St Andrew's Academy

Mathematics Department

S1 BLOCK 2

ALGEBRA

Turn negatives on?

Substitution

Bronze

Q1)If $s = 10$ find:
$$5s + 4$$

Q2)If $k = 5$ find:
$$7k - 11$$

Q3)If $c = 3$ find:
$$7c + 8$$

Q4)If $c = 3$ find:
$$4c - 11$$

Q5)If $r = 10$ find:
$$3r + 11$$

Q6)If $c = 5$ find:
$$8c - 4$$

Silver

Q1)If $b = 6$ and $y = 6$ find:
$$7b + 4y - 3$$

Q2)If $c = 9$ and $d = 7$ find:
$$10c + 7d - 12$$

Q3)If $m = 5$ and $z = 3$ find:
$$5m + 2z + 9$$

Q4)If $q = 9$ and $s = 8$ find:
$$6q + 4s + 8$$

Q5)If $a = 3$ and $g = 3$ find:
$$9a + 6g + 4$$

Q6)If $h = 7$ and $s = 7$ find:
$$5h + 7s + 12$$

Gold

Q1)If $k = 6$ and $e = 5$ find:
$$10k^2 + 3e^2$$

Q2)If $t = 9$ and $p = 3$ find:
$$7t^3 + 11p^2$$

Q3)If $f = 5$ find:
$$4f^2 - 11f + 7$$

Q4)If $w = 11$ find:
$$3w^2 + 3w + 11$$

Q5)If $v = 8$ and $c = 4$ find:
$$7v^2 + 8c^3$$

Q6)If $k = 2$ and $g = 3$ find:
$$4k^3 + 4g^3$$

Turn negatives on?

Substitution

Bronze

Q1)If $i = 6$ find:
$$3i + 10$$

Q2)If $e = 12$ find:
$$5e + 8$$

Q3)If $b = 3$ find:
$$9b + 10$$

Q4)If $r = 5$ find:
$$11r + 8$$

Q5)If $d = 11$ find:
$$5d + 12$$

Q6)If $a = 9$ find:
$$8a + 3$$

Silver

Q1)If $l = 3$ and $w = 6$ find:
$$7l + 9w - 9$$

Q2)If $n = 10$ and $k = 5$ find:
$$5n + 12k + 8$$

Q3)If $v = 4$ and $d = 2$ find:
$$8v + 10d - 8$$

Q4)If $c = 8$ and $a = 3$ find:
$$11c + 11a + 10$$

Q5)If $h = 4$ and $n = 5$ find:
$$2h + 9n - 2$$

Q6)If $c = 5$ and $w = 8$ find:
$$7c + 7w + 10$$

Gold

Q1)If $f = 7$ and $u = 8$ find:
$$9f^2 + 3u^2$$

Q2)If $y = 11$ find:
$$4y^2 - 11y + 9$$

Q3)If $f = 3$ find:
$$2f^2 + 12f - 3$$

Q4)If $y = 8$ find:
$$3y^2 - 12y - 8$$

Q5)If $j = 11$ find:
$$2j^2 - 2j - 12$$

Q6)If $t = 6$ find:
$$2t^2 + 12t + 7$$

Turn negatives on?

Substitution

Bronze

Q1)If $l = 10$ find:
$$2l + 2$$

Q2)If $r = 4$ find:
$$3r + 9$$

Q3)If $k = 6$ find:
$$4k - 11$$

Q4)If $q = 12$ find:
$$9q + 6$$

Q5)If $g = 10$ find:
$$8g + 3$$

Q6)If $h = 7$ find:
$$11h + 8$$

Silver

Q1)If $i = 6$ and $s = 4$ find:
$$2i + 9s + 3$$

Q2)If $q = 4$ and $m = 8$ find:
$$5q + 6m + 7$$

Q3)If $q = 6$ and $g = 5$ find:
$$4q + 6g + 4$$

Q4)If $b = 5$ and $p = 3$ find:
$$8b + 12p + 4$$

Q5)If $k = 11$ and $q = 6$ find:
$$3k + 10q - 6$$

Q6)If $p = 9$ and $i = 5$ find:
$$8p + 4i - 4$$

Gold

Q1)If $c = 3$ find:
$$4c^2 + 10c + 8$$

Q2)If $n = 6$ and $d = 5$ find:
$$3n^2 + 10d^3$$

Q3)If $a = 4$ find:
$$4a^2 + 5a - 11$$

Q4)If $i = 7$ and $e = 8$ find:
$$7i^2 + 4e^3$$

Q5)If $p = 5$ find:
$$3p^2 - 10p - 7$$

Q6)If $r = 9$ and $v = 9$ find:
$$8r^3 + 11v^2$$

Turn negatives on?

Substitution

Bronze

Q1)If $u = 6$ find:
$$6u + 7$$

Q2)If $v = 5$ find:
$$3v + 12$$

Q3)If $a = 7$ find:
$$11a + 6$$

Q4)If $h = 6$ find:
$$4h - 3$$

Q5)If $p = 6$ find:
$$11p + 4$$

Q6)If $b = 5$ find:
$$7b - 4$$

Silver

Q1)If $c = 8$ and $k = 6$ find:
$$10c + 3k - 3$$

Q2)If $s = 10$ and $h = 3$ find:
$$7s + 2h - 3$$

Q3)If $s = 6$ and $w = 5$ find:
$$12s + 6w + 3$$

Q4)If $c = 8$ and $f = 3$ find:
$$2c + 9f - 5$$

Q5)If $l = 7$ and $q = 5$ find:
$$11l + 12q + 10$$

Q6)If $n = 8$ and $p = 5$ find:
$$5n + 4p - 9$$

Gold

Q1)If $x = 7$ find:
$$4x^2 - 8x - 5$$

Q2)If $t = 5$ find:
$$3t^2 + 8t - 11$$

Q3)If $b = 2$ find:
$$4b^2 + 11b - 8$$

Q4)If $n = 6$ find:
$$3n^2 + 2n - 6$$

Q5)If $i = 7$ find:
$$4i^2 + 10i + 7$$

Q6)If $p = 6$ and $c = 9$ find:
$$9p^2 + 11c^3$$

Turn negatives on?

Substitution

Bronze

Q1)If $i = 2$ find:
$$12i + 4$$

Q2)If $a = 10$ find:
$$2a - 8$$

Q3)If $d = 2$ find:
$$3d + 12$$

Q4)If $m = 4$ find:
$$4m - 4$$

Q5)If $u = 9$ find:
$$5u - 2$$

Q6)If $q = 4$ find:
$$9q + 6$$

Silver

Q1)If $z = 8$ and $s = 3$ find:
$$5z + 8s - 9$$

Q2)If $b = 12$ and $k = 5$ find:
$$4b + 5k - 7$$

Q3)If $w = 10$ and $m = 3$ find:
$$5w + 7m - 10$$

Q4)If $l = 8$ and $b = 8$ find:
$$8l + 3b + 9$$

Q5)If $s = 7$ and $u = 4$ find:
$$11s + 3u - 7$$

Q6)If $x = 4$ and $v = 8$ find:
$$9x + 10v - 9$$

Gold

Q1)If $y = 3$ and $e = 2$ find:
$$6y^3 + 10e^3$$

Q2)If $j = 4$ and $q = 3$ find:
$$4j^3 + 6q^3$$

Q3)If $h = 7$ find:
$$2h^2 - 4h + 7$$

Q4)If $x = 4$ and $d = 8$ find:
$$12x^2 + 11d^3$$

Q5)If $e = 5$ find:
$$4e^2 - 10e - 9$$

Q6)If $y = 7$ find:
$$3y^2 + 11y + 3$$

Corbett maths

Substitution

Video 20 on www.corbettmaths.com

Examples

Workout

Click here

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Question 1: If a = 7 b = 10 c = 3 d = 8 and e = 15
Find the value of each expression.

(a) a + 5 (b) b – 4 (c) c + d (d) e – d

(e) 2a (f) 4b (g) 3e (h) 5c

(i) $\frac{b}{2}$ (j) $\frac{e}{5}$ (k) $\frac{d}{4}$ (l) $\frac{a}{2}$

(m) a^2 (n) b^2 (o) c^2 (p) d^2

(q) 2a + 1 (r) 3b – 7 (s) 9c + 11 (t) 4e – 45

(u) 2a + 3c (v) 4d – b (w) 5a + 2d (x) e – 4c

(y) 30 – 4a (z) 15 – 3c

Question 2: If f = 5 g = 6 h = 4 and i = 2
Find the value of each expression.

(a) fg (b) hi (c) fgh (d) i^3

(e) $\sqrt{h}$ (f) 3f + 2g (g) 5h + 7i (h) 9h – 7i

Question 3: If a = –2 b = 5 c = –6 d = 10 and e = 9
Find the value of each expression.

(a) a + 4 (b) b – 8 (c) c + e (d) a – d

(e) d – c (f) 2c (g) 7a (h) –7b

(i) 2d + 3c (j) 6e + 3a (k) 5a + 7 (l) 20 + 4a

(m) ac (n) 40 – d (o) 2e – a (p) bd + a

(q) $\frac{a}{2}$ (r) $\frac{d}{4}$ (s) $\sqrt{e}$ (t) c^2

Corbett maths

Substitution

Video 20 on www.corbettmaths.com

Question 4: If a = 1.5 b = 4 c = 6 d = 0.5 and e = −3
Find the value of each expression.

(a) $4(a + d)$ (b) $5(c + b)$ (c) $3(10 - e)$ (d) abc

(e) e^3 (f) d^2 (g) $5b^2$ (h) $8e^2 + 3$

(i) $\frac{b + 2}{3}$ (j) $\frac{2c - e}{4}$ (k) $\frac{10d + 4b}{7}$

Question 5: P = 2L + 2W, work out P if L = 8 and W = 3.

Question 6: C = 15h + 30, work out C if h = 6.

Apply

Question 1: The cost of hiring a car for a number of days is calculated using the formula

Hire Cost = 30 x Number of Days + 50

(a) Calculate the cost of hiring a car for 4 days.
(b) Calculate the cost of hiring a car for 9 days.
(c) The hire cost is £110, how many days was the car hired for?
(d) The hire cost is £380, how many days was the car hired for?

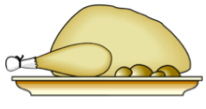
Question 2: The cost of photocopying is given as:

Cost in pence = 3 x number of black & white pages + 15 x number of colour pages

(a) Ella orders 20 black & white pages and 6 colour pages, work out the cost.
(b) Tom orders 400 black & white pages and 70 colour pages, work out the cost.

