A Number applications: Using ratios within a population

1 From a students survey on cars colours, it was found that the ratio of 1:3:4:5 described the colours pink, blue, white and red in that order. If 388 white were observed;
   (a) how many pink, blue and red cars were counted?
   (b) how many cars were observed altogether?

2 The formula for nitric acid is HNO_3. The ratio of hydrogen to nitrogen to oxygen atoms is 1:1:3. If in a pure sample there are 6×10^7 oxygen atoms then:
   (a) how many hydrogen and nitrogen atoms are there in the sample?
   (b) how many atoms are there in the sample altogether?

B Number applications: Using ratio in scale diagrams
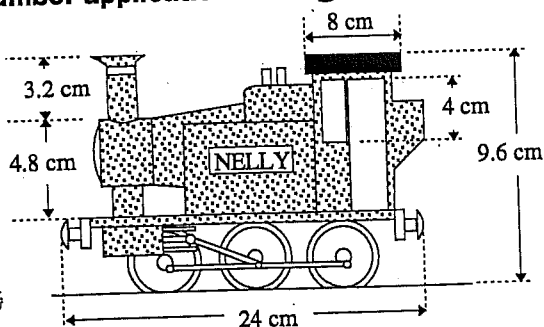
This is a diagram of a model steam train. Find the dimensions of the original if the model was made in the ratio of 25:1 (ratio of original to model).

C Number applications: Finding percentages of quantities

Find:

1 12% of $30	2 6% of $18	3 5% of $3000
4 $12\frac{1}{2}$% of $3000	5 $6\frac{1}{4}$% of $2500	6 $10\frac{1}{3}$% of $33\,000
7 $8\frac{1}{2}$% of $90	8 $15\frac{1}{2}$% of $32	9 $3\frac{1}{4}$% of $600
10 19% of $27	11 6% of $3.50	12 2% of $17.20

D Cartesian plane: The general equation of a straight line

Find the gradient and y-intercept of these lines from their equations:

1 $y = 4x - 1$ 2 $y = \frac{1}{2}x + 2$ 3 $y = -\frac{3}{4}x - 6$

4 $2y = 4x - 6$ 5 $3y = 9x + 1$ 6 $y + x = 1$

7 $y - x = 2$ 8 $y + 2x = 3$ 9 $2y + x = 5$

10 $7y - x = 6$ 11 $3y + x = 4$ 12 $x + y - 2 = 0$

13 $2x + y + 4 = 0$ 14 $-2x + y - 5 = 0$ 15 $x - 2y + 7 = 0$

E Cartesian plane: Simultaneous equations

1 Solve these simultaneous equations using substitution:
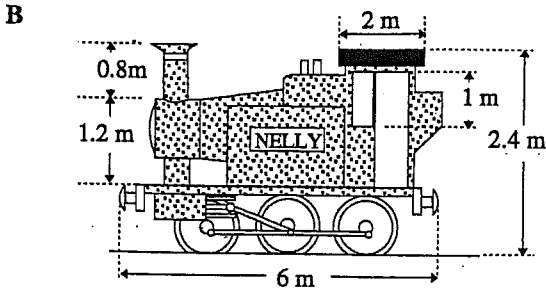   (a) $y = 2x$
        $y = 3 + x$
   (b) $y = x + 3$
        $y = 5 - x$

2 Sketch each of the above pairs of lines of the same set of axes using the x- and y-intercept method and identify the point of intersection.

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A 1 (a) 97 pink, 291 blue, 485 red
  (b) 1261 cars altogether
  2 (a) Hydrogen: 2×10^7, nitrogen 2×10^7
  (b) Total: 10^8 atoms

B

C

1	$3.60	2	$1.08	3	$150
4	$375	5	$156.25	6	$3410
7	$7.65	8	$4.96	9	$19.50
10	$5.13	11	$0.21	12	$0.34

D 1 gradient = 4
  y-int. = −1

  2 gradient = $\frac{1}{2}$
  y-int. = 2

  3 gradient = $-\frac{3}{4}$
  y-int. = −6

  4 gradient = 2
  y-int. = −3

  5 gradient = 3
  y-int. = $\frac{1}{3}$

  6 gradient = −1
  y-int. = 1

  7 gradient = 1
  y-int. = 2

  8 gradient = −2
  y-int. = 3

  9 gradient = $-\frac{1}{2}$
  y-int. = $2\frac{1}{2}$

  10 gradient = $\frac{1}{7}$
  y-int. = $\frac{6}{7}$

  11 gradient = $-\frac{1}{3}$
  y-int. = $1\frac{1}{3}$

  12 gradient = −1
  y-int. = 2

  13 gradient = −2
  y-int. = −4

  14 gradient = 2
  y-int. = 5

  15 gradient = $\frac{1}{2}$
  y-int. = $3\frac{1}{2}$

E 1 (a) $x = 3$
  $y = 6$
  $y = 2x$
  y-int. = 0 → (0, 0)
  x-int. = 0 → (0, 0)

  $y = 3 + x$
  y-int. → $y = 3$
  x-int. → $x = -3$

Solution

Point of intersection (3, 6)

$y = 3 + x$

$y = 2x$
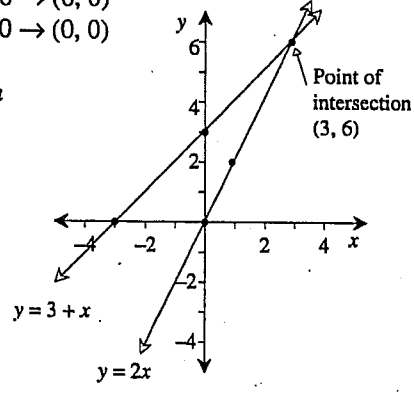
Check point:
  Choose $x = 1$→(1, 2)
   $y = 2$

  (b) $x = 1$
  $y = 4$
  $y = x + 3$
  y-int.→ $y = 3$
  x-int.→ $x = -3$

  $y = 5 - x$
  y-int. → $y = 5$
  x-int. → $x = 5$

Solution

$y = x + 3$

Point of intersection (1, 4)

$y = 5 - x$