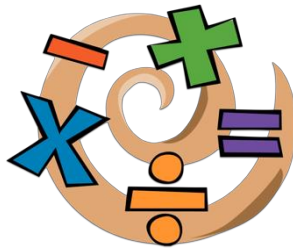




**St Andrew's Academy**

**Mathematics Department**



***S1 BLOCK 1***

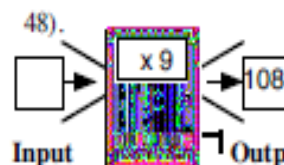
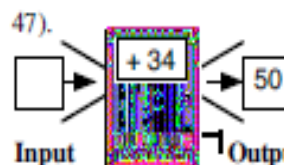
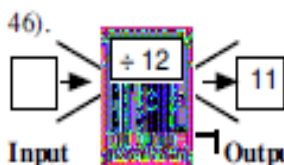
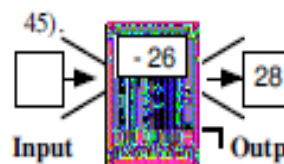
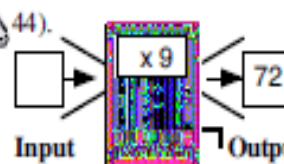
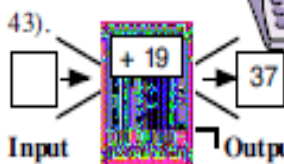
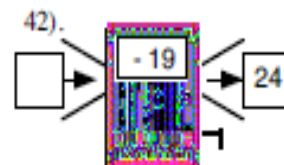
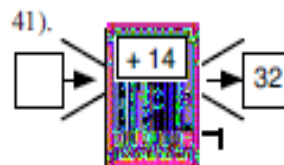
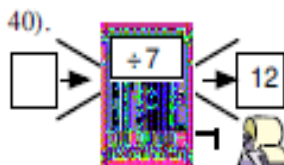
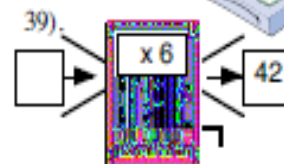
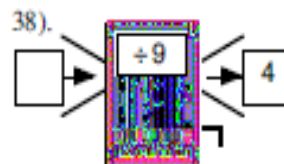
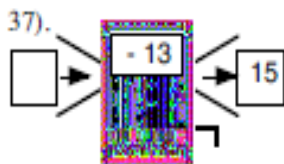
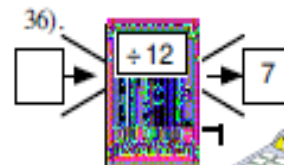
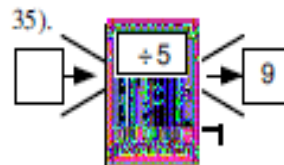
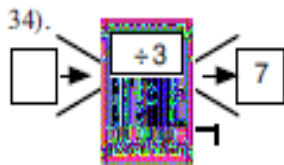
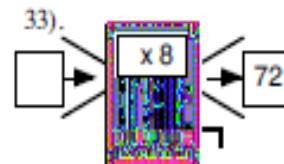
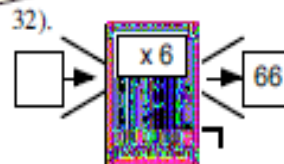
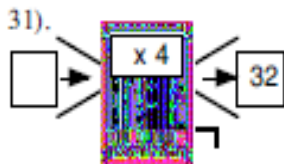
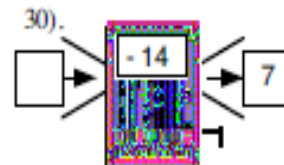
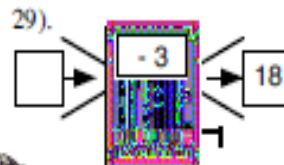
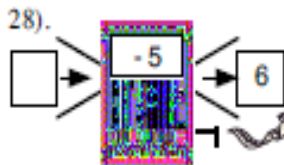
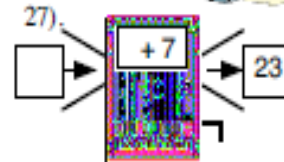
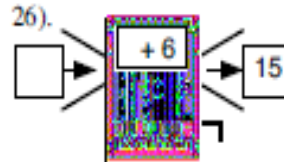
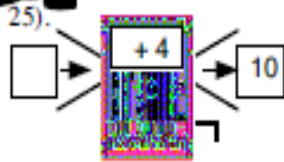
***Algebra***

*Functions & Simple  
Equations*





Draw these function machines.  
Write in the missing number.





## Function Machines 2 (One Operation).

Draw these function machines.

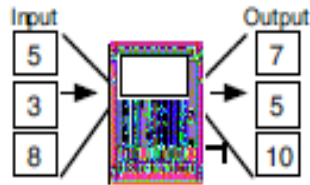
Find how the function machine changes the numbers.

Write the answer in the function machine.

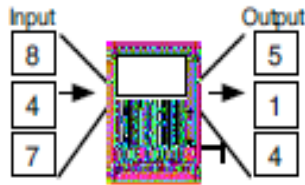
Write, in words, what happens to the input to get the output for each function machine.



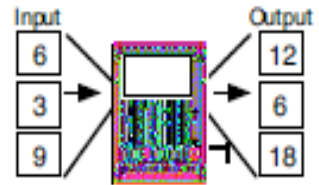
1).



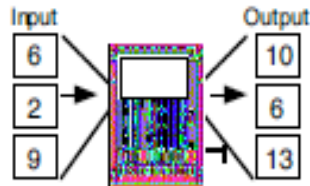
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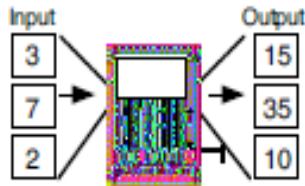
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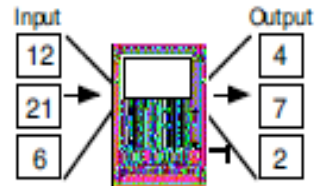
4).



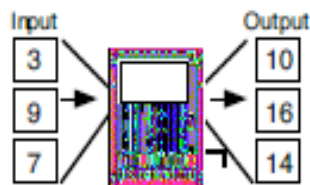
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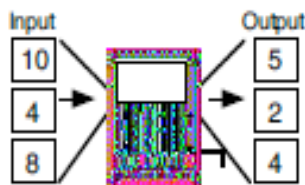
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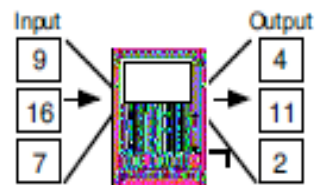
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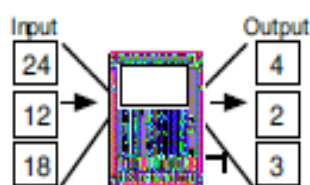
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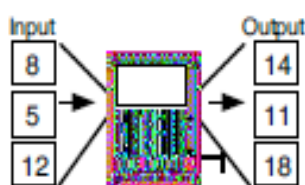
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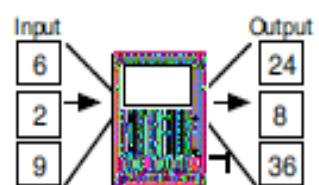
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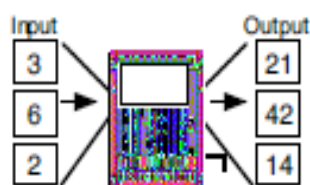
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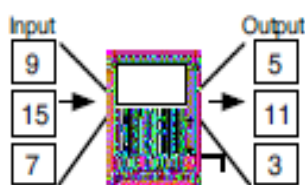
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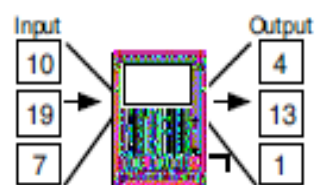
13).



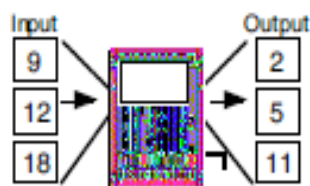
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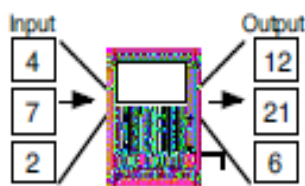
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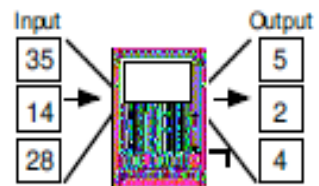
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17).