Question 3: The time in minutes, taken to cook a chicken is given by the formula

Time = 40 minutes per kilogram plus 20 minutes



(a) Work out the time taken to cook a 5kg chicken.
(b) Work out the time taken to cook a 2.5kg chicken.

Substitution

Video 20 on www.corbettmaths.com

Question 4: This formula is used to calculate the weekly pay of a letting agent.

Weekly pay = basic pay + number of houses rented x bonus

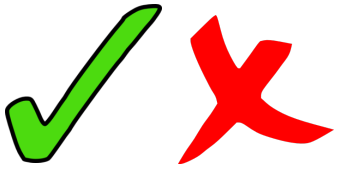
The basic pay is £400 and a bonus of £75 is paid for each house rented.
Mrs Lewis rents out 5 houses in one week.
Calculate her pay.

Question 5: This formula can be used to convert between Celsius and Fahrenheit:

$F = 1.8C + 32$

(a) Work out the value of F when C = 10
(b) Work out the value of F when C = 20
(c) Work out the value of F when C = 4
(d) Work out the value of C when F = 35.6
(e) Work out the value of C when F = 41
(f) Work out the value of C when F = 112
(g) Find a temperature when F and C are the same value.

Answers



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1. Find the value of $5c + 2$, if $c = 6$.

.....

(1)

---

2. If $x = 6$ and $y = -2$, find the value of

(a) x^2

.....

(1)

(b) $5x + y$

.....

(1)

(c) $x + y^2$

.....

(1)

(d) $\frac{y + 20}{x}$

.....

(2)

3. You are given that $m = 0.5$, $p = 0.75$ and $c = 2.2$

Find the value of

(a) $3c + m$

.....

(2)

(b) $m + p + c$

.....

(1)

---

4. $F = 1.8C + 32$

(a) Work out the value of F when C = 2

.....

(2)

(b) Work out the value of C when F = 50

.....

(2)

5. Given that a = 4, b = 9 and c = –5

Work out the value of

$$\frac{ab + 24}{2c}$$

.....

(3)

---

6. (a) Find the value of 5(a + c) when a = 4 and c = 9.

.....

(2)

(b) Find the value of 7x + 2y when x = 2 and y = –9.

.....

(2)

---

7. A = 2W + 2L

Find A if W = 3 and L = 9

.....

(2)

8. $A = 2W + 2L$

Find W if A = 30 and L = 11

.....

(2)

---

9. The cost in pounds, C, of hiring a car is given by
$C = 25d + 45$

where d is the number of days the car is hired.

(a) Find C if d = 4.

.....

(2)

(a) Find d if C = 245

.....

(2)

10. The amount of medicine, s ml, to give to a child can be worked out using the formula.

$$s = \frac{am}{150}$$

s is the amount of medicine, in ml.
a is the adult dose, in ml.
m is the age of the child, in months.

A child is 20 months old.
An adult's dose is 45ml.

Work out the amount of medicine the child should be given.

.....ml
(3)

---

11. $y = w - 2a^2$

w = 400
a = 5

Work out the value of y.

.....
(2)

12. $v = u + at$

(a) Work out v when u = 23, a = 4 and t = 3

.....

(2)

(b) Work out u when v = 30, a = 2 and t = 8

.....

(2)

(c) Work out t when v = 40, u = 12 and a = 4

.....

(2)

13.

$$m = abc$$

Find m if a = 3, b = –8 and c = 2

.....

(2)

Evaluating Expressions and Formulae

Be able to substitute numbers for letters

Examples :-

If $p = 3$, $q = 4$ and $r = -2$, find the values of :-

1. $7p$
$= 7 \times 3$
$= 21$

2. $4p + r$
$= 4 \times 3 + (-2)$
$= 10$

3. $q^2 - p^2$
$= (4 \times 4) - (3 \times 3)$
$= 16 - 9$
$= 7$

4. $2q^2$
$= 2 \times q \times q$
$= 2 \times 4 \times 4$
$= 32$

5. $5p^2 + 6q + 20r$
$= (5 \times p \times p) + (6 \times q) + (20 \times r)$
$= (5 \times 3 \times 3) + (6 \times 4) + (20 \times (-2))$
$= 45 + 24 - 40 = 29$

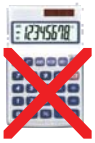
6. If $C = \frac{a + b}{4}$, find the value of C when when $a = 10$ and $b = 18$.

$C = \frac{a + b}{4}$

$C = \frac{10 + 18}{4}$

$C = \frac{28}{4} = 7$

Exercise 6



1. Find the value of each of the following when $a = 3$:-

a $a + 6$ **b** $a - 1$ **c** $8a$ **d** $5a - 19$

e $2 + 4a$ **f** $20 - 9a$ **g** a^2 **h** a^3

i $a^2 - 9$ **j** $2a^2$ **k** $a^2 + a$ **l** $a^2 - 1{\cdot}2a$.

2. Find the value of each of the following when $x = 4$:-

a $5x$ **b** $7x$ **c** x^2 **d** $2x^2$

e x^3 **f** $10x^2$ **g** $20x^3$ **h** $18 - x^2$.

3. Find the values of each of the following :-

a $g + 7$ when $g = 9$ **b** $3h + 4$ when $h = -1$

c $p - 9$ when $p = 25$ **d** $12q - 30$ when $q = 3$

e $15 - m$ when $m = -5$ **f** $s + t$ when $s = -9$ and $t = 4$

g $5ef$ when $e = 4$ and $f = -2$ **h** $20 - 4ab$ when $a = 1$ and $b = -4$.

4. Given $p = 1$, $q = 3$ and $r = 7$, calculate the value of :-

a $p + q + r$ **b** $2p + 5q + r$ **c** $q + p - 2r$

d pqr **e** $5p + 5q + 10r$ **f** $pq + qr + pr$

g $3p + 2q - r$ **h** $10pq - 4r$ **i** $5pqr - 100$.

The Square Root :-

You now know what **squaring** a number does. It multiplies the number by itself. $5^2 = 5 \times 5 = 25$.

In reverse, what number, times itself, gives 25 ? => The answer of course is **5** (since 5 x 5 = 25).

We say that **the square root** of 25 is 5 and use the symbol $\sqrt{\ }$ $\sqrt{25} = 5$.

It reads as **the square root of 25 is 5**. Here are some ***examples :-***

$\sqrt{16} = 4$ (since 4 x 4 = 16), $\sqrt{81} = 9$, $\sqrt{1{\cdot}44} = 1{\cdot}2$, $\sqrt{6^2 + 8^2} = \sqrt{36 + 64} = \sqrt{100} = 10$

5. If $m = 3$ and $n = 4$, find the values of :-

a m^2 **b** $m^2 + n^2$ **c** $(n - m)^2$ $\sqrt{n}$

e $(n + m)^2$ **f** $2m^2$ **g** $\sqrt{3mn}$ $(m - 2)^2$

i $35 - 2n^2$ **j** $40 - 4m^2$ **k** $\sqrt{m^2 + n^2}$ **l** $(n^2 - m^2)^2$.

6. If $x = 4$, $y = -2$ and $z = 1$, find :-

a $5x + y$ **b** $2y + 5z$ **c** y^2

d $10 + 8z^2$ **e** $2x^2 + 3y^2$ **f** $z^2 + y^2$

g $5x^2 + 10y - z$ **h** $4y^2 - 3x - z$ **i** $2z^2 + 4y^2 - 3x$.

7. Given $a = 2$, $b = 8$, $c = 10$ and $d = -4$, find :-

a $\frac{1}{2}a$ **b** $\frac{1}{4}b$ **c** $\frac{2}{5}c$

d $\frac{1}{5}(a + b)$ **e** $\frac{1}{3}(c + d)$ **f** $\frac{1}{7}(c - d)$

g $\frac{1}{4}(b - d)$ **h** $\sqrt{\frac{b + c}{2}}$ **i** $2c^2 - 25d$.

8. In each of the following formulae, find the value of the letter for which you are asked :-

a $P = q - r$ find P, when $q = 9{\cdot}5$ and $r = 2{\cdot}5$.

b $D = S \times T$ find D, when $S = 60$ and $T = 1{\cdot}5$.

c $W = G \times H$ find W, when $G = 25$ and $H = 6$.

d $V = Ah$ find V, when $A = 40$ and $h = 2{\cdot}5$.

e $C = ab$ find C, when $a = 2{\cdot}6$ and $b = 20$.

f $D = e \times f \times g$ find D, when $e = 100$, $f = 5$ and $g = 0{\cdot}5$.

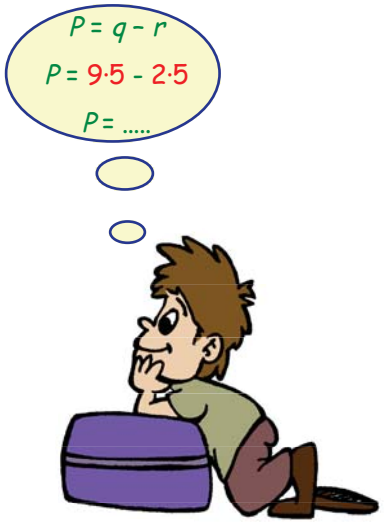
g $T = 2m + 2n$ find T, when $m = 3{\cdot}5$ and $n = 7{\cdot}5$.

h $N = z - 100v$ find N, when $z = 500$ and $v = 4{\cdot}4$.

i $A = \frac{b}{c}$ find A, when $b = 1200$ and $c = 40$.

j $G = \sqrt{z - 9v}$ find G, when $z = 100$ and $v = 4$.

k $J = \frac{h - g}{k}$ find J, when $h = 26$, $g = -4$ and $k = 3$.



Constructing and Evaluating Formulae

Be able to construct and evaluate formula from statements and diagrams

Examples :-

1. Julie is withdrawing money from an ATM.

She withdraws x lots of £5 notes and y lots of £10 notes.

a Write down a formula in terms of x and y for W, the total amount she withdraws.

b When $x = 4$ and $y = 3$, find the actual amount withdrawn.

a $W = 5x + 10y$

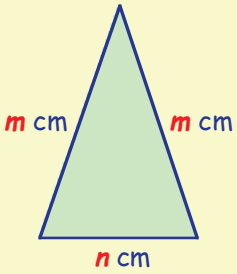
b $W = 5x + 10y$

$= 5 \times 4 + 10 \times 3$

$= 50$

£50 withdrawn.

