Order of Operations

Mathematical expressions are written to convey specific information. Therefore, everyone reading them interprets them the same way. For this reason, mathematicians have established a **convention** (an accepted method) that specifies the order in which operations are to be performed.

This **order of operations** states:

When working from left to right:

Step 1. Evaluate any expressions in brackets[1] first.

Step 2. Evaluate any powers and roots.

Step 3. Evaluate any multiplications or divisions.

Step 4. Evaluate any additions or subtractions.

Example 1

$$
\begin{aligned}
& 12 + 2 \times 3 && \text{evaluate the multiplication first,} \\
=\ & 12 + 6 && \text{finally, evaluate the addition,} \\
=\ & 18 \,.
\end{aligned}
$$

Example 2

$$
\begin{aligned}
& 8 - 12 \div (7 - 4 \times 2) && \text{evaluate the brackets first (multiplication first, then} \\
& && \text{subtraction),} \\
=\ & 8 - 12 \div -1 && \text{next do the division,} \\
=\ & 8 - (-12) && \text{finally, the subtraction,} \\
=\ & 8 + 12 \\
=\ & 20 \,.
\end{aligned}
$$

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[1]If there are brackets inside another set of brackets, do the inside brackets first.

Example 3

$$5^3 \times 2 - \left(\sqrt{81} - (7-3)^2 + 43 \right) \qquad \text{evaluate the inside bracket first,}$$
$$= \; 5^3 \times 2 - \left(\sqrt{81} - (4)^2 + 43 \right) \qquad \text{evaluate the last bracket; powers and roots first,}$$
$$= \; 5^3 \times 2 - (9 - 16 + 43) \qquad \text{addition and subtraction left to right in the brackets,}$$
$$= \; 5^3 \times 2 - 36 \qquad \text{evaluate the power,}$$
$$= \; 125 \times 2 - 36 \qquad \text{evaluate the multiplication,}$$
$$= \; 250 - 36 \qquad \text{finally, do the subtraction,}$$
$$= \; 214 \,.$$

Try yourself:

Here are some more for you to test yourself (answers are given at the bottom of the page):

1. $765 \div 15 + 822$;

2. $89 + 21 - 48 \times 23$;

3. $591 + 37^2$;

4. $4 \times (2 + 5) \div (3 + 1)$

5. $4\,763 + 395 \div 5 \times 16$;

6. $\left(62 - 24^2 + (7 + 3 \times 81) - 318 \right) + 61$.

Resources

- Other QuickTips flyers;

- Online resources at Study Support, USQ Library;

- Make a consultation with a Mathematics Learning Advisor.

Answers:

1. 873;

2. -994;

3. $1\,960$;

4. 7;

5. $6\,027$;

6. -521.