ALGEBRA - FORMULAS

Formulae

1 The charge for a phone calls (in pence) is given by the formula.

Charge = 1.2 x minutes   or C = 1.2m

Find the charge for these calls.

a) 3 minutes $1.2 \times 3 = 3.6p$

b) 10 minutes $1.2 \times 10 = 12p$

2 The formula to convert Pounds to Euros is

Euros = 1.15 x Pounds or € = 1.15 x £

Converts thes amounts to Euros.

a) £50 1.15×50
          $= € 57.50$

b) £200   € 230

3 Speed = distance ÷ time
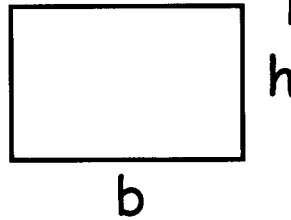
Distance = 63 miles
Time = 3 hours.
Find the speed.

$Speed = \frac{63}{3} = 21 \, mph$

4 Rectangle   Area = bh
                   Perimeter = 2b + 2h

h

b

b = 7 cm and h = 4 cm. Find
a) Area = $7 \times 4 = 28 \, cm^2$
b) Perimeter = $2 \times 7 + 2 \times 4$
               $14 + 8 = 22 cm$

5

h

b

Area = bh ÷ 2

b = 6 cm and h = 4 cm. Find the area
$6 \times 4 \div 2 = 24 \div 2 = 12 \, cm^2$

6

a

h

b

Area = (a + b)h ÷ 2

a = 4 cm, b = 10 cm and h = 4 cm.
Find the area

$(4 + 10) \times 4 \div 2$
$= 14 \times 4 \div 2$
$= 56 \div 2$
$= 28 \, cm^2$

①

7 v = u + at

u = 20, a = 5 and t = 2. Find v.

$v = 20 + 5 \times 2$
$= 20 + 10$
$= 30$

8 $s = ut + \frac{1}{2}at^2$

u = 10, a = 4 and t = 5. Find s.
$s = 10 \times 5 + \frac{1}{2} \times 4 \times 5^2$
$s = 50 + \frac{1}{2} \times 4 \times 25$
$s = 50 + 50 = 100$

9 $s = \frac{1}{2}(u + v)t$

u = 10, v = 14 and t = 3. Find s.
$s = \frac{1}{2}(10 + 14) \times 3$
$= \frac{1}{2} \times 24 \times 3 = 36$

10 F = 1.8C + 32

F = temperature in °F
C = temperature in °C

a) Find F when C = 5 °C $= 1.8 \times 5 + 32$
                           $= 41°F$
b) Find F when C = 100 °C
$= 1.8 \times 100 + 32$
$= 212°F$

There are b bears   There are d ducks

L stands for the total number of legs

Write a formula $L = 4 \times b + 2 \times d$
$L = 4b + 2d$

If b = 5 and d = 3 what does L =? $4 \times 5 + 2 \times 3$
$= 26$ legs

there are u unicycles

there are b bikes

there are c cars (ignore spare wheel and steering wheel)

$1 \times u + 2 \times b + 4 \times c$

W stands for the total number of wheels. $W = u + 2b + 4c$

If u = 4, b = 3 and c = 5 what does W = ?
$W = 4 + 2 \times 3 + 4 \times 5$
$= 4 + 6 + 20$
$= 30$

There are   t triangular buttons

s square buttons

c circular buttons

H stands for the total number of holes.
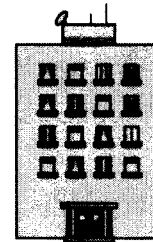
$H = 3 \times t + 4 \times s + 4 \times c$
$H = 3t + 4s + 4c$

If t = 4, s = 2 and c = 5 what does H =?