2. An **isosceles** triangle is shown opposite.



a Write a formula for its perimeter, P, in terms of m and n.

b Calculate its perimeter when $m = 8{\cdot}5$ and $n = 5$.

c Find n when $P = 52$ and $m = 20$.

a $P = 2m + n$

b $P = 2m + n$

$= 2 \times 8{\cdot}5 + 5$

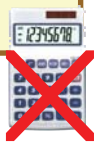
$= 22$

Perimeter = 22 cm.

c $P = 2m + n$

$52 = 40 + n$

$n = 12$



Exercise 7

1. A truck weighs x tonnes when empty. If rocks weighing y tonnes are lifted, its loaded weight becomes W tonnes.

a Write a formula for W, in terms of x and y.

b Find W when $x = 2{\cdot}75$ and $y = 2{\cdot}25$.

c Calculate y when $W = 9$ and $x = 6{\cdot}5$.

2.

A plank of wood is m metres long. When n metres have been sawn off, the remaining length is L metres.

a Write a formula for L, in terms of m and n.

b Find L when $m = 3{\cdot}75$ and $n = 1{\cdot}5$.

c Calculate m when $L = 10$ and $n = 2{\cdot}75$.

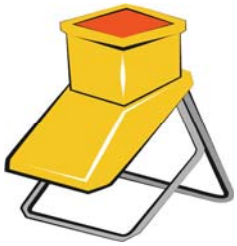
3. "To find the average speed (S mph) for a journey travelled, divide the distance travelled (D miles) by the time taken (T hrs)."

a Write a formula for S, in terms of D and T.

b Find S when $D = 180$ and $T = 3$.

c Calculate the distance travelled at that speed for $5\frac{1}{2}$ hours.

4.

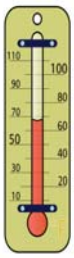


The cost C of hiring a shredder from a garden store is £k per day, plus a payment of £10.

a Write a formula for C, in terms of k, when hiring for 5 days.

b Find C when $k = 6$.

5. To change from degrees Celsius (°C) to degrees Fahrenheit (°F) use the following formula :-

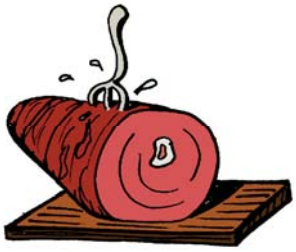


"Multiply the temperature in °C by 1·8, then add 32 to the answer".

a Write a formula for changing from C to F. F = ... x .... + ...

b Use your formula to change 30°C into degrees Fahrenheit.

6.

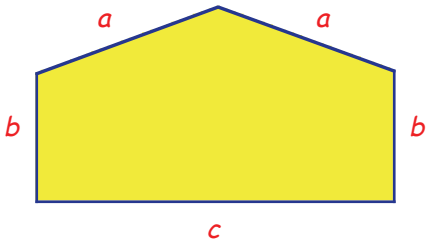


The recommended time, (T) minutes, to cook a ham joint in the oven is g minutes **per pound**, then add an extra h minutes at the end.

a Write a formula for T, in terms of g and h showing the time needed to cook a 10 pound joint of ham.

b Find T when $g = 20$ and $h = 15$.

7.

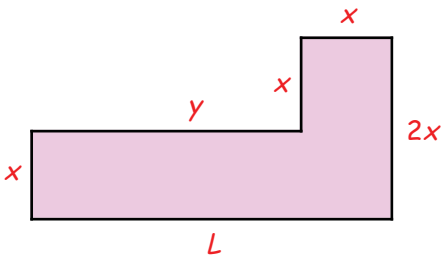


a Write down a formula, in terms of a, b and c, for finding the perimeter P of this shape.

b Find P when $a = 5$, $b = 4$ and $c = 8$.

c Calculate c when $P = 50$, $a = 10$ and $b = 7$.

8.

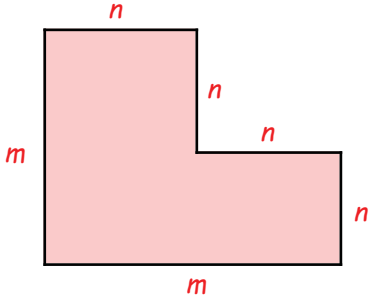


a Write down the length of the L side in terms of x and y.

b Write down a formula, in terms of x and y, for finding the perimeter P of this shape.

c Find P when $x = 3$ and $y = 10$.

9.

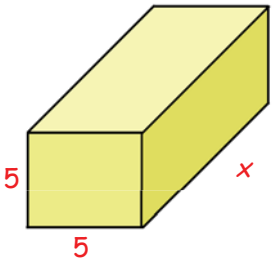


a Write down a formula, in terms of m and n, for finding the perimeter P of this shape.

b Find P when $m = 8$ and $n = 4$.

c Calculate n when $P = 40$ and $m = 10$.

10. The cuboid shown has length x cm, breadth 5 cm and height 5 cm.

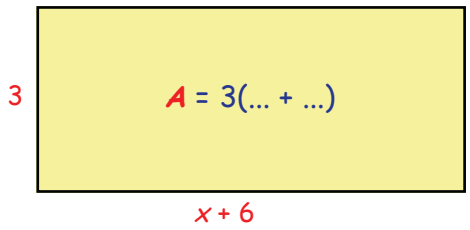


a Find a formula for the sum S cm of the lengths of **all** its edges.

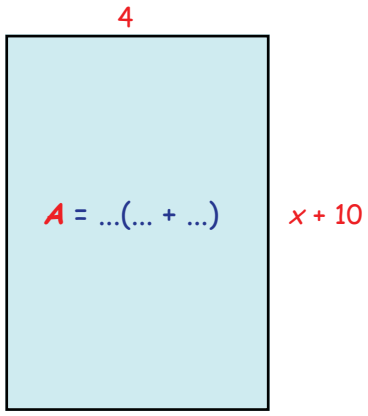
b Calculate S if $x = 20$.

11. a For each of the rectangles below, use brackets to write a formula for its **area** (A).

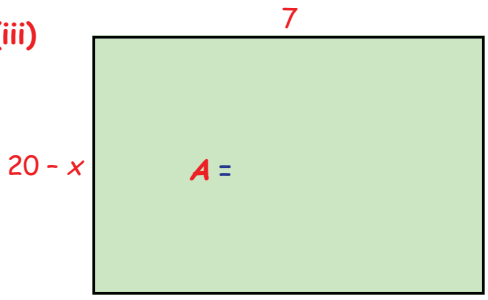
(i)



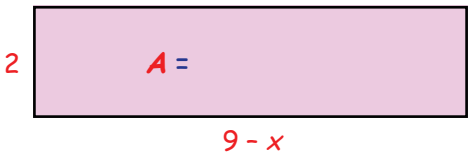
(ii)



(iii)



(iv)

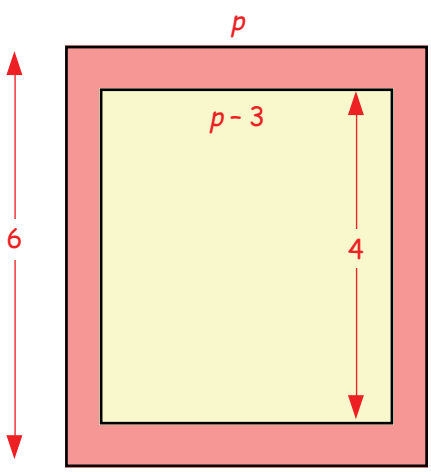


b Multiply out each of the brackets.

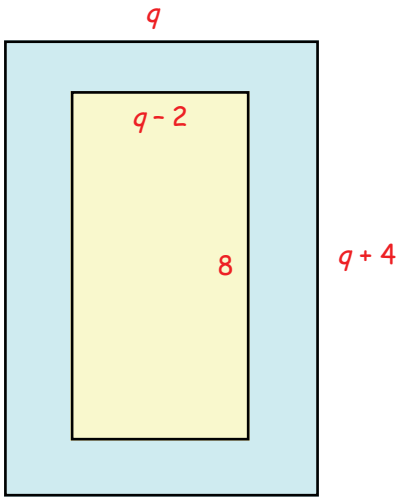
c Find the area each time, if $x = 5$.

12. a Write down a formula, in terms of p or q, for the area A of each **large** rectangle below.

(i)



(ii)



b Now write a formula, in terms of p or q, for the area A of each **small yellow** rectangle.

c Determine a formula for the red area and a formula for the blue area.

d Calculate the red area and the blue area (in sq. units) when $p = 4$ and $q = 6$.

Collecting Like Terms

Bronze

Simplify:

Q1) $4u + 3v + 8u + 8v$

Q2) $5v + 7x + 7v + 6x$

Q3) $7a + 9g + 4a + 8g$

Q4) $4t + 8m + 7t + 5m$

Q5) $6f + 4j + 8f + 6j$

Q6) $7w + 5k + 2w + 7k$

Q7) $4n + 7i + 9n + 6i$

Q8) $5u + 7w + 5u + 4w$

Silver

Simplify:

Q1) $9p - 7s + 2p + 4s$

Q2) $3h - 5p + 6h - 8p$

Q3) $5v + 5m + 5v - 8m$

Q4) $8k - 2p + 4k - 8p$

Q5) $7c - 6z + 5c - 8z$

Q6) $6e - 4q + 2e + 8q$

Q7) $5p - 5u + 6p - 8u$

Q8) $8e - 4c + 2e - 2c$

Gold

Simplify:

Q1)
$8x^2 + 4x - 3x^2 - 6x$

Q2)
$4k^2 + 2k + 4k^2 + 8k$

Q3) $2v^2 - 4v - 8v^2 - 6v$

Q4)
$6u^2 + 5u + 3u^2 - 6u$

Q5) $3r^2 - 8r + 3r^2 + 6r$

Q6)
$3x^2 - 7x - 5x^2 - 2x$

Q7)
$8m^2 - 6m + 5m^2 + 4m$

Q8) $5r^2 + 3r - 8r^2 - 6r$

Collecting Like Terms

Bronze

Simplify:

Q1) $5i + 4l + 5i + 6l$

Q2) $8c + 4r + 4c + 2r$

Q3) $4u + 5g + 6u + 5g$

Q4) $6a + 2x + 6a + 4x$

Q5) $5p + 6m + 5p + 4m$

Q6) $3x + 4l + 6x + 5l$

Q7) $6g + 8i + 4g + 3i$

Q8) $7r + 3l + 4r + 6l$

Silver

Simplify:

Q1) $5n - 6x + 3n - 6x$

Q2) $4c - 9e + 2c - 9e$

Q3) $9w - 9z + 8w - 8z$

Q4) $3r + 7v + 4r - 3v$

Q5) $2f - 8p + 3f - 5p$

Q6) $3t - 5c + 3t - 8c$

Q7) $5u - 2n + 4u + 4n$

Q8) $4l - 5m + 2l + 3m$

Gold

Simplify:

