MATHS AND STATS

Order of Operations II

Sometimes arithmetic can be ambiguous. Which is correct?

$6 + 2 \times 3 = 24$ OR
$6 + 2 \times 3 = 12$

To avoid ambiguity, we have an agreed convention for the order in which we process our calculations

B		Brackets
O		Operators - powers, roots, trig functions
{ D		Division and multiplication working from left to right
{ M		
{ A		Addition and subtraction working from left to right
{ S		

For example:

$$\begin{aligned} 8-2\times3+2\times3^2 &= 8-6+2\times9 \\ &= 8-6+18 \\ &= 20 \end{aligned}$$

Some other symbols can act as brackets:

$$\frac{196+36+16+256}{4} = \frac{504}{4} = 126$$

Here the fraction bar acts as a set of brackets around the calculations on the top.

$$\begin{aligned} \sqrt{3^2+4^2} &= \sqrt{9+16} \\ &= \sqrt{25} \\ &= 5 \end{aligned}$$

Similarly, the square root sign brackets the other operations

To get these calculations correct on you calculator you can either:

insert brackets on your calculator
OR do calculations in small parts first
OR use the ANS button on your calculator

Even though most scientific calculators know the order of operations they cannot read your mind! If you want to square a negative number or a fraction make sure you put that number in brackets so it squares the whole thing, for example if you want to square -3 then you need to write $(-3)^2$ because -3^2 is something different.

Exercises

1. $\frac{53+27}{13-8}$
2. What is the square of -8
3. $\sqrt{6^2+15^2-2\times6\times15\times cos\,145°}$
4. $\frac{-3+\sqrt{3^2+3\times2\times-1}}{2\times2}$
5. $4^2+\frac{1}{2}\times25\times16^2$
6. $\sqrt{13^2-12^2}$
7. $sin\,25°\times6$
8. $\frac{12^2-3^2}{6}+\frac{15^2-\sqrt{81}}{6\times3}$
9. $\frac{0.016}{1-0.016}$
10. $\frac{\pi9^3}{6}-\frac{\pi5^3}{6}$

Answers

1. 16
2. 64
3. 20.21
4. -0.317
5. 3216
6. 5
7. 2.536
8. 34.5
9. 0.016
10. 316.25