$H = 3 \times 4 + 4 \times 2 + 4 \times 5$
$H = 12 + 8 + 20$
$H = 30$ holes

f blocks of flats

h houses

b bungalows

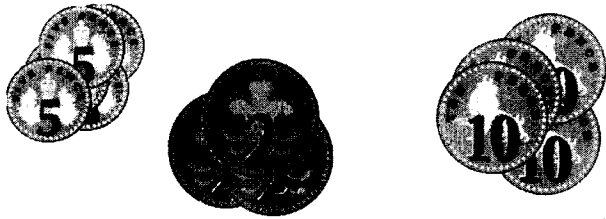W stands for windows you can see. $W = 16 \times f + 5 \times h + 2 \times b$
$16f + 5h + 2b$

If f = 2, h = 10 and b = 7, what does W =?

$W = 16 \times 2 + 5 \times 10 + 2 \times 7$
$= 32 + 50 + 14$
$= 96$

②

1) There are 's' 2p pieces, 't' 5p pieces and 'u' 10p pieces. Write a formula for the total amount of money.

Total $= 2 \times s + 5 \times t + 10 \times u = 2s + 5t + 10u$

2) On a mobile phone tarif. John pays 11p per text and 15p per minute for a call. He makes 'm' minutes of calls and sends 't' texts. Write a formula for the total cost of his bill.

Total $= 11 \times t + 15 \times m$
$= 11t + 15m$

3) There are 'L' ladybirds, 'd' ducks and 'b' bears. Write a formula for the total number of legs.
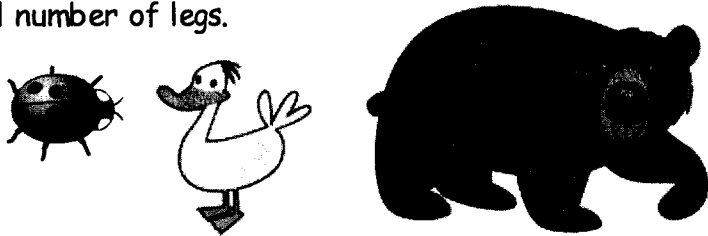
Legs $= 6 \times L + 2 \times d + 4 \times b = 6L + 2d + 4b$

4) Pens cost 23p each. Pencils cost 12p. Sally buys 'p' pens and 'q' pencils. Write a formula for the total cost of the pens and pencils.

Cost $= 23 \times p + 12 \times q$
$= 23p + 12q$

5) Tariq has 'a' 10g weights and 'b' 20g weights. Write a formula for the total weight he has.

Total $= 10 \times a + 20 \times b$
$= 10a + 20b$

6) To cook a chicken it takes 30 minutes per kg plus an extra 20 minutes. Write a formula for the total time taken to cook a chicken weighing 'w' kg.

Time $= 30 \times w + 20 = 30w + 20$

7) To go to the cinema it costs £4 per child and £6 per adult. 'a' adults and 'c' children go to the cinema. Write a formula for the total cost.

Cost $= 4 \times c + 6 \times a = 4c + 6a$

8) $C = 10s + 20$ Find C when s = 10
$C = 10 \times 10 + 20$
$= 100 + 20$
$= 120$

9) $T = 5a + 3b$ Find T when a=2 and b= 10
$T = 5 \times 2 + 3 \times 10 = 10 + 30 = 40$

10) Using the formulas you have written find the answers when
a) Qu 1 s=4, t=3 and u=2 $2 \times 4 + 5 \times 3 + 10 \times 2 = 43$
b) Qu 2 m=20 and t=30 $11 \times 30 + 15 \times 20 = 630$
c) Qu 3 L=2, d=4 and b=3 $6 \times 2 + 2 \times 4 + 4 \times 3 = 32$
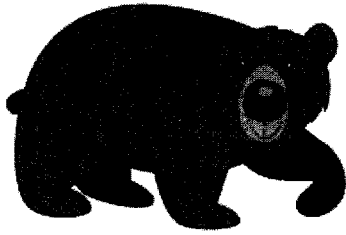d) Qu 4 p=3 and q=3 $23 \times 3 + 12 \times 3 = 105p = £1.05$
e) Qu 5 a=3 and b=6 $10 \times 3 + 20 \times 6 = 150g$
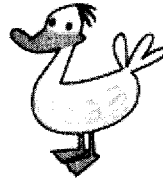f) Qu 6 w=3kg $30 \times 3 + 20 = 110$ minutes $= 1h$ 50 mins
g) Qu 7 a=2 and c=4 $4 \times 4 + 6 \times 2 = £28$