Q1) $6r^2 + 2r + 8r^2 + 5r$

Q2) $6h^2 + 7h - 3h^2 - 8h$

Q3) $8p^2 + 9p - 6p^2 + 6p$

Q4) $7x^2 + 3x + 3x^2 + 7x$

Q5) $5r^2 + 8r - 7r^2 + 6r$

Q6) $6m^2 - 8m + 8m^2 - 7m$

Q7) $8y^2 - 7y + 2y^2 - 4y$

Q8) $2h^2 + 7h - 4h^2 - 5h$

Collecting Like Terms

Bronze

Simplify:

Q1) $4k + 6b + 6k + 6b$

Q2) $6h + 6x + 4h + 8x$

Q3) $4b + 3z + 4b + 4z$

Q4) $3t + 8b + 6t + 3b$

Q5) $5n + 7y + 3n + 7y$

Q6) $8p + 9a + 3p + 5a$

Q7) $3n + 5g + 5n + 2g$

Q8) $5v + 4d + 4v + 4d$

Silver

Simplify:

Q1) $6i - 6u + 9i - 2u$

Q2) $3w + 3y + 7w - 8y$

Q3) $3i - 4t + 6i - 9t$

Q4) $6i - 7p + 2i - 7p$

Q5) $5r - 8f + 7r + 3f$

Q6) $9y + 7e + 8y - 3e$

Q7) $2x - 2u + 5x - 4u$

Q8) $7e + 3y + 2e - 6y$

Gold

Simplify:

Q1) $4t^2 + 4t - 7t^2 - 8t$

Q2) $4b^2 - 4b - 9b^2 - 5b$

Q3) $5c^2 + 4c + 5c^2 + 7c$

Q4) $6l^2 + 5l - 2l^2 + 5l$

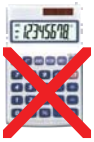
Q5)
$5u^2 + 4u + 7u^2 + 9u$

Q6)
$2u^2 - 7u + 5u^2 + 6u$

Q7) $6j^2 - 8j - 8j^2 + 7j$

Q8)
$9m^2 - 6m - 5m^2 - 4m$

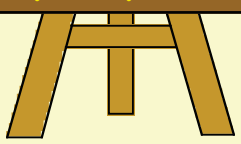
CHAPTER 5



Algebra

Solving Equations

Be able to solve simple equations



There are many ways of solving equations.

We are going to use the "**change side - change sign**" method.

* your teacher may show you an alternative method

Examples :- Solving equations of the type $x + a = b$.

move the +4 to the other side => change it to -4

$x + 4 = 9$
$\Rightarrow x = 9 - 4$
$\Rightarrow x = 5$

$x - 7 = 17$
$\Rightarrow x = 17 + 6$
$\Rightarrow x = 23$

$x - 9 = -2$
$\Rightarrow x = -2 + 9$
$\Rightarrow x = 7$

Exercise 1

1. Copy each equation and solve to find the value of x, as shown above :-

a	$x + 2 = 5$	**b**	$x + 9 = 19$	**c**	$x + 6 = 11$
d	$x + 12 = 12$	**e**	$x - 3 = 4$	**f**	$x - 8 = 1$
g	$x - 17 = 0$	**h**	$x - 20 = 30$	**i**	$x + 9 = 6$
j	$x - 7 = 0$	**k**	$x + 13 = 0$	**l**	$x - 16 = 29$
m	$9 + x = 1$	**n**	$4 + x = 4$	**o**	$22 + x = 0$
p	$11 + x = 4$	**q**	$8 + x = 8$	**r**	$19 + x = -19$.

Examples :- Solving equations of the type $ax = b$.

move the x4 to the other side => change it to ÷4

$4x = 28$
$\Rightarrow x = 28 \div 4$
$\Rightarrow x = 7$

$3p = -27$
$\Rightarrow p = -27 \div 9$
$\Rightarrow p = -3$

$5k = 18$
$\Rightarrow k = 18 \div 5$
$\Rightarrow x = \frac{18}{5} = 3\frac{3}{5}$

2. Copy each equation and solve to find the value of the letter :-

a	$2x = 16$	**b**	$5p = 45$	**c**	$3k = 24$
d	$3h = 21$	**e**	$4g = 36$	**f**	$7n = 7$
g	$8m = 12$	**h**	$13c = 0$	**i**	$4d = 1$
j	$3y = 120$	**k**	$10s = 300$	**l**	$6w = 21$
m	$4a = 13$	**n**	$5b = 29$	**o**	$7e = 23$
p	$10j = 65$	**q**	$8q = 2$	**r**	$3r = 29$.

Examples :- Solving equations of the type **$ax + b = d$**.

Move the −4 to the other side and change to +4

move the x2 to the other side and change to ÷ 2

$2x - 4 = 10$
$\Rightarrow \quad 2x = 10 + 4$
$\Rightarrow \quad 2x = 14$
$\Rightarrow \quad x = 7$ (divide)

$8x + 9 = 57$
$\Rightarrow \quad 8x = 57 - 9$
$\Rightarrow \quad 8x = 48$
$\Rightarrow \quad x = 6$

$6x - 3 = 24$
$\Rightarrow \quad 6x = 24 + 3$
$\Rightarrow \quad 6x = 27$
$\Rightarrow \quad x = 27 \div 6 = 4\frac{1}{2}$

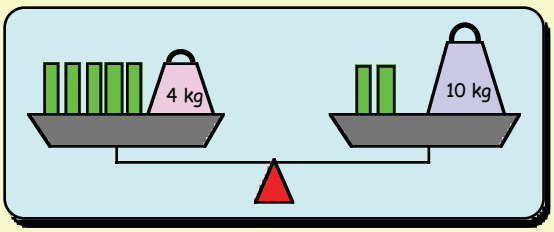
3. Find the value of x in the following equations (*Set down each step of working carefully*).

a	$2x + 4 = 10$	**b**	$6x + 3 = 21$	**c**	$5x + 2 = 47$
d	$3x + 5 = 29$	**e**	$4x - 3 = 37$	**f**	$7x - 2 = 5$
g	$10x - 6 = 44$	**h**	$8x - 8 = 0$	**i**	$9x - 7 = 38$
j	$7x - 3 = 39$	**k**	$3x + 12 = 15$	**l**	$8x + 1 = 65$
m	$6x - 6 = 36$	**n**	$10x + 23 = 123$	**o**	$5x + 4 = 44$
p	$2x - 1 = 14$	**q**	$12x + 12 = 0$	**r**	$3x - 8 = 0$
s	$4x + 10 = 8$	**t**	$6x + 3 = 30$	**u**	$4x - 7 = 6$.

Harder Equations

This diagram shows a set of balanced scales.

- 5 blocks and a 4 kg weight on the left
- 2 blocks and a 10 kg weight on the right.

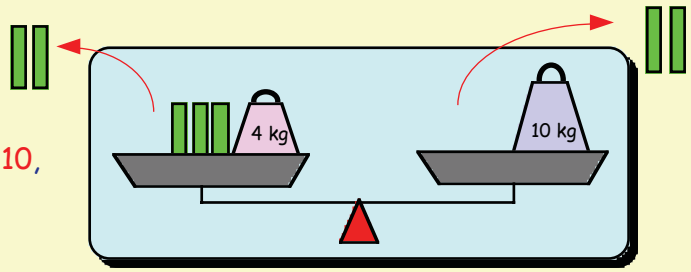


If each block weighs x kg, then the equivalent equation for this is :-

$5x + 4 = 2x + 10$ - to be solved.

To simplify the situation, remove 2 blocks ($2x$) from both sides.

This leaves a much simpler equation, $3x + 4 = 10$, which you already know how to solve.



remove $2x$ from both sides

$5x + 4 = 2x + 10$
$\Rightarrow \quad 3x + 4 = 10$
$\Rightarrow \quad 3x = 10 - 4$
$\Rightarrow \quad 3x = 6$
$\Rightarrow \quad x = 2$

$\Rightarrow$ 1 block must weigh 2 kg.

(*Check this works on the diagram above*).

* your teacher may show you an alternative method

Examples :- Solving equations of the type $ax + b = cx + d$.

Take $3x$ from both sides.

Move the $+2$ to the other side and change to -2

move the $\times 4$ to the other side and change to $\div 4$

$7x + 2 = 3x + 22$

(take "$3x$" from each side)

$\Rightarrow \quad 4x + 2 = 22$

$\Rightarrow \quad 4x = 22 - 2$

$\Rightarrow \quad 4x = 20$

$\Rightarrow \quad x = 5$

$9x - 1 = 4x + 14$

(take "$4x$" from each side)

$\Rightarrow \quad 5x - 1 = 14$

$\Rightarrow \quad 5x = 14 + 1$

$\Rightarrow \quad 5x = 15$

$\Rightarrow \quad x = 3$

$8x + 7 = 2x + 28$

(take "$2x$" from each side)

$\Rightarrow \quad 6x + 7 = 28$

$\Rightarrow \quad 6x = 28 - 7$

$\Rightarrow \quad 6x = 21$

$\Rightarrow \quad x = 21 \div 6 = 3\frac{1}{2}$

Exercise 2

1. Copy and complete

a

$6x + 1 = 4x + 19$

$\Rightarrow \quad 2x + 1 = \ldots.$

$\Rightarrow \quad 2x = \ldots.$

$\Rightarrow \quad x = \ldots.$

b

$8x - 5 = x + 16$

$\Rightarrow \quad 7x - \ldots = \ldots.$

$\Rightarrow \quad 7x = \ldots.$

$\Rightarrow \quad x = \ldots.$

2. Solve these equations by removing the correct number of x's from each side first :-

a $4x + 3 = 2x + 9$ **b** $3x + 2 = x + 18$ **c** $6x + 6 = 5x + 18$

d $10x - 9 = 7x + 12$ **e** $6x - 1 = 2x + 23$ **f** $6x - 4 = x + 41$

g $13x - 3 = 9x + 29$ **h** $10x - 7 = 8x + 8$ **i** $4x + 8 = x + 26$

j $6x + 9 = 2x + 11$ **k** $3x + 22 = 9x - 2$ **l** $x + 1 = 9x + 9.$

3. These equations are a little "different". Solve them in the same way as shown above :-

a $3x = 2x + 3$ **b** $5x = x + 16$ **c** $6x = 3x + 36$

d $9x = 8x + 1$ **e** $5x = 3x + 17$ **f** $7x - 9 = 5x$

g $4x - 27 = x$ **h** $3x + 13 = x$ **i** $8x = 11x - 39.$

4. Joe bought 3 packets of rollos. Harry bought 1 packet, but he already had 20 loose rollos.

They discovered that they then had exactly the same number of rollos.

a Make up an equation to show this information.
(*let* ***x*** *be the number of rollos in 1 packet*)

b Solve the equation to determine how many rollos there are in a packet.