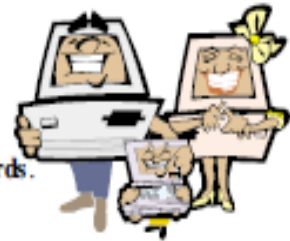


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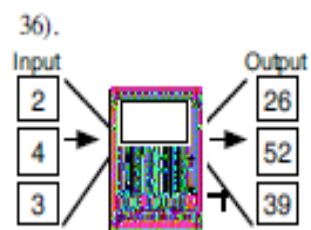
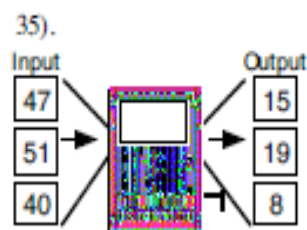
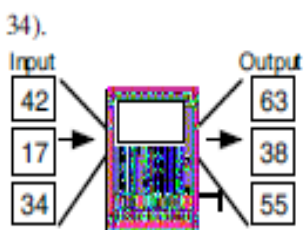
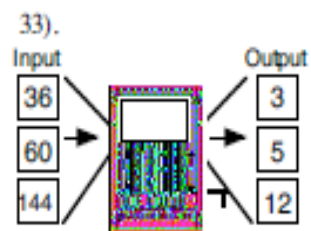
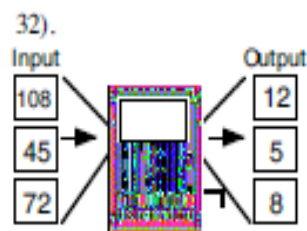
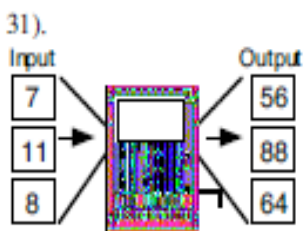
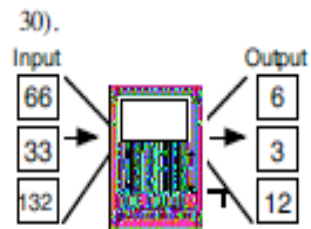
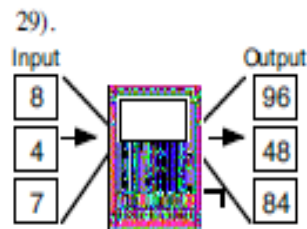
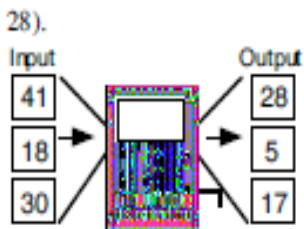
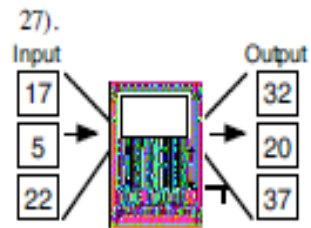
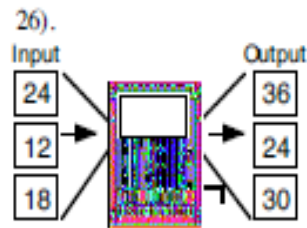
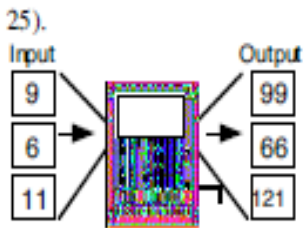
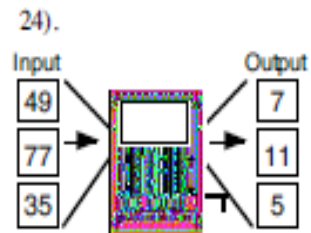
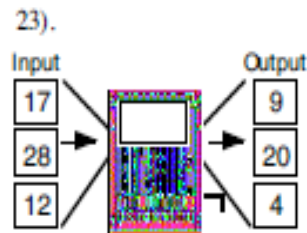
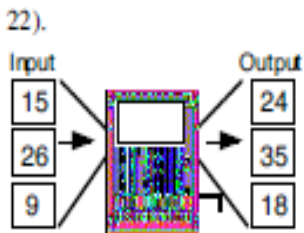
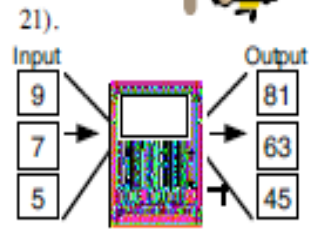
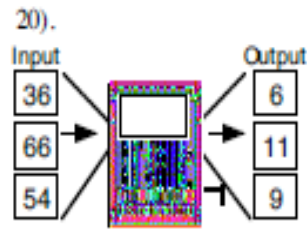
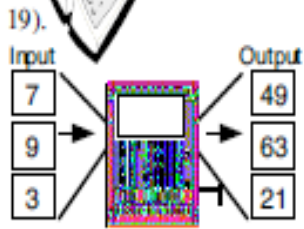




Draw these function machines.  
 Find how the function machine changes these numbers.  
 Write the answer in the function machine.



Write underneath an equation for the function machine in words.  
 These are harder!



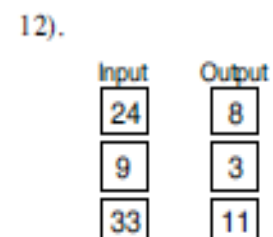
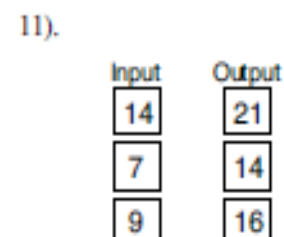
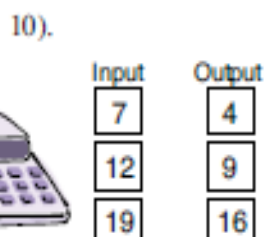
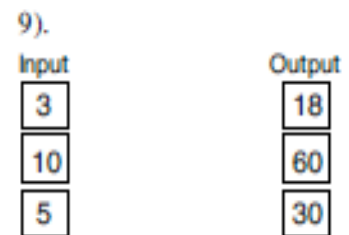
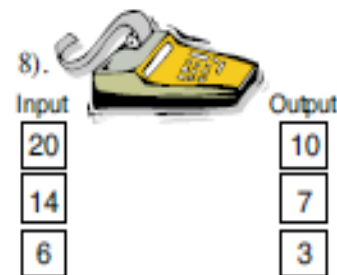
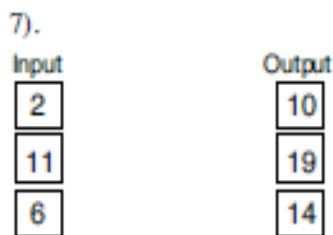
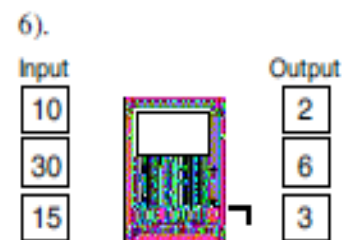
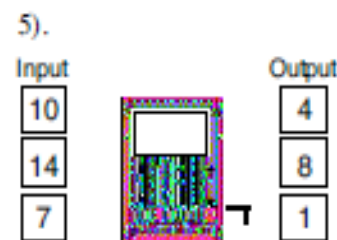
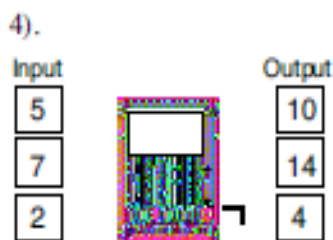
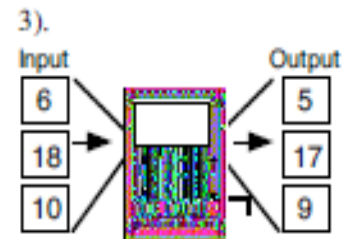
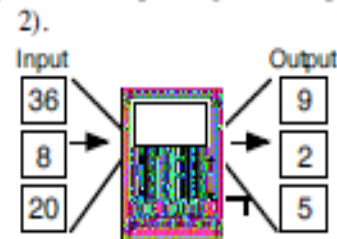
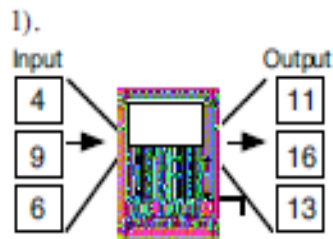


## Function Machines 3 (One Operation).

### Function Tables

Draw these function tables.

Write, in words, what happens to the input to get the output for each function table.



13).

Input	Output
4	7
1	4
3	6

14).

Input	Output
5	10
2	4
3	6

15).

Input	Output
7	8
15	16
3	4

16).

Input	Output
2	10
4	20
6	30

17).

Input	Output
2	9
6	13
3	10

18).

Input	Output
15	5
21	7
9	3



19).

Input	Output
10	9
7	6
15	14

20).

Input	Output
7	3
5	1
9	5

21).

Input	Output
10	5
4	2
6	3



22).

Input	Output
8	12
12	16
7	11

23).

Input	Output
3	12
9	36
4	16

24).

Input	Output
14	12
6	4
9	7

25).

Input	Output
6	15
4	13
2	11

26).

Input	Output
7	21
8	24
3	9

27).

Input	Output
7	18
3	14
12	23



28).

Input	Output
12	3
8	2
24	6

29).

Input	Output
13	6
23	16
9	2

30).

Input	Output
4	16
8	20
1	13



31).

Input	Output
12	9
31	28
17	14

32).

Input	Output
5	35
2	14
9	63

33).

Input	Output
35	7
50	10
15	3

34).

Input	Output
18	2
27	3
9	1

35).

Input	Output
7	84
3	36
5	60

36).

Input	Output
9	22
13	26
7	20



37).

Input	Output
9	54
7	42
5	30

38).

Input	Output
18	7
31	20
25	14

39).

Input	Output
3	18
9	24
7	22

40).

Input	Output
19	11
23	15
14	6

41).

Input	Output
27	11
34	18
19	3

42).

Input	Output
54	9
12	2
24	4

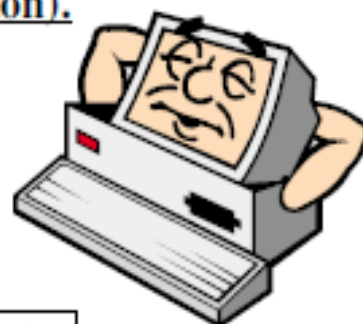




## Function Machines 4 (One Operation).

### Function Diagrams and Tables.

Look at the function diagrams and fill in the function table below it.

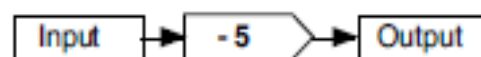


1).



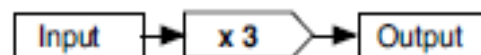
input	2	9	4	22	10	17	0	14	47
output									

2).



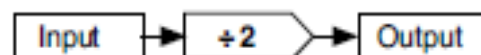
input	9	7	5	10	23	6	19	32	16
output									

3).



input	7	8	4	9	10	12	11	0	13
output									

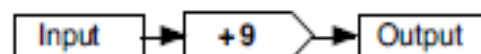
4).



input	10	20	16	24	40	18	30	28	50
output									

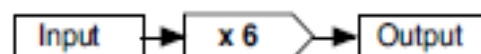


5).



input	11	7	4	10	23	15	43	47	113
output									

6).



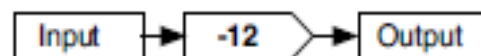
input	3	4	10	7	11	5	8	6	12
output									

7).



input	12	32	40	48	28	16	36	24	80
output									

8).

