

CALCULATIONS

Pupils should be taught to:

Understand the operation of multiplication and the associated vocabulary, and its relationship to addition and division

As outcomes, Year 4 pupils should, for example:

Use, read and write:
times, multiply, multiplied by, product, multiple, inverse...
and the \times sign.

Understand and use when appropriate the principles (but not the names) of the commutative, associative and distributive laws as they apply to multiplication:

Example of commutative law

$$8 \times 15 = 15 \times 8$$

Example of associative law

$$6 \times 15 = 6 \times (5 \times 3) = (6 \times 5) \times 3 = 30 \times 3 = 90$$

Example of distributive law

$$18 \times 5 = (10 + 8) \times 5 = (10 \times 5) + (8 \times 5) = 50 + 40 = 90$$

Understand that:

- $86 + 86 + 86$ is equivalent to 86×3 or 3×86 ;
- multiplication by 1 leaves a number unchanged;
- multiplication of zero results in zero.

Understand that multiplication is the inverse of division (multiplication reverses division and vice versa) and use this to check results.

See also mental calculation strategies (pages 60–65) and checking results of calculations (page 72).

Respond rapidly to oral or written questions, explaining the strategy used. For example:

- Two eights.
- Double 16.
- 7 times 4... 9 multiplied by 3.
- Multiply 15 by 6... by zero... by 1.
- Is 40 a multiple of 5? How do you know?
- What is the product of 15 and 6?
- Find all the different products you can make by using two of these five numbers: 2, 3, 4, 5, 10.

Complete written questions, for example:

- working rapidly, using known facts:
 $7 \times 2 = \square$ $10 \times \square = 80$ $\square \times 5 = 35$
 $4 \times 9 = \square$ $3 \times \square = 24$ $\square \times 4 = 20$
 - using pencil and paper jottings and/or mental strategies:
 $90 \times 6 = \square$ $8 \times \square = 560$ $\square \times 90 = 720$
 $4 \times \square + 8 = 24$
- progressing to:
- $$36 \times 18 = \square$$
- $$5 \times 35 + \square = 180$$
- $$\square \times \triangle = 720$$

As outcomes, Year 5 pupils should, for example:

Use, read and write, spelling correctly:
times, multiply, multiplied by, product, multiple, inverse... and the \times sign.

Understand and use as appropriate the principles (but not the names) of the commutative, associative and distributive laws as they apply to multiplication:

Example of commutative law

$$8 \times 65 = 65 \times 8$$

Example of associative law

$$14 \times 12 = (2 \times 7) \times 12 = 2 \times (7 \times 12) = 2 \times 84 = 168$$

Examples of distributive law

$$26 \times 7 = (20 + 6) \times 7 = (20 \times 7) + (6 \times 7) = 182$$

$$(6 \times 15) + (4 \times 15) = 10 \times 15 = 150$$

Understand that, with positive whole numbers, multiplying makes a number larger.

Understand that multiplication is the inverse of division and use this to check results.

See also mental calculation strategies (pages 60–65) and checking results of calculations (page 73).

Start to use brackets: know that they determine the order of operations, and that their contents are worked out first. For example:

$$3 + (6 \times 5) = 33, \text{ whereas } (3 + 6) \times 5 = 45.$$

Respond rapidly to oral or written questions, explaining the strategy used. For example:

- Two twelves.
- Double 32.
- 7 times 8... 9 multiplied by 7.
- Multiply 31 by 8... by zero... by 1.
- Is 81 a multiple of 3? How do you know?
- What is the product of 25 and 4?
- Find all the different products you can make by using three of these: 6, 7, 8, 9, 11.