5. A group of sales reps have booked a room on the top floor of a hotel for a conference.

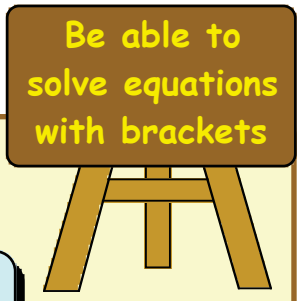
They use the hotel elevator (full) 4 times and as well as this, 9 of the reps use the stairway.

After the conference, the elevator is filled only **twice**, the remaining 25 reps using the stairway to go down to reception.

a Make up an equation to show this information.
(*let* ***x*** *be the number of reps in 1 full* elevator)

b Solve the equation to determine how many reps were at the conference.

Solving Equations with Brackets



Examples :- Solving equations with **brackets**.

* your teacher may show you an alternative method

Multiply out the brackets

Take "x" from both sides

Move the +3 to the other side

Divide by 5

$3(2x + 1) = x + 18$

$\Rightarrow \quad 6x + 3 = x + 18$

$\Rightarrow \quad 5x + 3 = 18$

$\Rightarrow \quad 5x = 18 - 3$

$\Rightarrow \quad 5x = 15$

$\Rightarrow \quad x = 3$

$4(3x + 5) - 2(4x - 1) = 2x + 20$

$\Rightarrow \quad 12x + 20 - 8x + 2 = 2x + 20$

$\Rightarrow \quad 4x + 22 = 2x + 20$

$\Rightarrow \quad 2x + 22 = 20$

$\Rightarrow \quad 2x = 20 - 22$

$\Rightarrow \quad 2x = -2$

$\Rightarrow \quad x = -1$

Note :- the + 2 (not - 2)

Exercise 3

1. Solve these equations by multiplying out the brackets first :-

a	$2(x + 2) = 10$	**b**	$3(x + 7) = 24$	**c**	$5(x - 4) = 25$
d	$4(x + 3) = 44$	**e**	$6(x + 3) = 60$	**f**	$2(x + 5) = 12$
g	$10(x - 2) = 30$	**h**	$8(x + 3) = 56$	**i**	$4(x - 1) = 24$
j	$7(x - 1) = 0$	**k**	$4(x - 1) = 2$	**l**	$3(x + 4) = 6.$

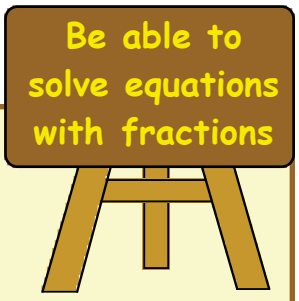
2. Solve these equations :-

a	$2(4x + 1) = 10$	**b**	$3(2x - 3) = 15$	**c**	$4(5x - 2) = 12$
d	$2(4x + 5) = 26$	**e**	$3(2x - 11) = 9$	**f**	$2(5x - 5) = 0$
g	$3(2x - 2) = 4x + 12$	**h**	$2(4x + 2) = 3x + 29$	**i**	$2(1 + 3x) = 4x + 7$
j	$7(2x - 1) = 13x$	**k**	$10(2x - 6) = 14x + 54$	**l**	$10(x + 4) = 2x.$

3. Solve :-

a	$3(x + 2) - x - 6 = 10$	**b**	$2(x + 2) + 3x - 8 = 16$
c	$5(x + 3) - 2x = 24$	**d**	$5(x - 2) + 2x + 6 = 38$
e	$2x + 8 + 3(x - 2) = 12$	**f**	$4x + 2(x - 4) = 10$
g	$2(x + 5) + 3(x - 3) = 21$	**h**	$4(3x + 2) + 5(1 - 2x) = 25$
i	$4(2x + 1) + 2(x - 3) = 6x + 40$	**j**	$2(3x - 5) + 4(x + 8) = 3x + 29$
k	$4(x + 8) - 2(x + 6) = 18$	**l**	$8(x - 1) - 3(x - 2) = 18$
m	$3(3x + 1) - 2(x - 5) = x + 31$	**n**	$13(x + 1) - 2(3x + 6) = 2x - 49.$

Solving Equations with Fractions



Fractions are a real nuisance in equations.

=> Fortunately, we can **do away with fractions** in equations quite easily.

Rule :- Always **eliminate** the fractions **at the beginning** by **multiplying** every term by the l.c.m. of all the fractional denominators.

Examples :-

Multiply both sides by 2 to eliminate the one fraction $\frac{1}{2}$

$\frac{1}{2}x + 4 = 9$

$2 \times \frac{1}{2}x + 2 \times 4 = 2 \times 9$

$\Rightarrow \quad x + 8 = 18$

$\Rightarrow \quad x = 18 - 8$

$\Rightarrow \quad x = 10$

The l.c.m. of 3 and 4 is **12**.

Multiply both sides by 12 to eliminate both fractions $\frac{2}{3}$ and $\frac{3}{4}$

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

$12 \times \frac{2}{3}x + 12 \times \frac{3}{4} = 12 \times 1$

$\Rightarrow \quad 8x + 9 = 12$

$\Rightarrow \quad 8x = 3$

$\Rightarrow \quad x = 3 \div 8 = \frac{3}{8}$

Exercise 4

1. Copy and complete the following two equations :-

a

$\frac{1}{2}x + 3 = 7$

$2 \times \frac{1}{2}x + 2 \times 3 = 2 \times 7$

$\Rightarrow \quad x + \ldots = \ldots$

$\Rightarrow \quad x = \ldots$

b

$\frac{3}{4}x - 5 = \frac{3}{5}x - 2$

$20 \times \frac{3}{4}x - 20 \times 5 = 20 \times \frac{3}{5}x - 20 \times 2$

$\Rightarrow \quad 15x - \ldots = \ldots x - \ldots$

$\Rightarrow \quad 3x - \ldots = -40 + \ldots$

$\Rightarrow \quad \ldots x = \ldots$

$\Rightarrow \quad x = \ldots.$

2. Solve each of these equations, by first of all multiplying every term by the l.c.m. of all the fractional denominators. This should eliminate all the fractions.

a $\frac{1}{2}x - 3 = 1$ **b** $\frac{1}{4}x + 5 = 6$ **c** $\frac{1}{8}x - 3 = 0$

d $\frac{2}{3}x - 4 = 4$ **e** $4 + \frac{4}{5}x = 16$ **f** $\frac{5}{8}x + 4 = 14$

g $\frac{3}{4}x + \frac{1}{2} = 5$ **h** $\frac{1}{2}x + \frac{3}{5} = 1$ **i** $\frac{2}{5}x + \frac{1}{3} = 1$

j $\frac{1}{2}x - 1 = \frac{1}{4}$ **k** $\frac{2}{3}x - 4 = \frac{1}{3}$ **l** $\frac{3}{4}x - 1 = \frac{2}{3}$

m $\frac{1}{2}x + 2 = \frac{1}{3}x + 4$ **n** $\frac{3}{4}x - 1 = \frac{3}{5}x + 2$ **o** $2 + \frac{3}{4}x = \frac{1}{3}x + 3$

p $\frac{1}{2}x - \frac{1}{3} = \frac{3}{4}$ **q** $\frac{1}{4}x + \frac{1}{2} = \frac{3}{5}$ **r** $\frac{1}{3}x - \frac{1}{2} = \frac{1}{4}x + \frac{2}{5}.$

Turn negatives on?

Substitution

Bronze	Silver	Gold
Q1) 54	Q1) 63	Q1) 435
Q2) 24	Q2) 127	Q2) 5202
Q3) 29	Q3) 40	Q3) 52
Q4) 1	Q4) 94	Q4) 407
Q5) 41	Q5) 49	Q5) 960
Q6) 36	Q6) 96	Q6) 140

Turn negatives on?

Substitution

Bronze	Silver	Gold
Q1) 28	Q1) 66	Q1) 633
Q2) 68	Q2) 118	Q2) 372
Q3) 37	Q3) 44	Q3) 51
Q4) 63	Q4) 131	Q4) 88
Q5) 67	Q5) 51	Q5) 208
Q6) 75	Q6) 101	Q6) 151

Turn negatives on?

Substitution

Bronze	Silver	Gold
Q1) 22	Q1) 51	Q1) 74
Q2) 21	Q2) 75	Q2) 1358
Q3) 13	Q3) 58	Q3) 73
Q4) 114	Q4) 80	Q4) 2391
Q5) 83	Q5) 87	Q5) 18
Q6) 85	Q6) 88	Q6) 6723

Turn negatives on?

Substitution

Bronze	Silver	Gold
Q1) 43	Q1) 95	Q1) 135
Q2) 27	Q2) 73	Q2) 104
Q3) 83	Q3) 105	Q3) 30
Q4) 21	Q4) 38	Q4) 114
Q5) 70	Q5) 147	Q5) 273
Q6) 31	Q6) 51	Q6) 8343

Turn negatives on?