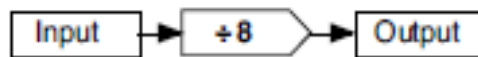


input	14	20	15	19	30	27	43	31	90
output									





9).

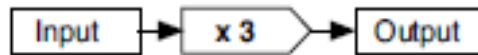


input	32	16	40	8	48	24	88	64	96
output									

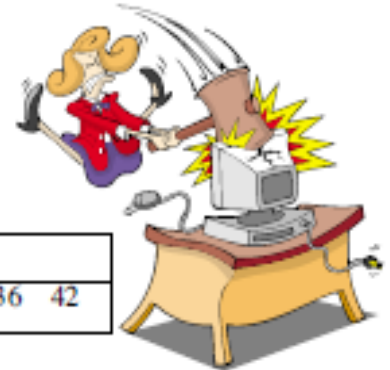


For these diagrams, fill in any part of the function table left blank.

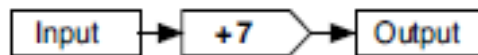
10).



input	3	5	7	10					
output					6	12	24	36	42

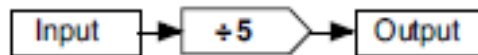


11).



input	10	6	9	15					
output					9	27	30	40	90

12).



input	20	35	15	45					
output					5	2	10	12	8

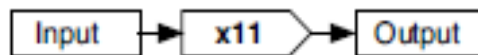


13).



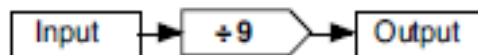
input	21	17	15	37					
output					4	10	1	25	43

14).



input	7	10	2	6					
output					33	88	121	99	132

15).



input	27	45	81	18					
output					4	8	6	10	12

16).



input	24	33	49	58					
output					2	7	12	3	15

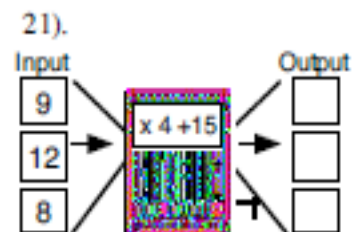
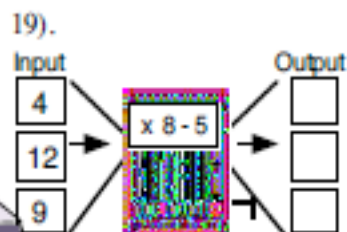
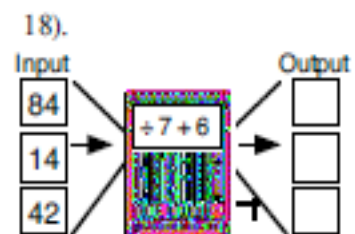
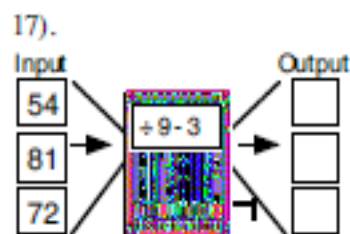
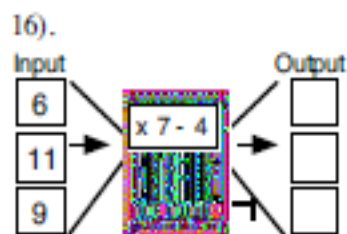
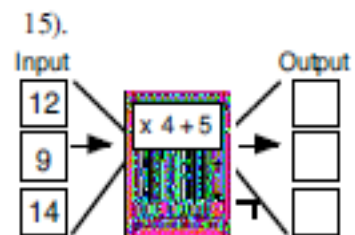
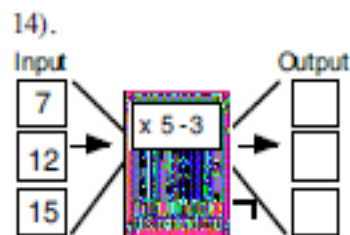
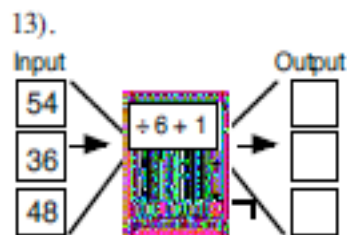
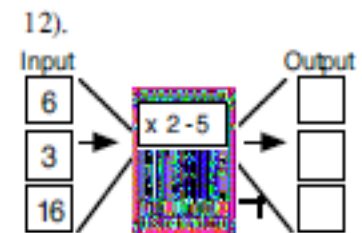
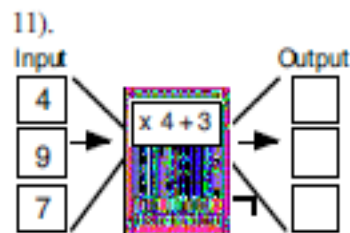
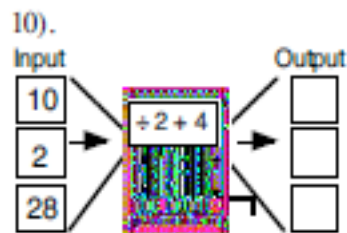
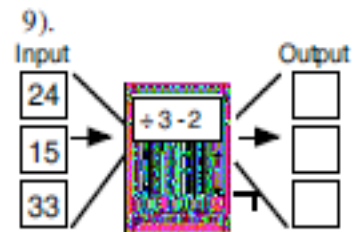
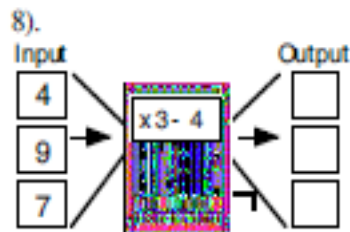
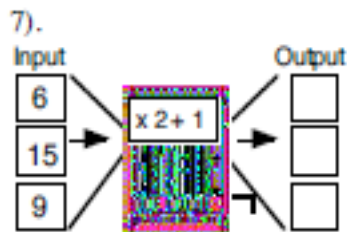
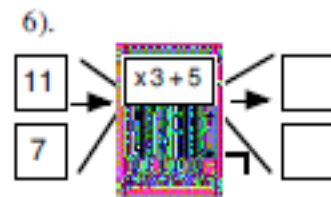
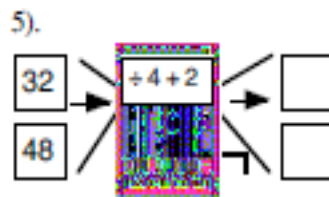
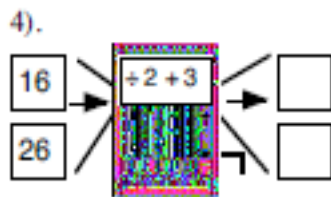
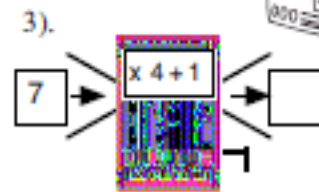
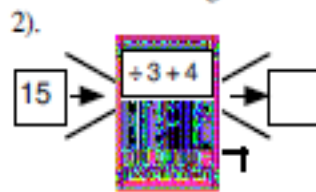
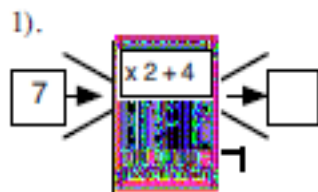


