

N1.1 Understand integers and place value to deal with arbitrarily large positive numbers.

If $53 \times 132 = 6996$, work out $6996 \div 530$.

N1.2 Add, subtract, multiply and divide any number.

Work out:

a) $\frac{3.6 \times 1.5}{0.3}$

b) $\frac{12}{0.2^2}$

N1.3 Understand and use number operations and the relationships between them, including inverse operations and hierarchy of operations.

A cup of coffee costs £1.30.

A cup of tea costs £1.10.

I want to buy three cups of coffee and two cups of tea.

I have a voucher for one free cup with every two cups bought.

How much should I pay?

N1.4 Approximate to a given power of 10, up to three decimal places and one significant figure.

Use approximations to estimate the answer to $\frac{6013}{39.46 \times 5.17}$

Estimate the value of $\frac{87.6 + 31.1}{5.08 \times 7.93}$

N1.5 Order rational numbers.

Which of the improper fractions $\frac{18}{5}$, $\frac{17}{6}$ or $\frac{31}{10}$ is the greatest?

N1.6 The concepts and vocabulary of factor (divisor), multiple, common factor, highest common factor, least common multiple, prime number and prime factor decomposition.

1. Write 60 as the product of its prime factors. Give your answer in index form.
2. Find the lowest common multiple of 42 and 63.
3. Envelopes are sold in packs of 18. Address labels are sold in packs of 30.
Terry needs the same number of envelopes and address labels.
What is the smallest number of each pack he can buy?

N1.7 The terms square, positive and negative square root, cube and cube root.

1. Write down the value of $\sqrt{49}$, $\sqrt[3]{125}$, $\sqrt{2^3 + 2^3}$
2. Show that it is possible to write 50 as the sum of two square numbers in two different ways.

N4.1 Distinguish the different roles played by letter symbols in algebra, using the correct notation.

£ p is shared equally between seven people.
How much does each person receive?

N4.2h Distinguish in meaning between the words 'equation', 'formula', 'expression' and identity.

Write an expression for the number that is six smaller than n .

N5.1h Manipulate algebraic expressions by collecting like terms, by multiplying a single term over a bracket, and by taking out common factors. Multiply two linear expressions

1. Expand and simplify $3(a - 4) + 2(2a + 5)$
2. Factorise $6w - 8y$
3. Expand and simplify $(3a - 2b)(2a + b)$

N5.2h Factorise quadratic expressions, including the difference of two squares.

1. Factorise $x^2 - 7x + 10$
2. Factorise
 - i). $y^2 - 9$
 - ii). $49k^2 - m^2$
 - iii). $5w^2 - 20t^2$
3. Factorise $6h^2 - 23h - 18$

N5.3h Simplify rational expressions.

Simplify:

1. $\frac{x^2 - 9}{x^2 + 8}$
2. $\frac{6h^2 - 23h - 18}{4h^2 - 81}$
3. $\frac{5}{4xy} - \frac{3}{2y^3}$

N5.6 Derive a formula, substitute numbers into a formula and change the subject of a formula.

1. When $a = 5$, $b = -7$ and $c = 8$, work out: $\frac{a(b+3)}{c}$

Change the subject of the formula

1. $y = 2x + 3$ (x)

2. $y = \frac{m+x}{x-2}$ (x)

N6.1 Generate terms of a sequence using term-to-term and position to term definitions of the sequence.

Write down the first three terms of a sequence where the n^{th} term is given by $n^2 + 4$

N6.2 Use linear expressions to describe the n^{th} term of an arithmetic sequence.

1. Write down the n^{th} term of the sequence 3, 7, 11, 15, ...
2. (a). Write down an expression for the n^{th} term of the sequence 5, 8, 11, 14
(b). Explain why 61 cannot be a term of this sequence.

N2.1 Understand equivalent fractions, simplifying a fraction by cancelling all common factors.

Write down a fraction between $\frac{5}{7}$ and $\frac{6}{7}$

N2.2 Add and subtract fractions.

1. $\frac{2}{5} + \frac{3}{4}$

2. $3\frac{2}{3} - 1\frac{1}{2}$

N2.3 Use decimal notation and recognise that each terminating decimal is a fraction.

N2.4 Recognise that recurring decimals are exact fractions and that some exact fractions are recurring decimals.