③

LEGS

There are b bears

There are d ducks

L stands for the total number of legs

There are 6 bears (b = 6) and 3 ducks (d = 3). How many legs?

$4 \times 6 + 3 \times 2$

$24 + 6 = 30$

L = 10 and b = 2. d = ?

Bears $2 \times 4 = 8$ legs

$10 - 8 = 2$ legs left for ducks

So 1 duck.

L = 20 and d = 4. b = ?

Ducks $4 \times 2 = 8$ legs

$20 - 8 = 12$ legs left $12 \div 4 = 3$

3 bears

Write these formulas
L given b and d.
b given L and d.
d given L and b.

$L = 4 \times b + 2 \times d$

$L = 4b + 2d.$

$b = \dfrac{L - 2d}{4}$

$d = \dfrac{L - 4b}{2}$

BUTTONS

There are **t** triangular buttons

s square buttons

H stands for the total number of holes.

If s = 2 and t = 5 what does H = ?

$2 \times 4 + 5 \times 3$

$8 + 15 = 23$

If H = 14 and t = 2 what does s = $(14 - 3 \times 2) \div 4$

$= 8 \div 4 = 2$

If H = 18 and s = 3 what does t = $(18 - 4 \times 3) \div 3$
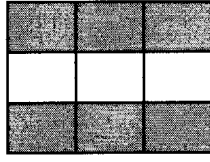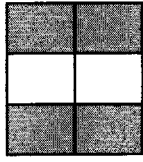
$6 \div 3 = 2$

Write these formulas

H =   given s and t $H = 4s + 3t$

s =   given H and t $s = \dfrac{H - 3t}{4}$

t =   given H and s $t = \dfrac{H - 4s}{3}$

④

Formulas

1   Look at the following patterns of grey and white squares.

a)   Fill in this table

White squares (w)	1	2	3	4	5	6
Grey squares (g)	2	4	6	8	10	12

b)   How many grey squares would there be for 10 white squares? _____ 20 _____

c)   How many white squares would there be for 30 grey squares? _____ 15 _____
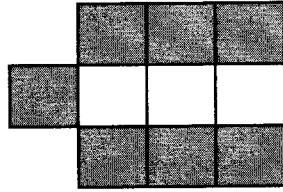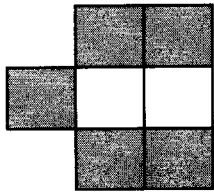
d) Write down a rule for finding the number of grey squares (g) if you know the number of white squares (w).

$$g = 2 \times w \qquad g = 2w$$

e)   Write down a rule for finding the number of white squares (w) if you know the number of grey squares (g).

$$w = g \div 2 \qquad w = \frac{g}{2}$$

2   Look at the following patterns of grey and white squares.

a)   Fill in this table

White squares (w)	1	2	3	4	5	6
Grey squares (g)	3	5	7	9	11	13

b)   How many grey squares would there be for 10 white squares? _____ 21 _____

c)   How many white squares would there be for 41 grey squares? _____ 20 _____

d)   Write down a rule for finding the number of grey squares (g) if you know the number of white squares (w). $g = 2 \times w + 1 \qquad g = 2w + 1$

e)   Write down a rule for finding the number of white squares (w) if you know the number of grey squares (g). $w = \dfrac{g - 1}{2}$