Substitution

Bronze	Silver	Gold
Q1) 28	Q1) 55	Q1) 242
Q2) 12	Q2) 66	Q2) 418
Q3) 18	Q3) 61	Q3) 77
Q4) 12	Q4) 97	Q4) 5824
Q5) 43	Q5) 82	Q5) 41
Q6) 42	Q6) 107	Q6) 227

2. a 5 b 0 c 18 d -2
e -5 f -8 g -14 h -8
i -10 j -20 k -25 l -25
m -20 n -38 o -300 p -100
q -26 r -26 s -14 t -60
u -2 v -70 w -36 x -8

Chapter 4 - Exercise 3 (page 36)

1. a 10 b 18 c 9
d 30 e 23 f 18
2. a 17 b 23 c 12 d 19
e 31 f 50 g 26 h 500
i 40 j 8 k 8 l $^1/_2$
m 3 n 6 o 2 p -2
q 2 r -8 s 0 t 40
u -20 v -10 w -1·3 x 0
3. a $7x$ b $16x$ c $8a$ d $20a$
e $12p$ f $25w$ g $25h$ h $110m$
i $4x$ j $-5x$ k 0 l $3d$
m $-11w$ no $-9w$ o $4n$ p $-30q$

Chapter 4 - Exercise 4 (page 37)

1. a -12 b -30 c -16 d -64
e -54 f -40 g -44 h -56
i -45 j -28 k -80 l -100
m -15 n -90 o -100 p -400
2. a -3 b -5 c -7 d -5
e -7 f -6 g -11 h -9
i -1 j -19 k -9 l -20
3. a 4 b -8 c -21 d -80
e -6 f -12 g -8 h -40
4. a 15 b -18 c -16
d -7 e -30 f -45
g -44 h -2 i -6
5. a -8 b no c -8
6. a -4 b -4 c -2 d -5
e -9 f -5 g -7 h -14
i -12 j -20 k -20 l -7
m -1 n -3·5 o -7·5 p -0·5
7. a 8 b 15 c 54 d 28
e 48 f 25 g 13 h 80
i 81 j 80 k 180 l 6000
8. a 3 b 7 c 8 d 9
e 5 f 4 g 6 h 40
i 9 j 30 k 80 l 49
9. a -4 b 8 c 60 d 10
e -9 f 30 g 28 h 64
i 7 j -42 k -90 l -200
m 1 n 4 o 64 p 400
q -1 r 16 s -1 t -1

Chapter 4 - Exercise 5 (page 39)

1. a -3 b -10 c 8 d -30
e 9 f -15 g 10 h 10
i 0 j -40 k 1 l -9
m -6 n -9 o -3 p 0
2. a -4 b -9 c 60
d 4 e 39 f -60
3. a -10 b -24 c 14 d 80
e -4 f -5 g 5 h 4
i -30 j 10 k -6 l 0·5
4. a 15 b 54 c 1
d 3 e -1 f 0
5. She ended up £14 overdrawn (-£14)
6. a $(-30) \div 5 = -6°C$ b $(-25) \div 5 = -5°C$
Swedish village 1°C warmer on average.

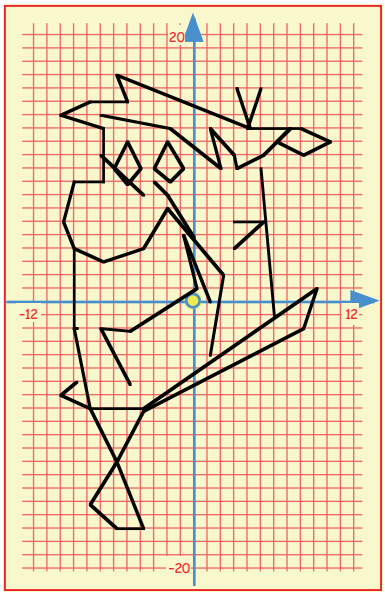
Answers to CHAPTER 5 (page 41)

Chapter 3 - Exercise 1 (page 23)

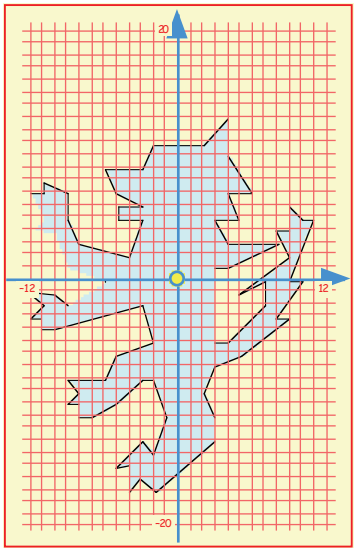
1. B(5, 3), C(3, -2), D(-4, -1), E(0, 3), F(-1, -3), G(-3, 0), H(5, -3), I(0, -2)
2. a J(4, 4), K(-3, 3), L(-4, -2), M(-1, -2), N(3, -1), O(0, 0), P6, -3), Q(0, -3), R(0, 2), S(-2, 0), T(-2, -1)
b S c Q, R d S, T e T, N
f S & T and R & Q g T & N, L & M, Q & P
h J
3. a See diagram
4. a a kite b parallelogram
c isosceles triangle d rhombus
e pentagon f hexagon
5. a see diagram b S(-3, -3) c $(1, -^1/_2)$
6. a see diagram b (-5, -1)
7. a A(1, 2), B(5, 2), C(5, 4)
b A'(1, -2), B'(5, -2), C'(5, -4)
c A''(-1, -2), B''(-5, -2), C''(-5, -4)
8. a see diagram b trapezium
c/d E'(2, -1), F'(3, -6), G'(5, -6), H'(6, -1)
9. a see diagram
b P'(0, 1), Q'(1, 6), R'(4, 7), S'(5, 2)
c P''(0, -1), Q''(-1, -6), R''(-4, -7), S''(-5, -2)

10/11/12. - see diagrams

13.



14.



Answers to CHAPTER 6 (page 46)

Chapter 6 - Exercise 1 (page 46)

1. a £1·50 b £35 c £1·510
d 320 kg e 315 kg f 16 kg
g £4·80 h 1·2 cm i 7200 km
j £250000 k 12·4 ml l 70 cm
m £16 n 1·5 mm o 25p
2. a £2·20 b £9 c 960p
d 240 m e 63 ml f 900 mm
g 5500 g h £144 i 36000 kg
j £200 k £46 l $891
m 43 ml n £7·50 o 40 km
3. a 90% b 324
4. a £24 b £96 c £21
5. £22·50
6. £16·40
7. a 160 b 240, 360, 120, 80
8. 7700 km
9. 444

Chapter 6 - Exercise 2 (page 48)

1. a £195 b 374·4 km c £14·14
d 340·2 ml e 27 kg f 158·4 mm
g £47·40 h 16·8 cm i 7200 km
j 1·26 cm k 9·5 km l £57500
m £808 n 187·5 km o £7·50
2. a 336 b 688 c 1872
d £5·40 e £428·40 f 80·04 kg
3. a (i) 9·1 kg (ii) 60·9 kg b 2 hr 42 min
4. a (i) £18 (ii) £138 b £16·02
5. a 11040 ml b £2183
6. £61·60 - £59·25 - Shop B better
7. a £9600 b £16800
8. 10%

Chapter 6 - Exercise 3 (page 50)

1. a 28% b 80%
c 60% d 45%
2. a 0·2, 20% b 0·15, 15% c 0·8, 80%
d 0·28, 28% e 0·58, 58% f 0·1, 10%
3. a 20% b 20% c 60%
d 20% e 30% f 40%
4. a 75% b 80%
5. a English - 75%, French - 80%, History - 78%
b French c English
6. a 80% b 60% c 48%
d 64% e 85% f 70%
g 90% h 75%
7. a Lynda b Jane
8. a 2X1-60%, 2X2 - 75%, 2X3 - 64%, 2X4 -75%
b 2X1-40%, 2X2 - 25%, 2X3 - 36%, 2X4 -25%
9. a 45%, 0·5, $^{40}/_{50}$
b $^{19}/_{25}$, 77%, 0·8
c $^2/_{13}$, $^1/_6$, 17%, 0·2
10. a $33^1/_3$% of £540, 20% of 50% of £1560, 0·28 x £520 - $^4/_9$ of £297
b half a % of 42000 - 65% of 320 - 0·85 x 240 - $^2/_3$ of 300
11. £345·60
12. various

Answers to CHAPTER 7 (page 54)

Chapter 7 - Exercise 1 (page 54)

1. a $2p$ b $3k$ c $5w$
d x e $2y$ f h
g $3p$ h $3k$ i 0
j $3x + y$ k $2a$ l $g + 2h$
m m n $10x - 1$ o $2a + 5$

p p q $6+u$ r $9p+q$
s $-g+4h$ t 0 u $x+4$
v $10l+1$ w $9+w$ x $2a+b$
y $3x^2$ z $2q^2$

2. a $8p$ b $4w$ c m^2 d d^3
e $12e$ f $0{\cdot}5h$ g $1{\cdot}2n$ h $5y^2$
i $48u$ j $56p$ k $12c^2$ l $3pq$
m w^3 n u^3 o $9ab$ p $15pq$
q $3y^{23}$ r $10g^3$ s $20h^3$ t $4q^2$
u 4 v 10 w $2b$ x $2x$
y $3x$ z $3x$

3. a $7x^2$ b $5a^2$ c $7k^2$ d $8y$
e $21n^2$ f $32mn$ g $30d$ h $63e^2$
i $100xy$ j $5a$ k $12a^2b$ l 7
m $20f$ n $14x-4yo$ z $+1$ p $2a^3+2$
q $7x^2$ r $8m-n$ s $u+10$ t $5x$
u $8-2a$ v $8g-2$ w 1 x $8x^2-6$
y $8p^2-8$ z $7k$

4. a $x^2+10x+24$ b $y^2+12y+20$
c $4mn$ d $9a+3ab$
e $80pq$ f $k^2+12k+32$

Chapter 7 - Exercise 2 (page 56)

1. a $2a+10$ b $3x+6$ c $6g+6$
d $7m+28$ e $2x-6$ f $5n-10$
g $8p-8$ h $10t-40$ i $5m-20$
j $2-2u$ k $14-7x$ l $30+15k$
m $4a+4b$ n $2c+2d$ o $5m-5n$
p $10d-10e$ q $60+20x$ r $120-30w$
s $100a-300$ t $50g-300$

2. a $6x+2$ b $8a+6$ c $3+15d$
d $12-20k$ e $49h-14$ f $40-32n$
g $30a+6y$ h $12t+4z$ i $10b-8c$
j $70k-14b$ k $xy+2x$ l $ab-8a$
m $vw-v$ n a^2-3a o $p-p^2$
p $2x+x^2$ q $3pq+pr$ r $10a-20a^2$
s $20u^2-2uy$ t $6a+4b+2$ u $10v+30w+40y$
v $15x-6y-12z$ w $10p+10q-40r$ x $24u-40v-72$

3. a $-3x-3$ b $-2a+10$ c $-m-n$
d $-m+n$ e $-6p+6q$ f $-x^2-7x$
g $-p-p^2$ h $-2w^2-18w$ i $-7k^2+k$
j $-8e^2-40e$ k $-3xy+8x^2$ l $-p^3+10p^2q$

4. a $3(x+6)=3x+18$
b $7(10-a)=70-7a$

Chapter 7 - Exercise 3 (page 57)

1. a $2x+6$ b $3a+17$ c $5p+7$
d $6w$ e $10k+2$ f $d+6$
g $20+2g$ h $10x+20$ i $12a-8$
j $22q-10$ k $5w-1$ l $9a+24b$
m $15m+16q$ n $20x-40y$ o $100p+6q$
p $3x+4$ q $-10b$ r $100w+20z$
s $2g$ t $7m+14n+1$ u $2e-4f$

2. a $5x+8$ b $9a+21$ c $7h+3$
d $9m+3$ e $17+v$ f $9+u$
g $20e+4$ h $12+2x$ i $8b+20a$

