2 – 6) - (3 + 7)
g (13 – 5) x (7 – 2)
h 50 – (2 + 4 x (7 – (3 x 2)))
i 6 (8 – 3) – 3 (2 + 3)
j $\frac{18\div3+4}{12\div6}$

3. a 7 x (6 - 3)
   b (6 + 2) x 5
   c 8 + 4 x 6
   d 30 – 5 x 5
   e (30 – 5) x 5
   f 40 ÷ (17 - 9)
   g 27 – 5 x 4
   h 27 – (5 x 4)
   i ((5 + 4) x 6) ÷ 2
   j 5 x (15 – 4 x 3)

4. a 30 – (12 ÷ (4 ÷ 4))
   b $\frac{9 \times 2}{13 - 7}$
   c $\frac{8 + 4}{4 \times 9}$
   d $\frac{16 + 8}{16 - 8}$
   e 35 – 120 ÷ 5
   f $3^2 \times 2$
   g $\frac{33}{32 - 3 \times 7}$
   h $\frac{60}{2 \times 6 + 3}$
   i $\frac{32 - 8}{6 + 2}$
   j 3 x 6 + 3 x 4
   k $7^2 - 5 \times 4$
   l 5×2^3

Answers

1.a	18	b 22	c 2	d 24	e 33
f	26	g 3	h 7	i 11	j 34
2. a	1/3	b 1	c 1/4	d 2 1/3	e 5
f	-8	g 40	h 44	i 15	j 5
3. a	21	b 40	c 32	d 5	e 125
f	5	g 7	h 7	i 27	j 15
4. a	18	b 3	c 1/3	d 3	e 11
f	18	g 3	h 4	i 3	j 30
k	29	l 40			