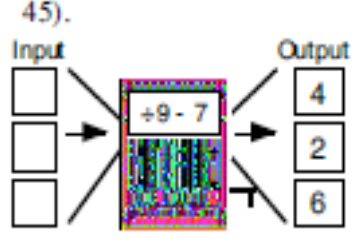
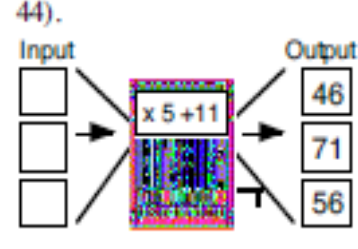
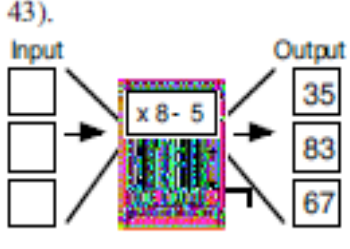
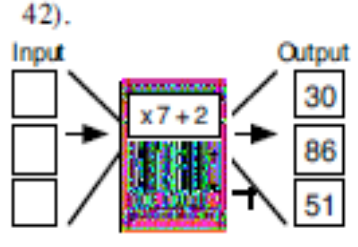
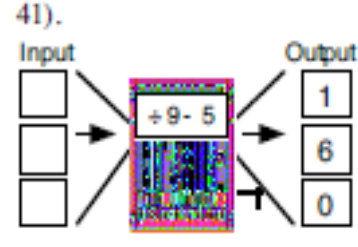
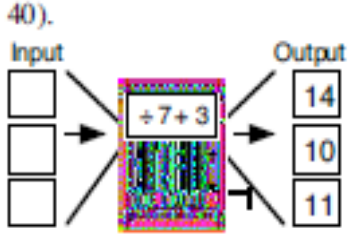
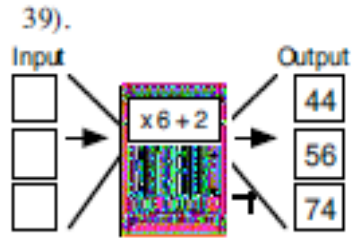
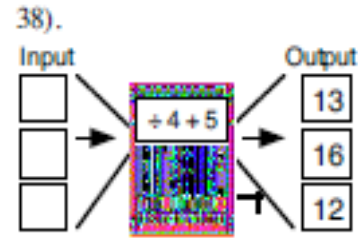
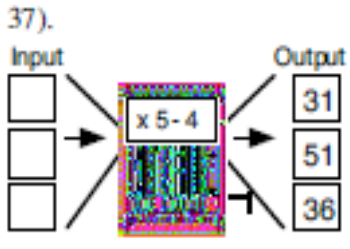
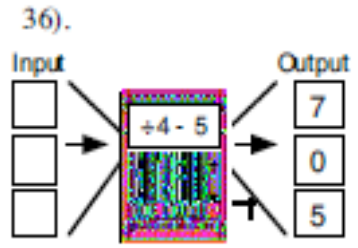
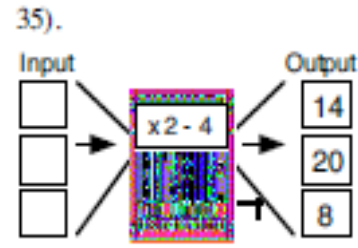
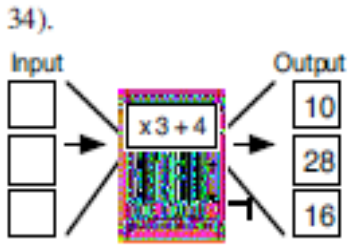
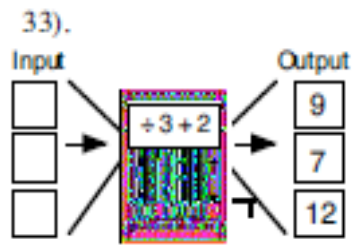
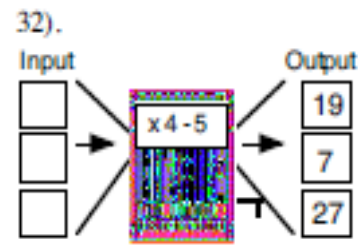
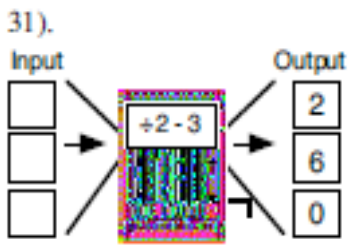
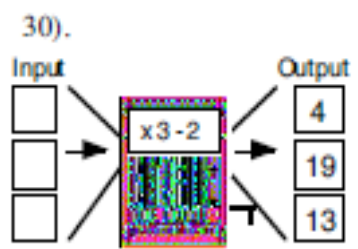
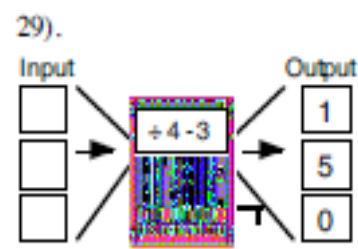
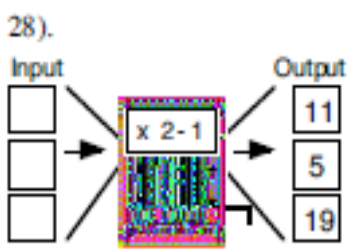
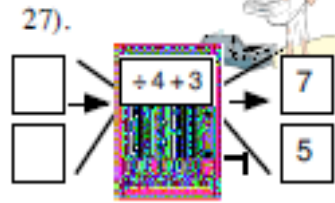
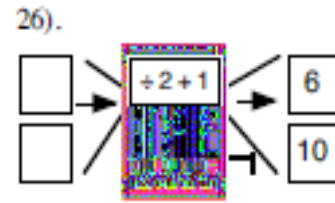
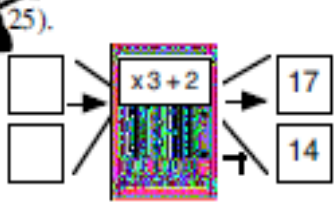
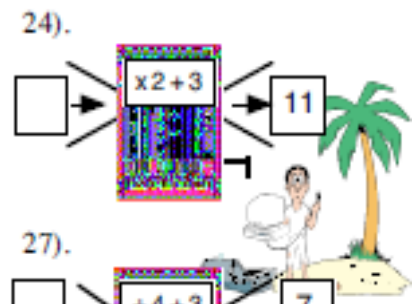
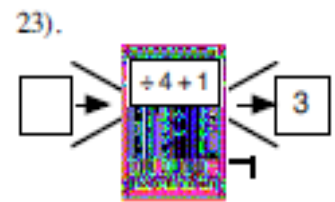
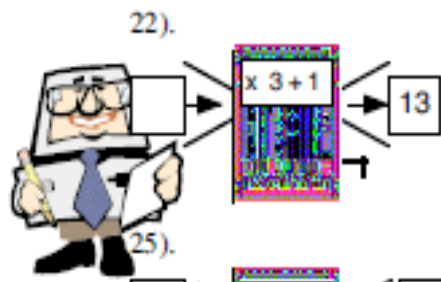


## Function Machines 1 (Two Operations).



Draw the following function machines.  
Write in the missing numbers.







## Function Machines 2 (Two Operations).



### Function Diagrams and Tables.

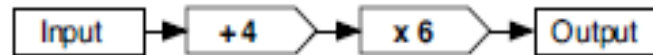
Look at the function diagrams and fill in the function table below it.

1).



input	7	9	4	20	10	2	0	15	40
output									

2).



input	5	7	2	0	4	6	10	3	16
output									

3).



input	7	8	4	9	10	20	15	2	23
output									

4).



input	50	20	15	35	60	10	45	30	5
output									

5).



input	11	7	4	10	3	15	23	43	103
output									

6).



input	23	43	15	27	11	35	51	39	7
output									

7).



input	12	33	5	47	75	19	68	26	82
output									

8).

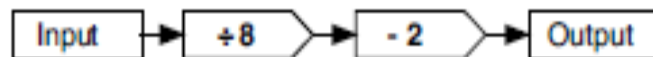


input	9	6	5	15	20	7	3	30	100
output									





9).

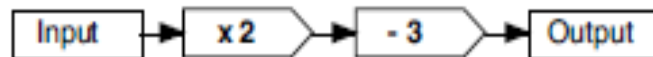


input	32	56	40	16	48	24	88	64	96
output									



For these diagrams fill in any part of the function table left blank.

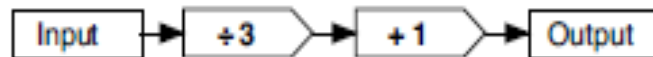
10).



input	3	5	7	10					
output					5	13	27	21	39



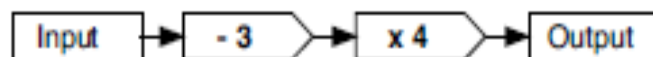
11).



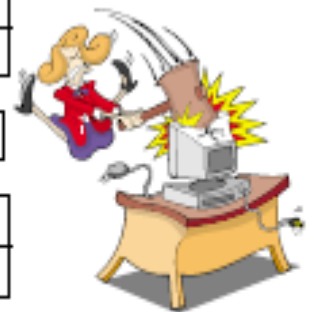
input	30	6	9	15					
output					5	7	2	9	12



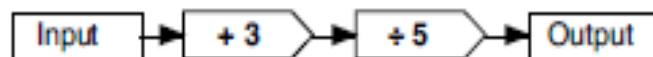
12).



input	7	9	14	4					
output					40	32	20	48	36

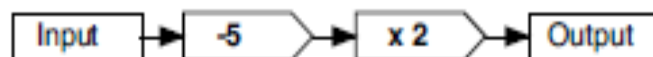


13).

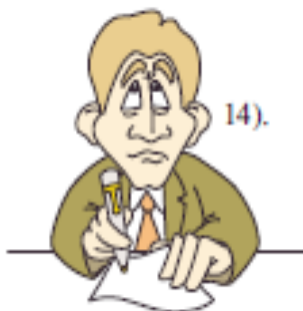


input	2	17	12	37					
output					2	7	11	5	13

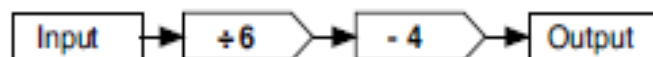
14).



input	7	12	17	6					
output					22	30	8	6	40



15).



input	30	36	72	24					
output					7	3	9	6	11

16).



input	21	33	9	18					
output					2	7	12	3	15





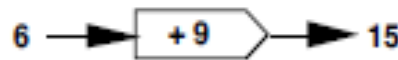
## Function Machines 3. (Two Operations).

### Opposites.

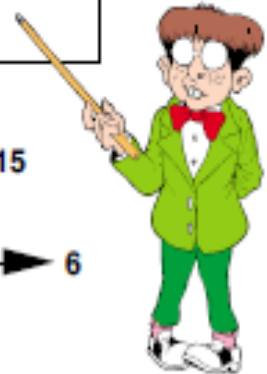
An operation is undone by an opposite operation.

Operation	Opposite Operation
+	-
-	+
x	÷
÷	x

For example:-



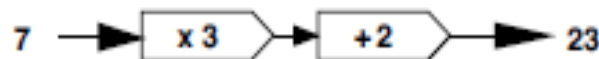
To undo this function, we do the opposite



1). What is the opposite function of:

- a). add 4,      b). take 2,      c). multiply by 7,      d). divide by 11,  
e). take 8,      f). add 6,      g). divide by 3,      h). multiply by 14 ?

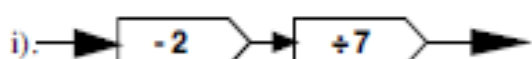
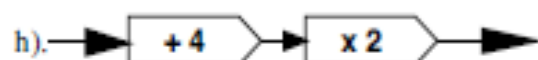
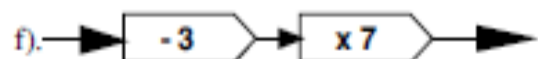
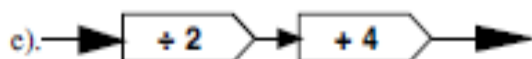
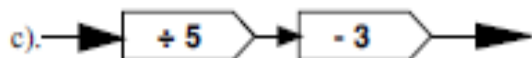
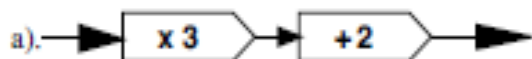
In worksheet "Function Machines 2 (Two operations)." we saw if a function has 2 operations we must undo them both.



To undo this function diagram we work backwards with the opposite operations.



