Pupils should be taught to:

Construct and solve linear equations, selecting an appropriate method

As outcomes, Year 7 pupils should, for example:

Use, read and write, spelling correctly:
equation, solution, unknown, solve, verify, prove, therefore (∴).

Construct and solve simple linear equations with integer coefficients, the unknown on one side only.

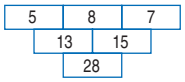
Choose a suitable unknown and form expressions leading to an equation. Solve the equation by using inverse operations or other mental or written methods.

For example:

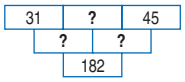
- I think of a number, subtract 7 and the answer is 16.
  What is my number?
  Let n be the number.
  $n - 7 = 16$
  $\therefore\ n = 16 + 7 = 23$

- A stack of 50 sheets of card is 12 cm high.
  How thick is one sheet of card?
  Let d cm be the thickness of each sheet.
  $50d = 12$
  $\therefore\ d = {}^{12}/_{50} = {}^{24}/_{100} = 0.24$
  The thickness of each sheet is 0.24 cm.

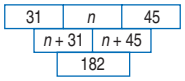
- In this diagram, the number in each cell is formed by adding the two numbers above it.

  What are the missing numbers in this diagram?

  Let n be the number in the top centre cell. Form the first row and the subsequent row. It follows that:

  $n + 31 + n + 45 = 182$
  $\therefore\ 2n = 106$
  $n = 53$

  What if the top three numbers are swapped around?
  What if you start with four numbers?

- I think of a number, multiply it by 6 and add 1.
  The answer is 37. What is my number?

- There are 26 biscuits altogether on two plates.
  The second plate has 8 fewer biscuits than the first plate.
  How many biscuits are there on each plate?

- Find the angle a in a triangle with angles a, a + 10, a + 20.

- Solve these equations:
  a. $a + 5 = 12$
  b. $3m = 18$
  c. $7h - 3 = 20$
  d. $7 = 5 + 2z$
  e. $2c + 3 = 19$
  f. $6 = 2p - 8$

Check solutions by substituting into the original equation.

As outcomes, Year 8 pupils should, for example:

Use vocabulary from previous year and extend to: linear equation…

Consolidate forming and solving linear equations with an unknown on one side.

Choose a suitable unknown and form expressions leading to an equation. Solve the equation by removing brackets, where appropriate, collecting like terms and using inverse operations.

For example:

- There are 376 stones in three piles. The second pile has 24 more stones than the first pile. The third pile has twice as many stones as the second.
  How many stones are there in each pile?

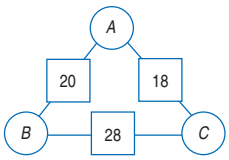
  Let s stand for the number in the first pile.

Pile 1	Pile 2	Pile 3	Total
s	s + 24	2(s + 24)	376

  $s + (s + 24) + 2(s + 24) = 376$
  $\therefore\ s + s + 24 + 2s + 48 = 376$
  $4s + 72 = 376$
  $4s = 376 - 72 = 304$
  $s = 76$

- In an arithmagon, the number in a square is the sum of the numbers in the two circles on either side of it.

  In this triangular arithmagon, what could the numbers A, B and C be?

  Let x stand for the number in the top circle.
  Form expressions for the numbers in the other circles, (20 – x) and (18 – x). Then form an equation in x and solve it.

  $(20 - x) + (18 - x) = 28$
  $\therefore\ 38 - 2x = 28$
  $2x = 10$
  $x = 5$
  So A = 5, B = 15, C = 13.

- On Dwain's next birthday, half of his age will be 16.
  How old is Dwain now?

- Solve these equations:
  a. $5x = 7$
  b. $3 = \frac{12}{n}$
  c. $2(p + 5) = 24$
  d. $2.4z + 5.9 = 14.3$
  e. $4(b - 1) + 5(b + 1) = 100$

Check solutions by substituting into the original

As outcomes, Year 9 pupils should, for example:

Use vocabulary from previous years and extend to: inequality, region… and, or…

Construct and solve linear equations with negative signs anywhere in the equation, negative solution…

Solve linear equations using inverse operations, by transforming both sides in the same way or by other methods.

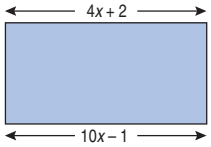
For example:

- Compare different ways of solving 'think of a number' problems and decide which would be more efficient – retaining brackets and using inverse operations, or removing brackets first.
  For example:
  I think of a number, add 3, multiply by 4, add 7, divide by 9, then multiply by 15.
  The final answer is 105.
  What was the number that I thought of?

- Jack, Jo and Jim are sailors.
  They were shipwrecked on an island with a monkey and a crate of 185 bananas.
  Jack ate 5 more bananas than Jim.
  Jo ate 3 more bananas than Jim.
  The monkey ate 6 bananas.
  How many bananas did each sailor eat?