3. a $x+5$ b $a+2$ c $4p+2$
d $4p+4$ e $2k+18$ f $1+8m$
g $8+2d$ h h^2+h+3 i $3a^2-5a+12$

4. a $-2x-2$ b $3w+1$ c $10-5d$
d $20-5h$ e $5+6m$ f $-2g$
g $2a-20$ h $6t$ i $7x-4$

5. $x^2+4x-(5x-10)=x^2-x+10$

Chapter 7 - Exercise 4 (page 58)

1. a 2 b 5 c 7
d 20 e 70 f -1
g 6 h -9 i 3
j -8 k 0 l -50
m 7 n 7 o $1/4$
p $6^2/3$ q $1/6$ r $2^1/2$

2. a 10 b 7 c 27
d 6 e 100 f 4
g 2 h 3 i 8
j 6 k 10 l 8
m 28 n -1 o $4^1/2$
p -4 q $2^1/2$ r $4^3/4$

Chapter 7 - Exercise 5 (page 59)

1. a 3 b 2 c 1
d 6 e 3 f 4
g 4 h 5 i $5^1/2$
j 3 k 5 l -1
m 2 n 4 o 1
p 6 q $4^1/2$ r 5
s 2 t 5 u 1
v 9 w 2 x 8

2. a 12 b 9 c 16
d 4 e 5 f 8
g 12 h 5 i 100
j 4 k -4 l -3
m $1/3$ n 11 o $7^1/3$
p 2 q -2 r $1/2$
s 9 t $-1^1/2$ u $3^1/2$
v 20 w 2 x 4
y 1 z 4

Chapter 7 - Exercise 6 (page 60)

1. a 9 b 2 c 24 d -4
e 14 f -7 g 9 h 27
i 0 j 18 k 12 l $5{\cdot}4$

2. a 20 b 28 c 16 d 32
e 64 f 160 g 1280 h 2

3. a 16 b 1 c 16 d 6
e 20 f -5 g -40 h 36

4. a 11 b 24 c -10
d 21 e 90 f 31
g 2 h 2 i 5

5. a 9 b 25 c 1 d 2
e 49 f 18 g 6 h 1
i 3 j 4 k 5 l 49

6. a 18 b 1 c 4
d 18 e 44 f 5
g 59 h 3 i 6

7. a 1 b 2 c 4
d 2 e 2 f 2
g 3 h 3 i 300

8. a 7 b 90 c 150
d 100 e 52 f 250
g 22 h 60 i 30
j 8 k 10

Chapter 7 - Exercise 7 (page 62)

1. a $W=x+y$ b 5 c $2{\cdot}5$
2. a $L=m-n$ b $2{\cdot}25$ c $12{\cdot}75$
3. a $S=D/T$ b 60 mph c 330 miles
4. a $C=10+5k$ b £40
5. a $F=1{\cdot}8C+32$ b $86°F$
6. a $T=10g+h$ b 215 mins
7. a $P=2a+2b+c$ b 26 c 16
8. a $L=x+y$ b $P=6x+2y$ c 38
9. a $P=4n+2m$ b 32 c 5
10. a $S=4x+40$ b 120
11. (i) a $A=3(x+6)=3x+18$ c 33
(ii) a $A=4(x+10)=4x+40$ c 60
(iii) a $A=7(20-x)=140-7x$ c 105
(iv) a $A=2(9-x)=18-2x$ c 8

12. (i) a $A=6p$ b $A=4(p-3)$
c $A=6p-4(p-3)=2p+12$ d 20
(ii) a $A=q(q+4)$ b $A=8(q-2)$
c $A=q(q+4)-8(q-2)=q^2-4q+16$
d 28

Answers to CHAPTER 8 (page 67)

Chapter 8 - Exercise 1 (page 67)

1. a Perimeter = 28 cm, Area = 40 cm²
b Perimeter = 27 cm, Area = 44 cm²
c Perimeter = 36 cm, Area = 81 cm²
d Perimeter = 40 cm, Area = 60 cm²
e Perimeter = 15 cm, Area = 9 cm²
f Perimeter = 54 cm, Area = 170 cm²
g Perimeter = 36 cm, Area = 54 cm²
h Perimeter = 28 cm, Area = 21 cm²
i Perimeter = 2 cm, Area = 0·25 cm²

2. a 81 cm² b 24000 mm² c 5 m²
d 540 m² e $72{\cdot}5$ cm² f $2{\cdot}4$ m²
3. a 170 m² b 10 c £130
4. a $14{\cdot}8$ m b £35
5. £600

Chapter 8 - Exercise 2 (page 69)

1. a/b see drawing
c 48 cm² d 24 cm²
2. (i) a 120 cm² b 60 cm²
(ii) a 60 cm² b 30 cm²
(iii) a 130 cm² b 65 cm²
3. a 30 cm² b 48 cm² c 35 cm²
d 1100 mm² e $6{\cdot}2$ m² f $9{\cdot}62$ cm²
4. a 18 cm² b $31{\cdot}5$ cm² c $9{\cdot}5$ cm²
d 26 cm² e 875 cm² f 4800 mm²
5. $6{\cdot}4$ m²
6. 180 cm² x 2 = 360 cm² (fish has 2 sides)
7. $112{\cdot}5$ cm²
8. $1{\cdot}26$ cm²
9. a $2{\cdot}3$ cm b $5{\cdot}175$ cm²
10. 140 cm²
11. a 150 cm² b 176 m² c 4800 mm²
12. 10 cm

Chapter 8 - Exercise 3 (page 72)

1. 160 cm²
2. a 99 cm² b 65 cm² c 72 cm²
d 54 cm² e 22 cm² f 50 cm²
g 138 cm² h $31{\cdot}5$ cm² i $14{\cdot}4$ cm²
3. 5580 mm²
4. 104 m²
5. $14{\cdot}4$ m²
6. 1200 cm²
7. 240 cm²
8. $14{\cdot}88$ m²
9. a RSUP and PQST b 810 cm² - 414 cm²
10. 15 cm

Chapter 8 - Exercise 4 (page 74)

1. a 56 cm² b $40{\cdot}5$ cm² c 108 cm²
d 44 cm² e 2200 mm² f 3672 mm²
2. 11 cm²
3. 15360 cm²
4. 1704 cm²

Collecting Like Terms

Bronze	Silver	Gold
Q1)$12u + 11v$	Q1)$11p - 3s$	Q1)$5x^2 - 2x$
Q2)$12v + 13x$	Q2)$9h - 13p$	Q2)$8k^2 + 10k$
Q3)$11a + 17g$	Q3)$10v - 3m$	Q3)$-6v^2 - 10v$
Q4)$11t + 13m$	Q4)$12k - 10p$	Q4)$9u^2 - u$
Q5)$14f + 10j$	Q5)$12c - 14z$	Q5)$6r^2 - 2r$
Q6)$9w + 12k$	Q6)$8e + 4q$	Q6)$-2x^2 - 9x$
Q7)$13n + 13i$	Q7)$11p - 13u$	Q7)$13m^2 - 2m$
Q8)$10u + 11w$	Q8)$10e - 6c$	Q8)$-3r^2 - 3r$

Collecting Like Terms

Bronze
Q1)$10i + 10l$
Q2)$12c + 6r$
Q3)$10u + 10g$
Q4)$12a + 6x$
Q5)$10p + 10m$
Q6)$9x + 9l$
Q7)$10g + 11i$
Q8)$11r + 9l$

Silver
Q1)$8n - 12x$
Q2)$6c - 18e$
Q3)$17w - 17z$
Q4)$7r + 4v$
Q5)$5f - 13p$
Q6)$6t - 13c$
Q7)$9u + 2n$
Q8)$6l - 2m$

Gold
Q1)$14r^2 + 7r$
Q2)$3h^2 - h$
Q3)$2p^2 + 15p$
Q4)$10x^2 + 10x$
Q5)$-2r^2 + 14r$
Q6)$14m^2 - 15m$
Q7)$10y^2 - 11y$
Q8)$-2h^2 + 2h$

Collecting Like Terms

Bronze
Q1)$10k + 12b$
Q2)$10h + 14x$
Q3)$8b + 7z$
Q4)$9t + 11b$
Q5)$8n + 14y$
Q6)$11p + 14a$
Q7)$8n + 7g$
Q8)$9v + 8d$

Silver
Q1)$15i - 8u$
Q2)$10w - 5y$
Q3)$9i - 13t$
Q4)$8i - 14p$
Q5)$12r - 5f$
Q6)$17y + 4e$
Q7)$7x - 6u$
Q8)$9e - 3y$

Gold
Q1)$-3t^2 - 4t$
Q2)$-5b^2 - 9b$
Q3)$10c^2 + 11c$
Q4)$4l^2 + 10l$
Q5)$12u^2 + 13u$
Q6)$7u^2 - u$
Q7)$-2j^2 - j$
Q8)$4m^2 - 10m$

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Textbook Answers – Substitution

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Workout

Question 1:

(a) 12 (b) 6 (c) 11 (d) 7

(e) 14 (f) 40 (g) 45 (h) 15

(i) 5 (j) 3 (k) 2 (l) 3.5

(m) 49 (n) 100 (o) 9 (p) 64

(q) 15 (r) 23 (s) 38 (t) 15

(u) 23 (v) 22 (w) 51 (x) 3

(y) 2 (z) 6

Question 2:

(a) 30 (b) 8 (c) 120 (d) 8

(e) 2 (f) 27 (g) 34 (h) 22

Question 3:

(a) 2 (b) -3 (c) 3 (d) -12

(e) 16 (f) -12 (g) -14 (h) -35

(i) 2 (j) 48 (k) -3 (l) 12

(m) 12 (n) 30 (o) 20 (p) 48

(q) -1 (r) 2.5 (s) 3 (t) 36

Question 4:

(a) 8 (b) 50 (c) 39 (d) 36

(e) -27 (f) 0.25 (g) 80 (h) 75

(i) 2 (j) 3.75 (k) 3

Question 5: 22

Question 6: 120

Apply

Question 1:

(a) £170

(b) £320

(c) 2 days

(d) 11 days

Question 2:

(a) £1.50

(b) £22.50

Question 3:

(a) 220 minutes or 3 hours 40 minutes

(b) 120 minutes or 2 hours

Question 4: £775

Question 5

(a) F = 50

(b) F = 68

(c) F = 39.2

(d) C = 2

(e) C = 5

1. Find the value of $5c + 2$, if $c = 6$.

$5 \times 6 + 2$

$30 + 2 = 32$

32

(1)

---

2. If $x = 6$ and $y = -2$, find the value of

(a) x^2

$6^2 = 36$

36

(1)

(b) $5x + y$

$5 \times 6 + (-2)$

$30 + (-2) = 28$

28

(1)