2). Draw out the function diagrams that undo these functions:



3). What is the opposite function of:

- a). multiply 3 take 4,      b). divide 5 add 7,      c). multiply 5 add 9,  
d). add 4 divide 11,      e). multiply 7 take 4,      f). divide 3 take 12,  
g). take 6 divide 5,      h). divide 6 take 3,      i). add 2 multiply 8,  
j). take 3 multiply 7,      k). multiply 2 take 9,      l). add 5 divide 13 ?



## Worted Questions.

Example: I think of a number. Then I divide it by 3 and add 5. The answer is 11.

- Draw this as a function diagram,
- Now draw the opposite function diagram,
- Hence find the number I first thought of.



The opposite function diagram is



Therefore the number I first thought of is **18**.



4). For each of the following questions

- Draw the function diagram,
- Draw the opposite function diagram,
- Find the number I first thought of.



- I think of a number. Then I take 4 away from it and multiply it by 3. The answer is 15.
- I think of a number. Then I multiply it by 4 and add 6 to it. The answer is 14.
- I think of a number. Then I divide it by 2 and add 7 to it. The answer is 12.
- I think of a number. Then I add 4 to it and then divide it by 5. The answer is 3.
- I think of a number. Then I divide it by 4 and take 7 from it. The answer is 3.
- I think of a number. Then I multiply it by 3 and take 6 from it. The answer is 15.
- I think of a number. Then I add 8 to it and then divide it by 3. The answer is 6.
- I think of a number. Then I take 9 away from it and divide it by 2. The answer is 7.
- I think of a number. Then I multiply it by 5 and add 3 to it. The answer is 33.
- I think of a number. Then I divide it by 7 and add 9 to it. The answer is 13.

5). Use function diagrams and their opposites to solve the following problems.

- To get his Mum's age Tom multiplied his own age by 4 and then took 5 years off it. His mum is 31, how old is Tom ?
- Jenny says she spends three times as long plus an extra 10 minutes on her homework than her sister. If she does 55 minutes homework, how long does her sister spend on homework ?
- Grandpa George adds 14 years to his age then divides it by 9 to get his grandsons age. His grandson is 10, how old is Grandpa George ?

d). To find the perimeter of this rectangle you multiply the length by two and add on 6 cm.

Find the length if the perimeter is

- 16 cm,
- 26 cm,
- 30 cm.



e). To work out a very simple electricity bill you multiply the number of units used by £2 and then add on the £7 standing charge.

Find out how many units were used if the total bill was

- £23,
- £37,
- £87.



## Function Machines – What is the secret code?

Calculate the missing outputs from the function machines below.

For each of your answers, shade the corresponding number on the grid below to reveal the secret code.

The secret code only includes numbers.

4	+ 3	→	
3	+ 5	→	
7	+ 10	→	
5	+ 6	→	
18	+ 9	→	
6	- 4	→	
13	- 3	→	
20	- 5	→	
18	- 6	→	
26	- 8	→	
5	× 6	→	
3	× 8	→	
7	× 4	→	
9	× 5	→	
6	× 7	→	

25	÷ 5	→	
18	÷ 6	→	
27	÷ 3	→	
32	÷ 8	→	
54	÷ 9	→	
13	+ 16	→	
44	- 19	→	
8	× 6	→	
57	÷ 3	→	
26	+ 17	→	
63	- 16	→	
4	× 11	→	
72	÷ 2	→	

3	× 6	→	+ 4	→	
7	× 5	→	- 2	→	
4	× 9	→	+ 5	→	
9	× 6	→	- 3	→	
8	× 8	→	+ 6	→	
6	× 7	→	- 8	→	

73	42	7	22	39	24	44	27	37	2	41	18	23
40	51	14	26	52	20	89	45	50	6	32	1	71
53	11	25	30	61	12	33	29	62	36	48	17	54
60	0	21	4	56	31	13	34	38	70	16	28	63
35	5	43	10	46	19	8	9	55	3	15	47	49



## Function Machines (Extension) – What is the secret code?

Calculate the missing outputs and inputs from the function machines below.

For each of your answers, shade the corresponding number on the grid below to reveal the secret code.

The secret code includes letters and numbers.

2 → $\times 5$ → <span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span>	17 → $+ 28$ → <span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span>	7 → $\times 10$ → $+ 6$ → <span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span>
11 → $\times 2$ → <span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span>	25 → $+ 12$ → <span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span>	6 → $\times 5$ → $+ 9$ → <span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span>
4 → $\times 10$ → <span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span>	19 → $+ 35$ → <span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span>	3 → $\times 6$ → $+ 3$ → <span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span>
14 → $\div 7$ → <span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span>	55 → $- 29$ → <span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span>	9 → $\times 4$ → $- 12$ → <span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span>
12 → $\div 3$ → <span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span>	70 → $- 13$ → <span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span>	8 → $\times 7$ → $- 6$ → <span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span>
130 → $\div 2$ → <span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span>	36 → $- 9$ → <span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span>	12 → $\times 8$ → $- 7$ → <span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span>
<span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span> → $\times 8$ → 72	<span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span> → $+ 13$ → 82	<span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span> → $\times 3$ → $+ 5$ → 29
<span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span> → $\times 3$ → 18	<span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span> → $+ 17$ → 40	<span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span> → $\times 11$ → $+ 19$ → 96
<span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span> → $\times 5$ → 100	<span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span> → $+ 26$ → 67	<span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span> → $\times 2$ → $+ 36$ → 58
<span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span> → $\div 4$ → 4	<span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span> → $- 18$ → 31	<span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span> → $\times 9$ → $- 10$ → -1
<span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span> → $\div 10$ → 7	<span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span> → $- 56$ → 24	<span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span> → $\times 12$ → $- 33$ → 27
<span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span> → $\div 3$ → 17	<span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span> → $- 30$ → 14	<span style="border: 1px dashed black; display: inline-block; width: 20px; height: 15px;"></span> → $\times 5$ → $- 7$ → -7

4	39	24	57	73	41	5	0	51	60	76	11	45	6
33	25	53	16	17	80	13	12	20	42	58	56	30	21
35	32	43	8	52	9	89	7	50	48	40	44	27	70
28	18	46	37	78	22	34	19	26	55	69	14	31	15
29	36	59	10	90	54	38	47	65	3	1	49	23	2



3 →

11 →

..... →



→ .....

→ .....

→ 27

11 →

100 →

..... →

→ .....

→ .....

→ 0

3 →

11 →

..... →

→ .....

→ .....

→ 105

12 →

100 →

..... →

→ .....

→ .....

→ 1



2 →



→ ....

2 →



→ ....

5 →



→ ....

5 →



→ ....

10 →



→ ....

10 →



→ ....



3 →

50 →

..... →



→ 8

→ .....

→ 100

11 →

100 →

..... →

→ 33

→ .....

→ 0

3 →

11 →

..... →

→ 12

→ .....

→ 100

12 →

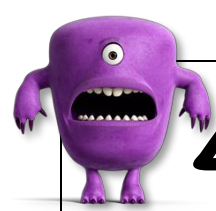
100 →

..... →

→ 6

→ .....

→ 1



4→



→16

5→

→18

2→

→.....

6→

→9

100→

→197

10→

→.....

3→

→13

11→

→37

5→

→.....

4→

→20

6→

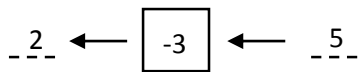
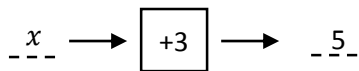
→40

.....→

→100

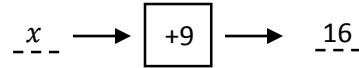
# Solving Equations

a)  $x + 3 = 5$



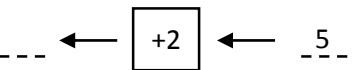
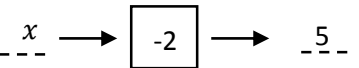
$x = 2$

b)  $x + 9 = 16$



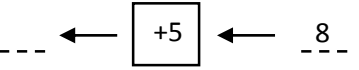
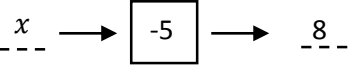
$x = 7$

c)  $x - 2 = 5$



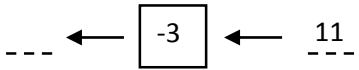
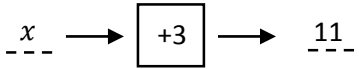
$x = 7$

d)  $x - 5 = 8$



$x = 13$

e)  $x + 3 = 11$



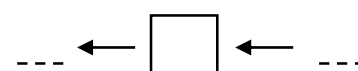
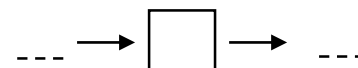
$x = 8$

f)  $x - 4 = 7$



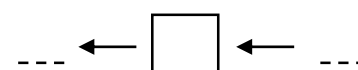
$x = 11$

g)  $x + 7 = 13$



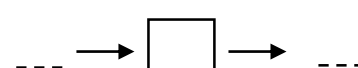
$x = 6$

h)  $x - 7 = 13$



$x = 20$

i)  $x + 3 = 9$



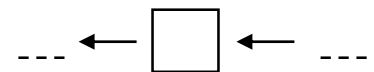
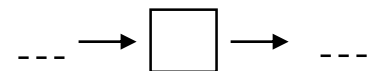
$x = 6$

j)  $x - 11 = 8$



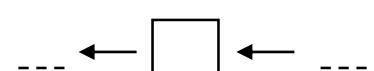
$x = 19$

k)  $x + 5 = 36$



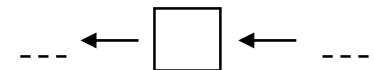
$x = 31$

l)  $x - 12 = 31$



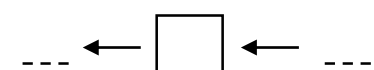
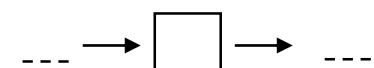
$x = 43$

m)  $x + 2 = 8$



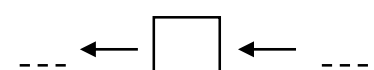
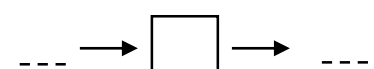
$x = 6$