1. Write 0.3 and 0.6 as fractions

2. Put these numbers in ascending order $\frac{3}{4}$, 0.83, $\frac{4}{5}$, $\frac{13}{20}$

3. (a). Show that $\frac{5}{9}$ is equivalent to 0.555

(b). Use the answer to part a. to write the decimal 0.4555 as a fraction

N2.5 Understand that 'percentage' means 'number of parts per 100' and use this to compare proportions.

1. Paving slabs cost £3.20 each.

A supplier offers '20% off when you spend more than £300'.

What will it cost to buy 100 paving slabs?

2. The cash price of a leather sofa is £700.

Credit terms are a 20% deposit plus 24 monthly payments of £25.

Calculate the difference between the cash price and the credit price.

N2.6 Interpret fractions, decimals and percentages as operators.

In School A 56% of the 750 pupils are girls.

In School B $\frac{4}{9}$ of the 972 pupils are girls.

Which school has the greatest number of girls and by how many?

N2.7h Calculate with fractions, decimals and percentages, including reverse percentage calculations.

1. In a school there are 600 students and 50 teachers. 15% of the students are left-handed. 12% of the teachers are left-handed. How many left-handed students and teachers are there altogether?
2. Attendance at a football match is 48,400. This is a 10% increase on the attendance at the last game. What was the attendance at the last game?

N1.7 The terms square, positive and negative square root, cube and cube root

1. Show that it is possible to write 50 as the sum of two square numbers in two different ways
2. Estimate the square root of 43

N1.8 Index notation for squares, cubes and powers of 10.

Tim says that $\sqrt{13^2 - 12^2}$ is greater than $\sqrt[3]{11^2 + 2^2}$. Is he correct?

N1.9h Index laws for multiplication and division of integer powers, fractional powers and negative powers.

1. Write (a) $7^5 \times 7^3$ as a single power of 7 (b) $9^{12} \div 9^5$ as a single power of 9.
2. Work out the value of $6^{-2} \times 144^{0.5}$. Give your answer in its simplest form.
3. Simplify fully (a) $x^4 \times x^9$ (b) $y^{20} \div y^5$ (c) $(2m^3p^2)^4$

N1.10h Interpret, order and calculate numbers written in standard index form.

1. Write in standard form

(a) 379.4

(b) 0.0712

2. Work out the value of the following. Give your answers in standard form.

(a) $(2.8 \times 10^9) \div (4 \times 10^5)$

(b) $(5 \times 10^{-3})^2$

Solve the equation $x \times 10^6 = 1.5 \times 10^3$ Give your answer in standard form.

N6.4 Recognise and plot equations that correspond to straight-line graphs in the coordinate plane, including finding their gradients.

1. Plot the graph of $y = 3x - 1$

(table of values will not be given)

2. Plot the graph of $x + 2y = 10$

3. For a given straight line graph (such as $y = 3x - 1$ or $x + 2y = 10$), calculate the gradient of the line.

N6.11 Construct linear functions from real-life problems and plot their corresponding graphs.

The cost of hiring a bike is given by the formula $C = 8d + 10$, where d is the number of days for which the bike is hired and C (£) is the total cost of hire. Plot the graph of number of days against cost for values of d from 0 to 7.

N6.12 Discuss, plot and interpret graphs (which may be non-linear) modelling real situations.

The cost of hiring a floor sanding machine is worked out as follows:

Deposit = £28. Cost per day = £12.

Draw a graph to show the cost of hiring the machine for six days.

N5.4h Set up and solve simple linear equations, including simultaneous equations in two unknowns. Part 1

1. Solve $5x - 4 = 2(x + 1)$

2. Bill is twice as old as Will and Will is three years older than Phil.

The sum of their ages is 29.

If Will is x years old, form an equation and use it to work out their ages.

3. Solve $\frac{24-x}{5} = 3$

4. Solve $\frac{2x-1}{4} + \frac{x+2}{3} = 2$

N5.4h Set up and solve simple linear equations, including simultaneous equations in two unknowns.

Part 2

5. Solve the simultaneous equations

$$5x + 6y = 28$$

$$x + 3y = 2$$

You must show your working.

6. The cost for three adults and two children to go to the theatre is £73.

For two adults and five children, the cost is £89.

Work out the cost of an adult ticket and the cost of a child ticket.

N5.5h Solve quadratic equations.