- The length of a rectangle is three times its width.
  Its perimeter is 24 centimetres.
  Find its area.

- The area of this rectangle is 10 cm^2.

  Calculate the value of x and use it to find the length and width of the rectangle.

- In ΔABC, ∠B is three quarters of ∠A, and ∠C is one half of ∠A. Find all the angles of the triangle.

- Solve these equations:
  a. $3c - 7 = {}^{-}13$
  b. $1.7m^2 = 10.625$
  c. $4(z + 5) = 8$
  d. $4(b - 1) - 5(b + 1) = 0$
  e. $\frac{12}{(x + 1)} = \frac{21}{(x + 4)}$

Check solutions by substituting into the original equation.

Pupils should be taught to:

Construct and solve linear equations, selecting an appropriate method (continued)

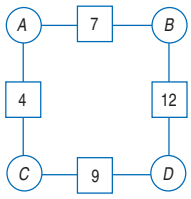
As outcomes, Year 7 pupils should, for example:

Explore ways of constructing simple equations to express relationships, and begin to recognise equivalent statements. For example:

- In an arithmagon, the number in a square is the sum of the numbers in the two circles either side of it.

In this square arithmagon, what could the numbers A, B, C and D be?

Can you find any relationships between A, B, C and D?



Some results

A	B	C	D
3	4	1	8
2	5	2	7
1	6	3	6
4	3	0	9
0	7	4	5

Some relationships

$A + B = 7$
$C + D = 9$
$A + B + C + D = 16$
$D - A = 5$
$B - C = 3$
$B = C + 3$

Recognise that statements such as $B - C = 3$ and $B = C + 3$ express the same relationship in different ways.

As outcomes, Year 8 pupils should, for example:

Explore alternative ways of solving simple equations, e.g. deciding whether or not to remove brackets first. For example:

- $2(x + 5) = 36$ or $2(x + 5) = 36$
  $x + 5 = 18$ $2x + 10 = 36$
  $x = 13$ $2x = 26$
  $x = 13$

Begin to understand that an equation can be thought of as a balance where, provided the same operation is performed on both sides, the resulting equation remains true. For example:

- Start with a true statement, such as:
  $52 - 7 = 41 + 4$
  Make the same change to both sides, e.g. subtract 4:
  $52 - 7 - 4 = 41$
  Check that this statement is true.

  Then start with a simple equation, such as:

	$y = x + 4$
add 3	$y + 3 = x + 7$
double	$2(y + 3) = 2(x + 7)$
subtract d	$2(y + 3) - d = 2(x + 7) - d$

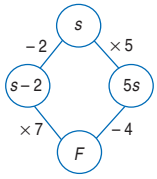
  Check that the resulting equation is true by substituting numbers which fit the original, e.g. $x = 1$, $y = 5$.

Form linear equations (unknown on both sides) and solve them by transforming both sides in the same way. Begin to recognise what transformations are needed and in what order. For example:

- Jill and Ben each have the same number of pens.
  Jill has 3 full boxes of pens and 2 loose pens.
  Ben has 2 full boxes of pens and 14 loose pens.
  How many pens are there in a full box?
  $3n + 2 = 2n + 14$

- In the two-way flow diagram, find the starting number s that has to be entered, so that you reach the same finishing number F, whichever route is followed.

  $7(s - 2) = 5s - 4$
  $\therefore 7s - 14 = 5s - 4$
  $7s = 5s - 4 + 14$
  $7s = 5s + 10$
  $2s = 10$
  $s = 5$



- Solve these equations:
  a. $3x + 2 = 2x + 5$
  b. $5z - 7 = 13 - 3z$
  c. $4(n + 3) = 6(n - 1)$

Check solutions by substituting into the original equation.

As outcomes, Year 9 pupils should, for example:

Form linear equations (unknown on both sides) and solve them by transforming both sides in the same way. For example:

- Multiplying a number by 2 and then adding 5 gives the same answer as subtracting the number from 23.
  What is the number?

- Françoise and Jeanette have 250 euros between them. Jeanette gave Françoise 50 euros. Françoise now has four times as many euros as Jeanette.
  How many euros has Françoise?

- The sum of the ages of a mother and her daughter is 46. In three years' time the mother will be three times as old as her daughter is then.
  How old is the daughter now?

- Solve these equations:
  a. $7(s + 3) = 45 - 3(12 - s)$
  b. $3(2a - 1) = 5(4a - 1) - 4(3a - 2)$
  c. $2(m - 0.3) - 3(m - 1.3) = 4(3m + 3.1)$
  d. $\frac{3}{4}(c - 1) = \frac{1}{2}(5c - 3)$
  e. $\frac{x - 3}{2} = \frac{x - 2}{3}$

Check solutions by substituting into the original equation.