n)  $x - 6 = 4$



$x = 10$

o)  $x + 4 = 14$



$x = 10$

**Extension** – solve for  $x$

1)  $4 + x = 6$

2)  $2 + x = 7$

3)  $8 + x = 11$

4)  $5 + x = 9$

5)  $7 + x = 12$

6)  $12 + x = 18$

7)  $14 + x = 23$

8)  $19 + x = 32$

9)  $7 + x = 40$

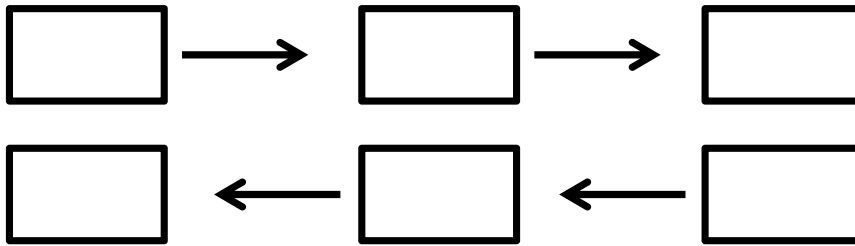
10)  $8 + x = 72$

11)  $11 + x = 64$

12)  $28 + x = 90$

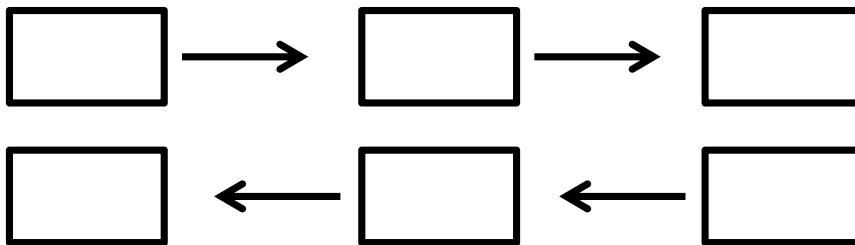
## One-step equations with function machines

a)  $x + 6 = 10$



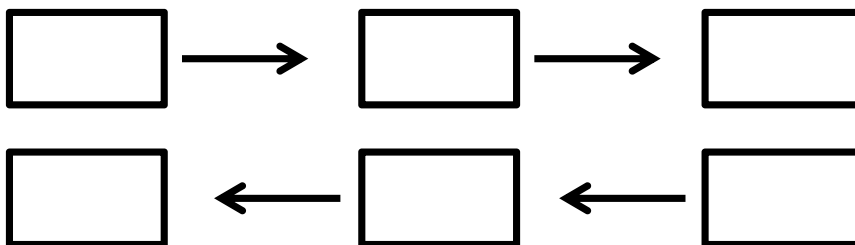
x = .....

b)  $x - 5 = 1$



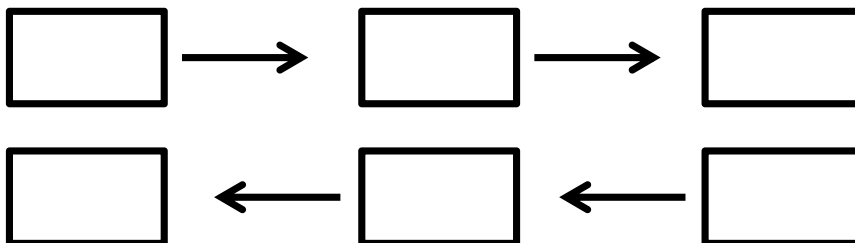
x = .....

c)  $x + 9 = 13$



x = .....

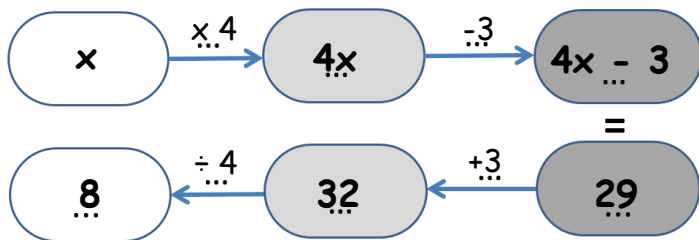
d)  $x - 8 = 14$



x = .....

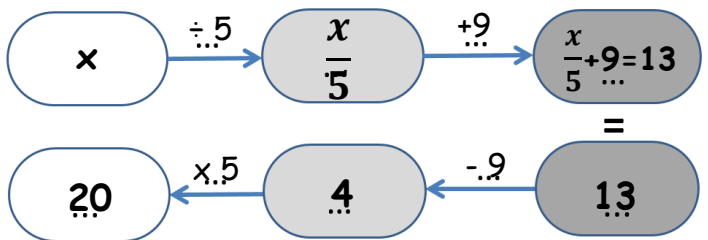
# Solving equations using function machines

**Example 1 - Solve  $4x - 3 = 29$**



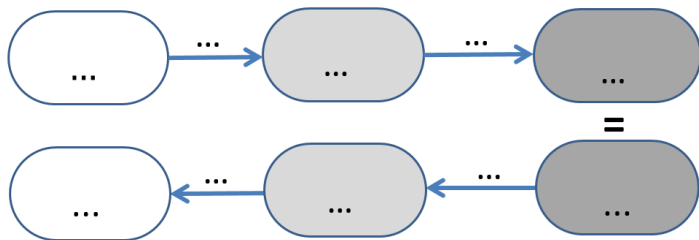
**So  $x = 8$**

**Example 2 - Solve  $\frac{x}{5} + 9 = 13$**



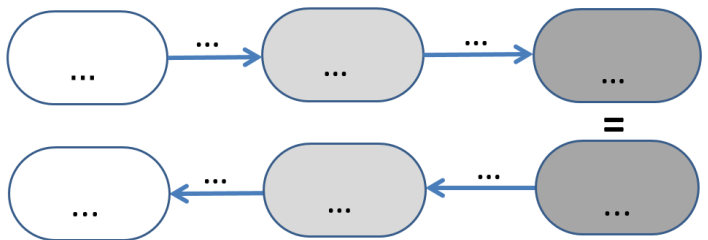
**So  $x = 20$**

**2) Solve  $5x + 3 = 23$**



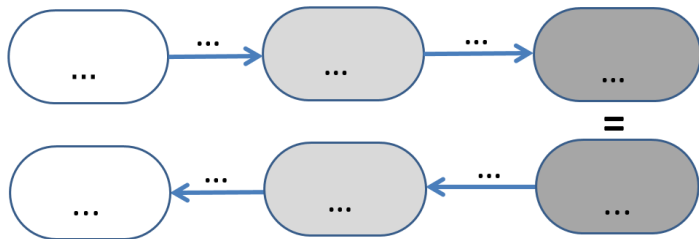
**So  $x = \dots$**

**1) Solve  $2x - 1 = 9$**



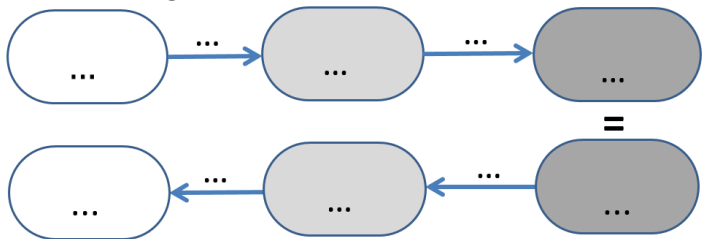
**So  $x = \dots$**

**4) Solve  $8p - 6 = 18$**



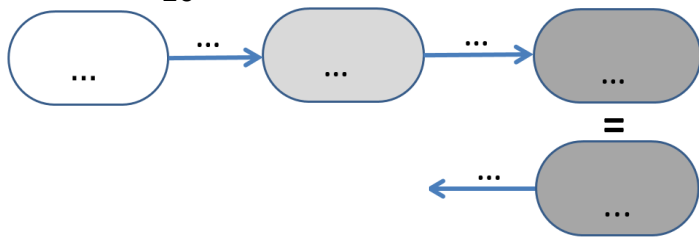
**So  $x = \dots$**

**3) Solve  $\frac{x}{3} + 7 = 9$**



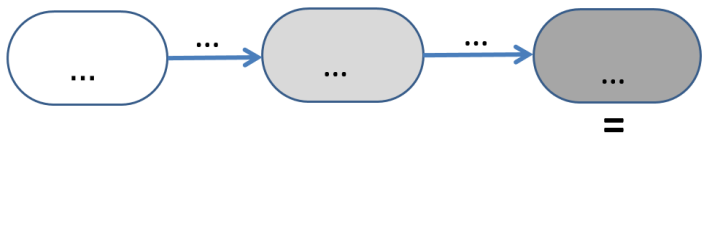
**So  $x = \dots$**

**6) Solve  $\frac{x}{10} - 4 = 1$**



**So  $x = \dots$**

**5) Solve  $\frac{x}{6} - 4 = -1$**



**So  $x = \dots$**

**8) Solve  $7p + 6 = 20$**



**So  $x = \dots$**

**7) Solve  $\frac{x}{2} - 11 = 4$**



**So  $x = \dots$**



## Simple Equations

Fill in the blanks to solve the equation.