Complete written questions, for example:

- working rapidly, using pencil and paper jottings and/or mental strategies:

$70 \times 6 = \square$	$11 \times \square = 88$	$\square \times 9 = 0.36$
$80 \times 9 = \square$	$6 \times \square = 4.8$	$\square \times 7 = 0.49$
- using informal or standard written methods:

$72 \times 6 = \square$	$180 \times \square = 540$	$\square \times 9 = 189$
$14 \times \square + 8 = 50$		$46 \times 28 = \square$

Use written methods or a calculator to work out:

$132 \times 46 = \square$	$\square \times \triangle = 162$
$2.7 \times 8 = \square$	$(14 \times 60) + \square = 850$

As outcomes, Year 6 pupils should, for example:

Use, read and write, spelling correctly:
times, multiply, multiplied by, product, multiple, inverse... and the \times sign.

Understand and use when appropriate the principles (but not the names) of the commutative, associative and distributive laws as they apply to multiplication:

Example of commutative law

$$95 \times 78 = 78 \times 95$$

Example of associative law

$$10.4 \times 40 = 10.4 \times (10 \times 4) \text{ or } (10.4 \times 10) \times 4$$

Example of distributive law

$$\begin{aligned} 46 \times 98 &= 46 \times (100 - 2) \\ &= (46 \times 100) - (46 \times 2) \\ &= 4600 - 92 = 4508 \end{aligned}$$

Understand that multiplication is the inverse of division and use this to check results.

See also mental calculation strategies (pages 60–65) and checking results of calculations (page 73).

Use brackets: know that they determine the order of operations, and that their contents are worked out first.

Respond rapidly to oral or written questions, explaining the strategy used. For example:

- Two nineteens.
- Double 75.
- 11 times 8... 9 multiplied by 8.
- Multiply 25 by 8... by zero... by 1.
- Is 210 a multiple of 6? How do you know?
- What is the product of 125 and 4?
- Find all the different products you can make using two of these: 0.2, 1.4, 0.03, 1.5, 0.5.

Complete written questions, for example:

- working rapidly, using pencil and paper jottings and/or mental strategies:

$0.7 \times 20 = \square$	$20 \times \square = 8000$	$\square \times 5 = 3.5$
$4 \times 0.9 = \square$	$0.3 \times \square = 2.4$	$\square \times 0.4 = 2$
- using informal or standard written methods:

$132 \times 46 = \square$	$\square \times 9 = 18.9$
$24 \times \square + 8 = 3008$	$38 \times \square = 190$

Use written methods or a calculator to work out:

$738 \times 639 = \square$	$\square \times \triangle = 9506$
$(41 \times 76) + \square = 4000$	$78 \times (97 - 42) = \square$

CALCULATIONS

Pupils should be taught to:

Understand the operation of division and the associated vocabulary, and its relationship to subtraction and multiplication

As outcomes, Year 4 pupils should, for example:

Use, read and write:
share, group, divide, divided by, divided into, divisible by, factor, quotient, remainder, inverse...
and the division signs \div or $/$.

Understand the operation of division either as sharing equally or as grouping (that is, repeated subtraction). For example, $30 \div 6$ can be modelled as:

- sharing among 6 and the number given to one person counted; or
- groups or lots of 6 being taken and the number of groups or lots counted.

Understand that:

- division by 1 leaves a number unchanged.

Understand that division is the inverse of multiplication (division reverses multiplication and vice versa) and use this to check results.

See also mental calculation strategies (pages 60–65) and checking results of calculations (page 72).

Respond to oral or written questions, explaining the strategy used. For example:

- Share 44 between 4.
- Divide 69 by 3. 69 divided by 3. Divide 3 into 69.
- How many groups of 6 can be made from 48?
- How many lengths of 10 cm can you cut from 183 cm?
- Is 72 divisible by 3? How do you know?
- What are the factors of 12?
- Tell me two numbers with a quotient of 5.
Are there any other possibilities?

Begin to relate division and fractions. Understand that:

- $\frac{1}{2}$ of 10 is the same as $10 \div 2$;
- $\frac{1}{4}$ of 3 is the same as $3 \div 4$.