1. Solve $x^2 - 7x + 10 = 0$

2. Solve $5x^2 + 13x - 6 = 0$

3. Factorise $x^2 - 10x + 25$

Hence, or otherwise, solve the equation

$$(y - 3)^2 - 10(y - 3) + 25 = 0$$

4. Find the values of p and q such that $x^2 + px + 17 = (x - 5)^2 + q$

5. Solve the equation $x^2 + 6x - 3 = 0$ using completing the square, leave your answer in surd form.

6. Solve the equation

$$\frac{4}{2x-1} - \frac{1}{x+1} = 1$$

N1.11h Surds and π in exact calculations.

1. Work out the volume of a cone of base radius 6 cm and perpendicular height 11 cm.

Give your answer in terms of π .

The formula for the volume of a cone is $\frac{1}{3}\pi r^2 h$.

2. Write $\sqrt{28} + \sqrt{63}$ in the form $\sqrt[p]{7}$ where p is an integer.

3. Work out:

a). $(\sqrt{11})^2$

b). $\sqrt{192} \div \sqrt{12}$

4. Simplify fully

a). $\sqrt{27} \times \sqrt{3}$

b). $\frac{85}{\sqrt{7}}$

N1.12h Rules of arithmetic applied to calculations and manipulations with surds.

1. Show that $\sqrt{20} = 2\sqrt{5}$
2. Expand and simplify $(\sqrt{2} + \sqrt{10})^2$
3. Expand and simplify fully $(\sqrt{27} + 3)(\sqrt{6} - \sqrt{2})$
4. Find the value of x if $\frac{\sqrt{x}\sqrt{50}}{5} = 4\sqrt{5}$

N5.7h Solve linear inequalities in two variables, and represent the solution set on a suitable diagram.

1. Show the inequality $-4 < x \leq 2$ on a number line.
2. Solve the inequality $2x - 7 \leq 3$ and represent the solutions set on a number line.
3. Write down all the integers that satisfy the inequality $-12 \leq 3n < 6$

N3.1 Use ratio notation, including reduction to its simplest form and its various links to fraction notation.

1. The ratio of red balls to blue balls in a bag is 3 : 4
What fraction of the balls are red?
2. Write the ratio 15 : 8 in the form $n : 1$
3. A recipe for fruit cake uses sultanas and raisins in the ratio 5 : 3
Liz uses 160g of raisins.
What weight of sultanas should she use?
4. The ratio 15000000 : 50 can be written in the form $n : 1$
Work out the value of n
Give your answer in standard form.

N3.2 Divide a quantity in a given ratio.

1. Work out the share for each of three persons, A, B and C who share £480 in the ratio 1 : 4 : 3
2. Bill and Phil buy a lottery ticket.
Bill pays 40p and Phil pays 60p
They win £6000 and divide the money in the ratio of the amounts they paid.
How much should each of them receive?
3. In a school the ratio of boys to girls is 5 : 6
There are 468 girls in the school.
How many pupils are there altogether?
4. Leah, Chloe and Maya share £400 between them.
Leah receives the smallest amount of £90
The ratio of Leah's share to Chloe's share is 2 : 3
Work out how much Maya receives.

N3.3 Solve problems involving ratio and proportion, including the unitary method of solution.

1. A person travels 20 miles in 30 minutes.

How far would they travel in $1\frac{1}{4}$ hours?

2. Fiona is delivering leaflets.

She is paid £7.40 for delivering 200 leaflets.

How much should she be paid for delivering 300 leaflets?

3. Eight pencils can be bought for £2.58.

How many can be bought for £4.80?

N5.9h Use algebra to support and construct arguments and simple proofs. Part 1

1. w is an even number, explain why $(w - 1)(w + 1)$ will always be odd.

2. Liz says that when $m > 1$, $m^2 + 2$ is never a multiple of 3. Give a counter example to show that she is wrong.

3. Alice says that the sum of three consecutive numbers will always be even.

Explain why she is wrong.

N5.9h Use algebra to support and construct arguments and simple proofs. Part 2

1. n is a positive integer.

Prove that the product of three consecutive integers must always be a multiplier of 6.

2. n is a positive integer.

a). i). Explain why $n(n + 1)$ must be an even number.

ii). Explain why $2n + 1$ must be an odd number.

b). Expand and simplify $(2n + 1)^2$

c). Prove that the square of any odd number is always 1 more than a multiple of 8.