1)  + 3 = 5

11) 14 +  = 20

2)  + 5 = 9

12) 4 +  = 11

3)  + 2 = 8

13) 7 +  = 15

4)  + 3 = 9

14) 9 +  = 24

5)  + 9 = 12

15) 11 +  = 17

6)  + 4 = 11

16) 10 -  = 4

7)  - 5 = 10

17) 15 -  = 6

8)  - 7 = 13

18) 21 -  = 7

9)  - 3 = 5

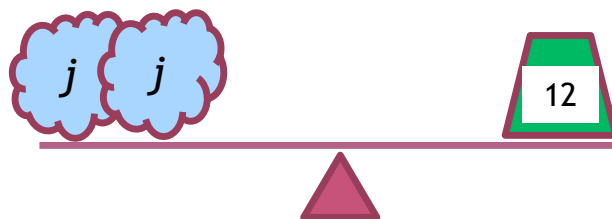
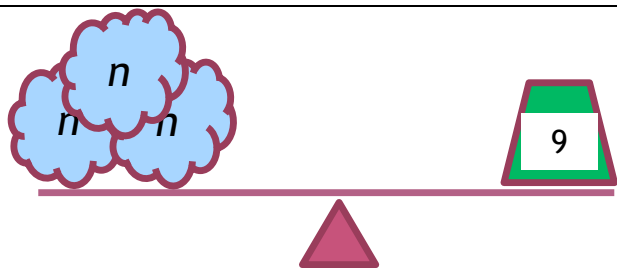
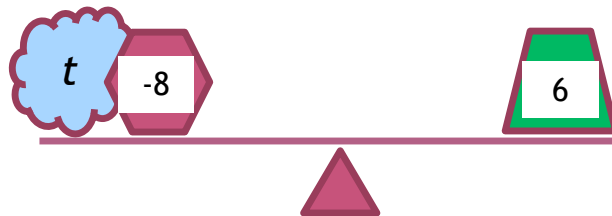
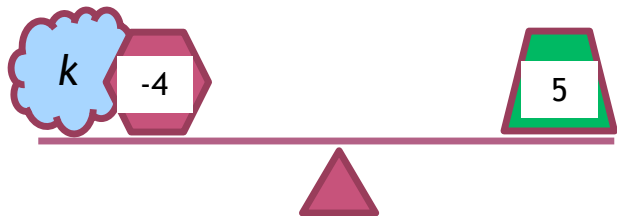
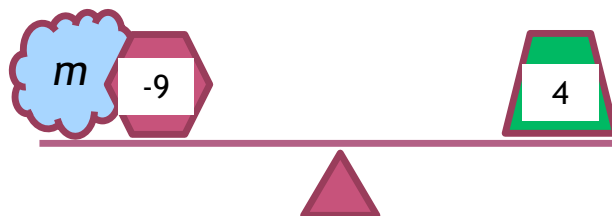
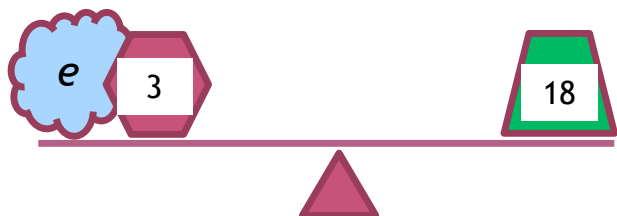
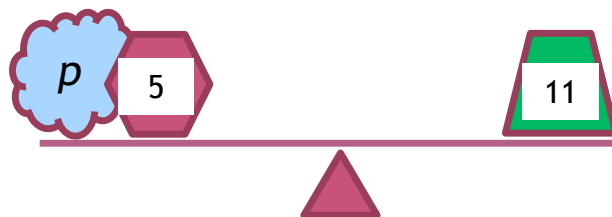
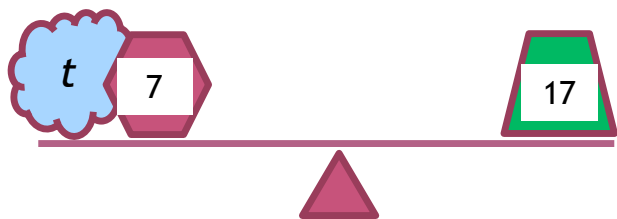
19) 19 -  = 4

10)  - 6 = 14

20) 23 -  = 8

# Writing and solving equations

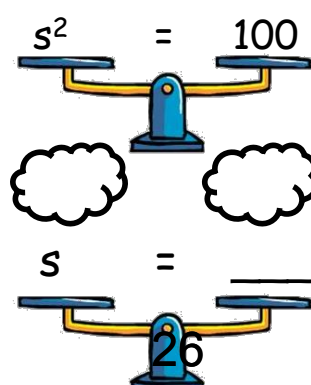
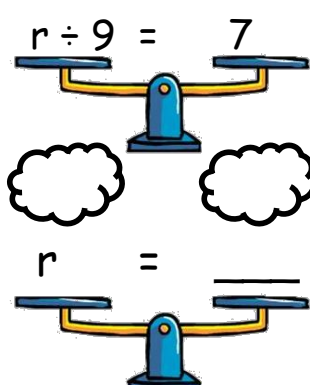
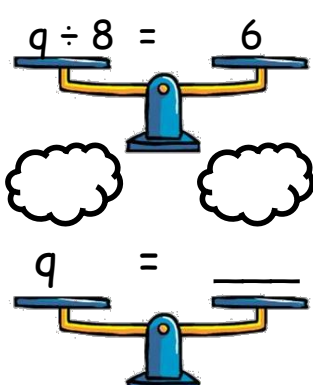
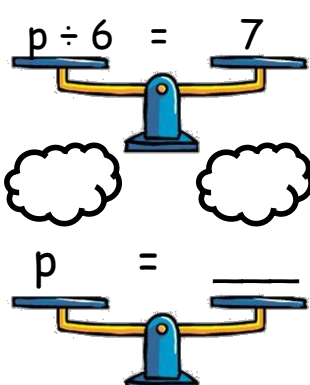
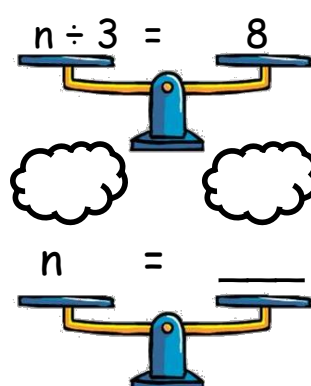
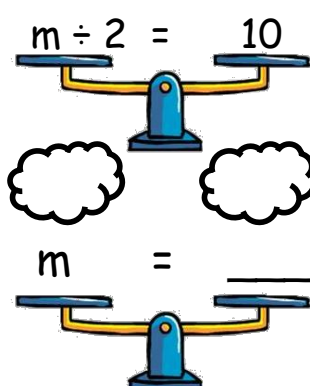
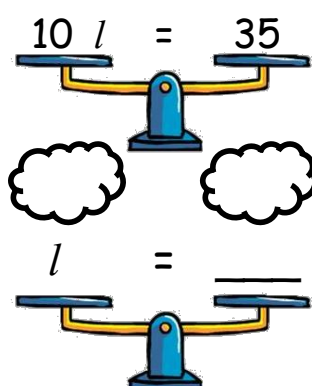
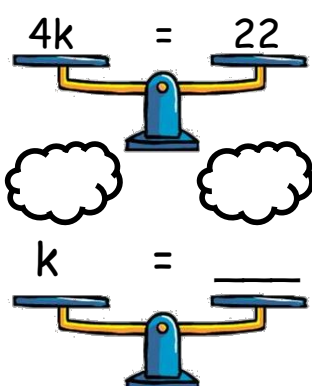
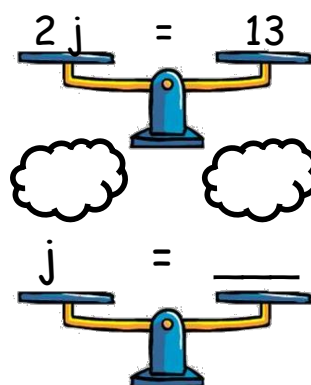
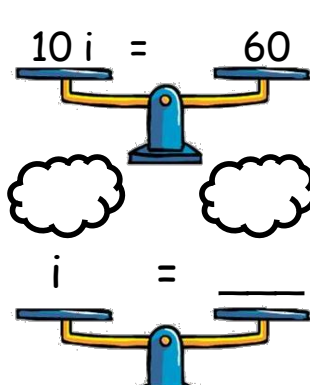
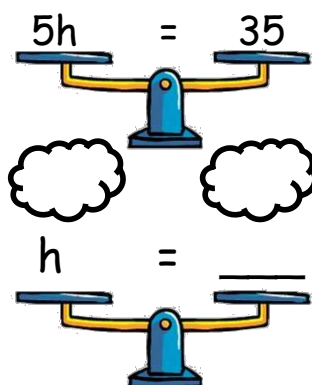
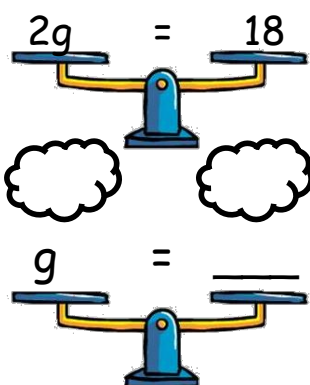
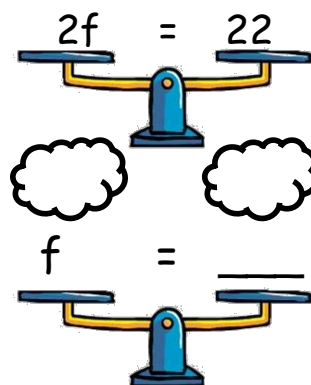
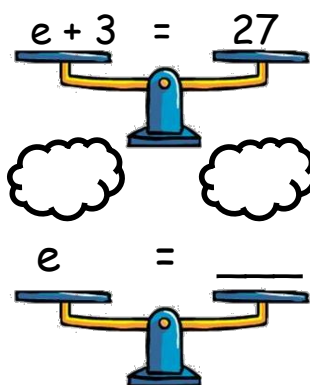
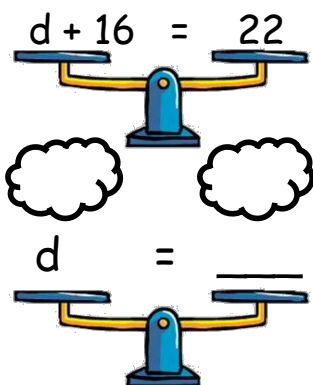
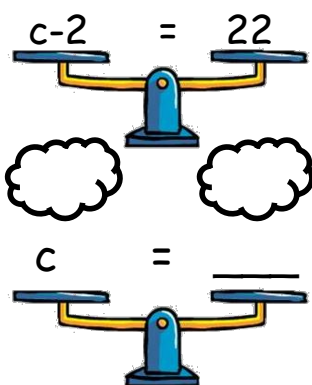
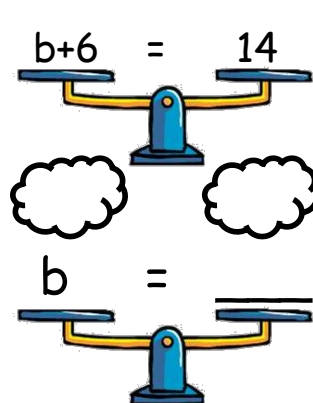
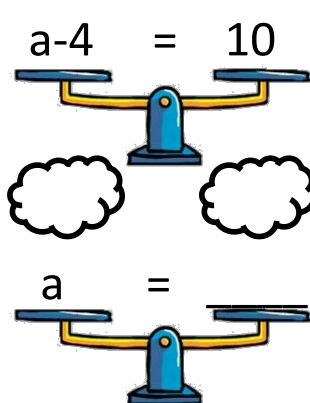
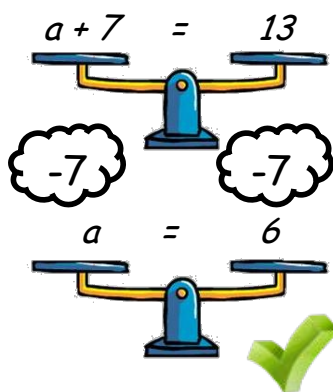
Write and then solve these equations.