Complete written questions, for example:

- with rapid mental recall:
 $36 \div 4 = \square$ $60 \div \square = 6$ $\square \div 3 = 7$
 - using pencil and paper jottings and/or mental strategies:
 $320 \div 4 = \square$ $240 \div \square = 60$ $\square \div 30 = 8$
 $(25 \div \square) + 2 = 7$ $(\square \div 5) - 2 = 3$
- progressing to:
- $1456 \div 4 = \square$
- $156 \div \square = 26$
- $\square \div 9 = 460$

As outcomes, Year 5 pupils should, for example:

Use, read and write, spelling correctly:
share, group, divide, divided by, divided into,
divisible by, factor, quotient, remainder, inverse...
 and the division signs \div or $/$.

Understand the operation of division as either sharing equally or repeated subtraction (grouping):

- sharing is better for dividing by small numbers;
- grouping is better for dividing by larger numbers.

Understand that:

- with positive whole numbers, division makes a number smaller;
- division is non-commutative: that is, $72 \div 9$ is not the same as $9 \div 72$;
- a number cannot be divided by zero.

Understand that division is the inverse of multiplication and use this to check results.

See also mental calculation strategies (pages 60–65) and checking results of calculations (page 73).

Respond to oral or written questions, explaining the strategy used. For example:

- Share 48 between 8.
- Divide 56 by 7. Divide 3 into 72.
- How many groups of 8 can be made from 73?
- What is the remainder when 74 is divided by 8?
- How many lengths of 20 cm can you cut from 270 cm?
- Is 156 divisible by 6? How do you know?
- What are the factors of 36?
- Tell me two numbers with a quotient of 100.

Relate division and fractions. Understand that:

- $\frac{1}{3}$ of 24 is equivalent to $24 \div 3$ or $24/3$;
- $16 \div 5$ is equivalent to $1\frac{1}{5}$ or $3\frac{1}{5}$.

Complete written questions, for example:

- with rapid mental recall:
 $\frac{63}{7} = \square$ $56 \div \square = 8$ $\square \div 9 = 8$
- using pencil and paper jottings and/or mental strategies:
 $172 \div 4 = \square$ $\frac{54}{\square} = 18$ $\square \div 21 = 90$

Use written methods or a calculator to work out:

$$\begin{array}{ll} (125 \div \square) + 2 = 27 & (\square \div 5) - 22 = 30 \\ 900 \div 36 = \square & 1560 \div \square = 120 \\ \square/28 = 46 & \end{array}$$

As outcomes, Year 6 pupils should, for example:

Use, read and write, spelling correctly:
share, group, divide, divided by, divided into,
divisible by, factor, quotient, remainder, inverse...
 and the division signs \div or $/$.

Continue to understand the operation of division as either sharing or repeated subtraction (grouping):

- sharing is better for dividing by small numbers;
- grouping is better for dividing by larger numbers.

Understand that division is the inverse of multiplication and use this to check results.

See also mental calculation strategies (pages 60–65) and checking results of calculations (page 73).

Respond to oral or written questions, explaining the strategy used. For example:

- Share 108 between 9.
- Divide 112 by 7. Divide 15 into 225.
- How many groups of 16 can be made from 100?
- What is the remainder when 104 is divided by 12?
- How many lengths of 25 cm can you cut from 625 cm?
- Is 156 divisible by 8? How do you know?
- What are the factors of 98?
- Tell me two numbers with a quotient of 0.5.

Relate division and fractions. Understand that:

- $\frac{1}{8}$ of 72 is equivalent to $72 \div 8$ or $72/8$;
- $4 \div 7$ is equivalent to $\frac{4}{7}$;
- $13 \div 7$ is equivalent to $1\frac{6}{7}$.

Complete written questions, for example:

- with rapid mental recall:
 $6.3 \div 7 = \square$ $9.9 \div \square = 1.1$ $\square \div 5 = 0.8$
- using pencil and paper jottings and/or mental strategies:
 $17.2 \div 4 = \square$ $\square/25 = 39$

Use written methods or a calculator to work out:

$$\begin{array}{ll} 4123 \div 365 = \square & \square \div 2.8 = 4.6 \\ (\square \div 25) - 22 = 30 & (56 + 97)/(133 - 85) \\ (100 \div \square) + 5 = 7.5 & \end{array}$$