(c) $x + y^2$

$6 + (-2)^2$

$6 + 4 = 10$

10

(1)

(d) $\frac{y + 20}{x}$

$\frac{-2 + 20}{6} = \frac{18}{6} = 3$

3

(2)

3. You are given that $m = 0.5$, $p = 0.75$ and $c = 2.2$

Find the value of

(a) $3c + m$

$3 \times 2.2 + 0.5$

$6.6 + 0.5 = 7.1$

7.1

(2)

(b) $m + p + c$

$0.5 + 0.75 + 2.2$

3.45

(1)

---

4. $F = 1.8C + 32$

(a) Work out the value of F when C = 2

$F = 1.8 \times 2 + 32$

$= 3.6 + 32 =$

35.6

(2)

(b) Work out the value of C when F = 50

$50 = 1.8C + 32$

$-32 \quad -32$

$18 = 1.8C$

$\div 1.8 \quad \div 1.8$

$10 = C$

10

(2)

5. Given that $a = 4$, $b = 9$ and $c = -5$

Work out the value of

$$\frac{ab + 24}{2c}$$

$$\frac{4 \times 9 + 24}{2 \times (-5)} = \frac{36 + 24}{-10}$$

$$\frac{60}{-10} = -6$$

-6

(3)

---

6. (a) Find the value of $5(a + c)$ when $a = 4$ and $c = 9$.

$$5(4 + 9)$$
$$5(13) = 65$$

65

(2)

(b) Find the value of $7x + 2y$ when $x = 2$ and $y = -9$.

$$7 \times 2 + 2 \times (-9)$$
$$14 + (-18) =$$

-4

(2)

---

7. $A = 2W + 2L$

Find A if $W = 3$ and $L = 9$

$$A = 2 \times 3 + 2 \times 9$$
$$= 6 + 18$$
$$= 24$$

24

(2)

8. $A = 2W + 2L$

Find W if A = 30 and L = 11

$30 = 2W + 2 \times 11$

$30 = 2W + 22$

$8 = 2W$

$W = 4$

4

.....

(2)

---

9. The cost in pounds, C, of hiring a car is given by
$C = 25d + 45$

where d is the number of days the car is hired.

(a) Find C if d = 4.

$C = 25 \times 4 + 45$

$= 100 + 45$

$= 145$

145

.....

(2)

(a) Find d if C = 245

$245 = 25d + 45$

$-45 \quad -45$

$200 = 25d$

$\div 25 \quad \div 25$

$8 = d$

8

.....

(2)

10. The amount of medicine, s ml, to give to a child can be worked out using the formula.

$$s = \frac{am}{150}$$

s is the amount of medicine, in ml.
a is the adult dose, in ml.
m is the age of the child, in months.

A child is 20 months old.
An adult's dose is 45ml.

Work out the amount of medicine the child should be given.

$s = \frac{45 \times 20}{150} = \frac{900}{150}$

6 .....ml
(3)

---

11. $y = w - 2a^2$

w = 400
a = 5

Work out the value of y.

$y = 400 - 2(5)^2$
$y = 400 - 2 \times 25$
$y = 400 - 50$

350 .....
(2)

12. $v = u + at$

(a) Work out v when u = 23, a = 4 and t = 3

$v = 23 + 4 \times 3$
$= 23 + 12$
$= 35$

35

(2)

(b) Work out u when v = 30, a = 2 and t = 8

$30 = u + 2 \times 8$
$30 = u + 16$
$14 = u$

14

(2)

(c) Work out t when v = 40, u = 12 and a = 4

$40 = 12 + 4t$
$28 = 4t$
$t = 7$

7

(2)

13.

$m = abc$

Find m if a = 3, b = –8 and c = 2

$m = 3 \times (-8) \times 2$
$m = (-24) \times 2$

-48

(2)

i (i) -4, -2, 0 (ii) $y = 2x - 6$
(iii) (-2, -10), (-1, -8)....
(iv/v) line through(-2, -10) & (3, 0)

j (i) -5,.. 15, 20 (ii) $y = 5x + 5$
(iii) (-2, -5), (-1, 0)....
(iv/v) line through(-2, -5) & (3, 20)

k (i) -2, ..., 6, 8 (ii) $y = x + 2$
(iii) (-4, -2), (-2, 0)....
(iv/v) line through(-4, -2) & (6, 8)

l (i) 3, 3, (ii) $y = 0x + 3$ or $y = 3$
(iii) (-2, 3), (-1, -3)....
(iv/v) line through(-2, 3) & (3, 3)
horizontal line 3 up from origin

Answers to Review Ex 4 (page 46)

1. a -5 b 4 c 6
   d 10 e -5 f 2
   g 0 h 8
2. a 0 b 0 c 90
3. a -20 b 14 c -8
   d 4 e -24 f -24
   g 0 h -24
4. a 2 b 23 c 0
5. a overdrawn by £545
   b +£820
6. 47°
7. a $3p$ b m^2 c $20de$
   d $8a - 2b$ e $4p^3$ f $15t^3$
   g $4x$ h $6s$
8. a 22 b 65 c 49
   d 32 e 3 f 3
   g 16 h 7
9. a $12x + 8$ b $42a - 21b$ c $g^2 + 5g$
   d $12y^2 - 21yz$ e $-6d + 30$ f $-a^2 + 4ab$
   g $-10w + 2w^2$ h $-q^3 - 4q^2r$
10. a $3x + 3$ b $4m - 3$ c $5h + 2$
    d $16g + 3$ e $4b + 3$ f $6d - 3$
11. $10x + 5(x - 1) = 15x - 5$
12. a 6 b 3 c 5
13. 224
14. 20
15. a £288 b £324
16. a. $C = \pi D$
    b 47·1 cm
17. a $P = 4a + 2b + c$
    b 79 cm c 7·4 mm

Answers to Chapter 5 (page 48)

Exercise 1 (Page 48)

1. a 3 b 10 c 5
   d 0 e 7 f 9
   g 17 h 50 i -3
   j 7 k -13 l 45
   m -8 n 0 o -22
   p -7 q 0 r -38
2. a 8 b 9 c 8
   d 7 e 9 f 1
   g 1·5 h 0 i 0·25
   j 40 k 30 l 3·5
   m 3·25 n 5·8 o $3^2/_7$
   p 6·5 q 0·25 r $9^2/_3$
3. a 3 b 3 c 9
   d 8 e 10 f 1
   g 5 h 1 i 5
   j 6 k 1 l 8
   m 7 n 10 o 8
   p 7·5 q -1 r $2^2/_3$
   s -0·5 t 4·5 u 3·25

Exercise 2 (Page 50)

1. a $2x + 1 = 19$, $2x = 18$, $x = 9$ b $7x - 5 = 16$, $7x = 21$, $x = 3$
2. a 3 b 8 c 12
   d 7 e 6 f 9
   g 8 h 7·5 i 6
   j 0·5 k 4 l -1
3. a 3 b 4 c 12
   d 1 e 8·5 f 4·5
   g 9 h -6·5 i 13
4. a $3x = x + 20$ b 10
5. a $4x + 9 = 2x + 25$ b 41

Exercise 3 (Page 51)

1. a 3 b 1 c 9
   d 8 e 7 f 1
   g 5 h 4 i 7
   j 1 k 1·5 l -2
2. a 1 b 4 c 1
   d 2 e 7 f 1
   g 5 h 5 i 2·5
   j 7 k 19 l -5
3. a 5 b 4 c 3
   d 6 e 2 f 3
   g 4 h 6 i 10·5
   j 1 k -1 l 4
   m 3 n -10

Exercise 4 (Page 52)

1. a $x + 6 = 14$, $x = 8$ b $15x - 100 = 12x - 40$, $3x = 60$, $x = 20$
2. a 8 b 4 c 24
   d 12 e 15 f 16
   g 6 h $^4/_5$ i $1^2/_3$
   j $2^1/_2$ k $6^1/_2$ l $2^2/_9$
   m 12 n 20 o $2^2/_5$
   p $2^1/_6$ q $^2/_5$ r $10^4/_5$

Exercise 5 (Page 53)

1. a $x > 4$ b $x < 8$ c $x \leq 17$
   d $x \geq 5$ e $x \leq 12$ f $x \geq 14$
2. a $x < 3$ b $x > 8$ c $x < 6$
   d $x \geq 4$ e $x \leq 6$ f $x > 28$
3. a $x < 6$ b $x > 4$ c $x < 3$
   d $x \geq 8$ e $x \leq 5$ f $x > 7$
   g $x < 2{\cdot}5$ h $x \geq 2$ i $x \leq 3{\cdot}5$
   j $x < 28$ k $x \geq 20$ l $x > 10$
   m $x < 7$ n $x \geq 12$ o $x \leq 2$
   p $x \leq -1$ q $x > 4$ r $x < 21$
   s $x < 3$ t $x > 2{\cdot}5$ u $x \geq 29$

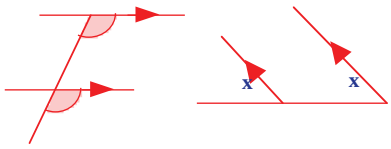
Answers to Review Ex 5 (page 55)

1. a 20° b 120°
2. a 35° b 52° c 22·5°
   d 35° e 35° f 15°
   g 50° h 50° i 170°
   j 47°, 133° k 149°, 31° l 54°
   m 60° n 69°, 42° o 72°, 72°
   p 76°, 80° q 74°, 74°, 106°
   r 42°, 42°, 96°, 138°

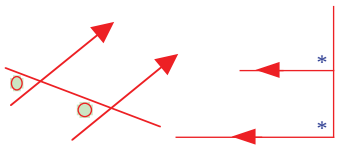
Answers to Chapter 6 (page 56)

Exercise 1 (Page 56)

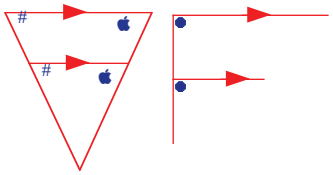
1. a ∠TPQ b ∠FRV & ∠MVG
   c ∠EFH & ∠FGI d ∠KLM & ∠LNO
2. a c b p c q
3. a b



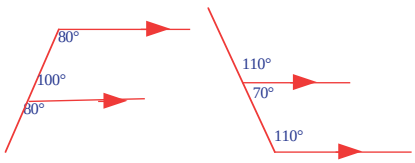
c d



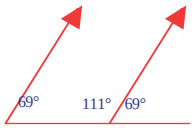
e f



4. a 76° b 52° c 68°
   d 105° e 137° f 15°, 165°
5. a b



c



6.