

CALCULATIONS

Pupils should be taught to:

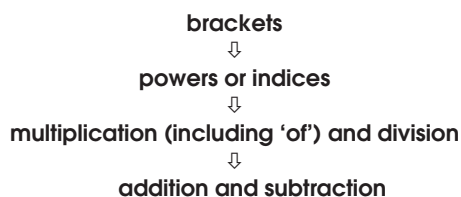
Know and use the order of operations, including brackets

As outcomes, Year 7 pupils should, for example:

Use, read and write, spelling correctly: order of operations, brackets...

Know the conventions that apply when evaluating expressions:

- Contents of brackets are evaluated first.
- In the absence of brackets, multiplication and division take precedence over subtraction and addition.
- A horizontal line acts as a bracket in expressions such as $\frac{5+6}{2}$ or $\frac{a+b}{5}$.



- With strings of multiplications and divisions, or strings of additions and subtractions, and no brackets, the convention is to work from left to right, e.g. $12 \div 4 \div 2 = 1.5$, not 6.

Calculate with mixed operations. For example:

- Find mentally or use jottings to find the value of:
 - a. $16 \div 4 + 8 = 12$
 - b. $16 + 8 \div 4 = 18$
 - c. $14 \times 7 + 8 \times 11 = 186$
 - d. $\frac{100}{4 \times 5} = 5$
 - e. $32 + 13 \times 5 = 97$
 - f. $(3^2 + 4^2)^2 = 625$
 - g. $(5^2 - 7) / (2^2 - 1) = 6$
- Use a **calculator** to calculate with mixed operations, e.g. $(32 + 13) \times (36 - 5) = 1395$
- In algebra recognise that, for example, when $a = 4$, $3a^2 = 3 \times 4^2 = 3 \times 16 = 48$

[Link to calculator methods \(pages 108–9\), order of algebraic operations \(pages 114–15\), and substitution in expressions and formulae \(pages 138–41\).](#)

Number operations and the relationships between them

As outcomes, Year 8 pupils should, for example:

Use vocabulary from previous year.

Recognise that, for example:

$$\frac{100}{4 \times 5} = 100 \div 4 \div 5 = 5$$

or $\frac{a}{b \times c} = a \div (b \times c)$ or $a \div b \div c$

Calculate with more complex mixed operations, including using the bracket keys on a **calculator**. For example:

- Find the value of:
 - a. $2.1 - (3.5 + 2.1) + (5 + 3.5) = 5$
 - b. $\frac{(2 + 3)^2}{(14 - 9)^2} = \frac{5^2}{5^2} = 1$
- Find, to two decimal places, the value of:
 - a. $(5.5 + 2) / 7 = 1.07$ to 2 d.p.
 - b. $\frac{8 + 4}{13 - 2} = 1.09$ to 2 d.p.
 - c. $\frac{25}{6 \times 93} = 0.04$ to 2 d.p.
 - d. $\sqrt{(26^2 - 14^2)} = 21.91$ to 2 d.p.

Evaluate expressions using nested brackets, such as:
 $120 \div \{30 - (2 - 7)\}$

Understand that the position of the brackets is important. For example:

- Make as many different answers as possible by putting brackets into the expression
 $3 \times 5 + 3 - 2 \times 7 + 1$
 For example:
 - a. $3 \times (5 + 3) - (2 \times 7) + 1 = 11$
 - b. $3 \times (5 + 3) - 2 \times (7 + 1) = 8$
 - c. $(3 \times 5) + 3 - (2 \times 7) + 1 = 5$
 - d. $(3 \times 5) + (3 - 2) \times 7 + 1 = 23$
 - e. $(3 \times 5) + (3 - 2) \times (7 + 1) = 23$
 - f. $(3 \times 5) + 3 - (2 \times 7 + 1) = 3$

[Link to calculator methods \(pages 108–9\), order of algebraic operations \(pages 114–15\), substitution in expressions and formulae \(pages 138–41\).](#)

As outcomes, Year 9 pupils should, for example:

Use vocabulary from previous years.

Understand the effect of powers when evaluating an expression. For example:

- Find the value of:
 - a. $36 \div (3 + 9) - 7 + 3 \times (8 \div 2)^3 = 188$
 - b. $\frac{7 \times 8^2}{7 \times 2} = \frac{8^2}{2} = 32$
 - c. $\frac{(7 \times 8)^2}{7 \times 2} = \frac{7 \times 8 \times 7 \times 8}{7 \times 2} = 7 \times 8 \times 4 = 224$
 - d. $-7^2 + 5 = -44$
 - e. $(-7)^2 + 5 = 54$
 - f. $(\frac{4}{3})^2 = 4^2 \div 3^2 = \frac{16}{9} = 1\frac{7}{9}$

Calculate with more complex mixed operations, including using the bracket keys on a **calculator**. For example:

- Find the value of:
 - a. $-(251 \times 3 + 281) + 3 \times 251 - (1 - 281) = -1$
- Find, to two decimal places, the value of:
 - a. $\frac{(12 - 5)^2(7 - 3)^2}{(8 - 5)^3} = \frac{7^2 \times 4^2}{3^3} = 29.04$ to 2 d.p.
 - b. $\frac{(16 - 9)^2(17 - 15)^2}{3(16 - 11)^3} = \frac{7^2 \times 2^2}{3 \times 5^3} = 0.52$ to 2 d.p.
- In algebra recognise that when $a = 2$,
 - a. $3a^2 - 9 = 3(2^2) - 9 = 3$
 - b. $3(a^2 - 9) = 3(4 - 9) = -15$
 - c. $(3a)^2 - 9 = 6^2 - 9 = 27$

Recognise that $(-a)^2 \neq -a^2$.

[Link to calculator methods \(pages 108–9\), order of algebraic operations \(pages 114–15\), substitution in expressions and formulae \(pages 138–41\).](#)