⑤

Make x the subject of each of these formulas

1) $x + a = b$ $x = b - a$

2) $x - c = d$ $x = d + c$

3) $ex = f$ $x = \dfrac{f}{e}$

4) $\dfrac{x}{g} = h$ $x = gh$

5) $\sqrt{x} = j$ $x = j^2$

6) $x^2 = k$ $x = \sqrt{k}$

7) $mx + n = p$ $x = \dfrac{p - n}{m}$
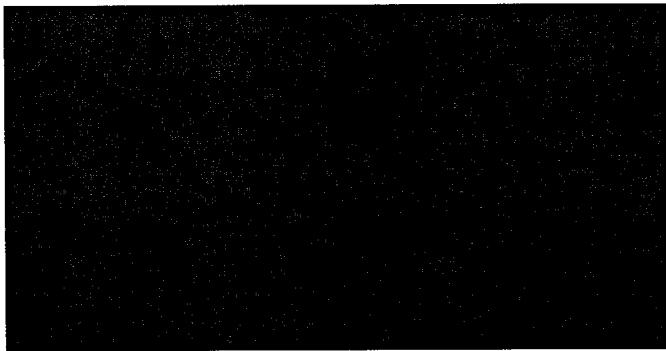
8) $\dfrac{x}{q} - s = t$
$x = (t + s) \times q$
$= q(t + s)$

9) $ax + b^2 = c$ $x = \dfrac{c - b^2}{a}$

10) $abcx = d$ $x = \dfrac{d}{abc}$

11) $4x - 9y = 8$ $x = \dfrac{8 + 9y}{4}$

12) $a - x = b$ $a = b + x$
$x = a - b$

b

h

A = Area

$A = bh$

$b = \dfrac{A}{h}$

P = Perimeter

$P = 2b + 2h$

$b = \dfrac{P - 2h}{2}$

⑥

Rearranging Formulas

Make 'x' the subject of these formulas

1) $A = x + y$ $x = A - y$

2) $s = 2x$ $x = s/2$

3) $w = 2x + y$ $x = \frac{w - y}{2}$

4) $d = 3x + 4y$ $x = \frac{d - 4y}{3}$

5) $e = \frac{x}{3}$ $x = 3e$

6) $y = x - 3d$ $x = y + 3d$

7) $y = 3x^2$ $x = \sqrt{\frac{y}{3}}$

8) $a - x = y$ $x = a - y$

9) $d = \frac{x}{3} - h$ $x = 3(d + h)$

10) $y = \sqrt{x} - 2$ $x = (y + 2)^2$

Make the letter in brackets the subject of these formulas. Write down what each formula is for, including defining each letter.

11) $C = \pi d$ (d) $d = C/\pi$

12) $A = \pi r^2$ (r) $r = \sqrt{\frac{A}{\pi}}$

13) $V = L \times B \times H$ (L) $L = \frac{V}{BH}$

14) $S = \frac{D}{T}$ (T) $T = D/S$

15) $V = \pi r^2 h$ (h) $h = \frac{V}{\pi r^2}$

16) $V = \pi r^2 h$ (r) $r = \sqrt{\frac{V}{\pi h}}$

17) $V = \frac{1}{3}\pi r^2 h$ (h) $h = \frac{3V}{\pi r^2}$

18) $V = \frac{1}{3}\pi r^2 h$ (r) $r = \sqrt{\frac{3V}{\pi h}}$

19) $D = \frac{M}{V}$ (M) $M = DV$

20) $V = \frac{4}{3}\pi r^3$ (r) $r = \sqrt[3]{\frac{3V}{4\pi}}$

21) $ax = bx + y$

$ax - bx = y$

$x(a - b) = y$

$x = \dfrac{y}{a - b}$

22) $ax - by = cx + dy$

$ax - cx = dy + by$

$x(a - c) = dy + by$

$x = \dfrac{dy + by}{a - c}$

⑦