## Solving Simple Equations - The Balancing Method

*Example:*

Inverse operations!  
Subtract 7 from both  
sides of the equation  
to keep the scales  
Balanced.



# Solving One Step Equations - Addition/Subtraction

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Look at these equations and give the value for the pronumeral	Now solve these equations showing working	The letter is on the right and so these need an extra line. Find the value of the letter.
1 $k + 8 = 10$ $k =$ _____	Examples $b + 15 = 85$ $a - 9 = 27$ $\quad -15 \quad -15$ $\quad +9 \quad +9$ $b = 70$ $a = 36$	Examples $16 = 5 + c$ $35 = e - 7$ $\quad -5 \quad -5$ $\quad +7 \quad +7$ $11 = c$ $42 = e$ $c = 11$ <small>Then reverse the equation</small> $e = 42$
2 $b + 3 = 15$ _____	24 $c + 15 = 22$ 25 $y + 11 = 28$ _____	44 $20 = f - 11$ 45 $19 = m + 4$ _____
3 $d + 4 = 9$ _____	26 $x - 9 = 34$ 27 $t - 7 = 18$ _____	46 $83 = r + 16$ 47 $12 = n - 36$ _____
4 $x + 20 = 60$ _____	28 $q - 20 = 17$ 29 $b + 10 = 11$ _____	48 $64 = 19 + k$ 49 $11 = m - 17$ _____
5 $t - 10 = 5$ _____	30 $n + 26 = 26$ 31 $d - 20 = 77$ _____	50 $87 = u - 51$ 51 $100 = a - 9$ _____
6 $m - 8 = 20$ _____	32 $r - 14 = 33$ 33 $a - 11 = 59$ _____	52 $33 = 18 + s$ 53 $56 = d - 24$ _____
7 $h + 9 = 30$ _____	34 $15 + g = 33$ 35 $w - 9 = 8$ _____	54 $75 = p + 55$ 55 $86 = 37 + x$ _____
8 $l - 20 = 70$ _____	36 $x - 12 = 38$ 37 $18 + c = 27$ _____	56 $11 = j - 11$ 57 $62 = 16 + t$ _____
9 $w - 15 = 104$ _____	38 $e + 7 = 103$ 39 $i - 56 = 11$ _____	_____
10 $s + 12 = 13$ _____	40 $37 + h = 80$ 41 $k - 8 = 109$ _____	_____
11 $u - 9 = 9$ _____	42 $d - 90 = 1$ 43 $u - 15 = 63$ _____	_____
12 $q + 7 = 23$ _____	_____	_____
13 $n - 100 = 40$ _____	_____	_____
14 $y + 22 = 30$ _____	_____	_____
15 $a + 16 = 50$ _____	_____	_____
16 $e - 7 = 6$ _____	_____	_____
17 $z - 11 = 5$ _____	_____	_____
18 $c - 10 = 94$ _____	_____	_____
19 $j + 3 = 101$ _____	_____	_____
20 $v + 35 = 100$ _____	_____	_____
21 $t - 4 = 24$ _____	_____	_____
22 $m - 17 = 4$ _____	_____	_____
23 $x + 11 = 100$ _____	_____	_____

# Solving equations

When two expressions are equal, this is called an **equation**.

An equation is in balance:  $x + 9 = 31$

An equation always has an equals sign.

The value of each side is the same

To **solve** an equation adjust each side to find the value of the variable.

Subtract 9 from each side:  $x + 9 = 31$  →  $x = 22$

## Example

Solve the equations

(a)  $y + 13 = 52$

$$\begin{array}{r} y + 13 = 52 \\ -13 \quad -13 \\ \hline y = 39 \end{array}$$

(b)  $p - 18 = 5$

$$\begin{array}{r} p - 18 = 5 \\ +18 \quad +18 \\ \hline p = 23 \end{array}$$

(c)  $7 = 4 + x$

$$\begin{array}{r} 7 = 4 + x \\ -4 \quad -4 \\ \hline 3 = x \\ x = 3 \end{array}$$

## Exercise 15.1

Solve the equation:

1  $x + 12 = 23$

2  $y - 6 = 11$

3  $m - 7 = 13$

4  $21 = y + 6$

5  $15 = t - 9$

6  $20 + y = 51$

7  $z - 32 = 53$

8  $r - 23 = 1$

9  $x - 1 = 7$

10  $p + 9 = 13$

11  $t - 15 = 6$

12  $q - 4 = 0$

13  $24 + x = 24$

14  $33 + y = 101$

15  $m - 45 = 7$

16  $x - 17 = 3$

17  $x - 4 = 2$

18  $c - 51 = 3$

19  $x - 11 = 2$

20  $17 + s = 23$

21  $34 = v + 7$

22  $13 + x = 31$

23  $m - 3 = 19$

24  $23 + y = 46$

# Solving One Step Equations - Multiplication

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<p>Look at these equations and give the value for the pronumeral</p> <p></p>	<p>Solve these equations only this time show your working out.</p> <p></p>	<p>38 <math>40a = 25</math>      39 <math>12v = 10</math></p>
<p>1 <math>4d = 8</math>      <math>d =</math> _____</p> <p>2 <math>6h = 12</math>      _____</p> <p>3 <math>5x = 45</math>      _____</p> <p>4 <math>9g = 36</math>      _____</p> <p>5 <math>10n = 120</math>      _____</p> <p>6 <math>7e = 42</math>      _____</p> <p>7 <math>8y = 56</math>      _____</p> <p>8 <math>5t = 55</math>      _____</p> <p>9 <math>11a = 44</math>      _____</p> <p>10 <math>9q = 18</math>      _____</p> <p>11 <math>3z = 39</math>      _____</p> <p>12 <math>2w = 30</math>      _____</p> <p>13 <math>5r = 15</math>      _____</p> <p>14 <math>15p = 45</math>      _____</p> <p>15 <math>4b = 28</math>      _____</p> <p>16 <math>6c = 36</math>      _____</p> <p>17 <math>2k = 48</math>      _____</p> <p>18 <math>9y = 90</math>      _____</p> <p>19 <math>30u = 180</math>      _____</p> <p>20 <math>15x = 60</math>      _____</p> <p>21 <math>2v = 34</math>      _____</p> <p>22 <math>7j = 84</math>      _____</p> <p>23 <math>5r = 0</math>      _____</p>	<p>Examples</p> <p><math>6p = 54</math>  <math>\begin{array}{r} +6 \\ +6 \\ \hline p = 9 \end{array}</math></p> <p><math>5d = 3</math>  <math>\begin{array}{r} +5 \\ +5 \\ \hline d = \frac{3}{5} \end{array}</math></p> <p>24 <math>3e = 36</math>      25 <math>9u = 4</math></p> <p>_____      _____</p> <p>26 <math>8a = 40</math>      27 <math>2w = 54</math></p> <p>_____      _____</p> <p>28 <math>11g = 9</math>      29 <math>17t = 7</math></p> <p>_____      _____</p> <p>30 <math>12c = 60</math>      31 <math>15x = 13</math></p> <p>_____      _____</p> <p>32 <math>20m = 9</math>      33 <math>7r = 42</math></p> <p>_____      _____</p> <p> These will have fraction answers that can be simplified</p> <p>34 <math>6j = 3</math>      35 <math>8d = 6</math></p> <p>_____      _____</p> <p>36 <math>15k = 9</math>      37 <math>20e = 12</math></p> <p>_____      _____</p>	<p>_____ <math>\frac{\quad}{\quad}</math>      _____ <math>\frac{\quad}{\quad}</math></p> <p>_____ <math>\frac{\quad}{\quad}</math>      _____ <math>\frac{\quad}{\quad}</math></p> <p>40 <math>24f = 6</math>      41 <math>20s = 16</math></p> <p>_____ <math>\frac{\quad}{\quad}</math>      _____ <math>\frac{\quad}{\quad}</math></p> <p>_____ <math>\frac{\quad}{\quad}</math>      _____ <math>\frac{\quad}{\quad}</math></p> <p>42 <math>30h = 12</math>      43 <math>35x = 28</math></p> <p>_____ <math>\frac{\quad}{\quad}</math>      _____ <math>\frac{\quad}{\quad}</math></p> <p>_____ <math>\frac{\quad}{\quad}</math>      _____ <math>\frac{\quad}{\quad}</math></p> <p> These can be changed from improper fractions to mixed numerals</p> <p>44 <math>4r = 9</math>      45 <math>3c = 11</math></p> <p>_____ <math>\frac{\quad}{\quad}</math>      _____ <math>\frac{\quad}{\quad}</math></p> <p>_____ <math>\frac{\quad}{\quad}</math>      _____ <math>\frac{\quad}{\quad}</math></p> <p>46 <math>8n = 35</math>      47 <math>14d = 33</math></p> <p>_____ <math>\frac{\quad}{\quad}</math>      _____ <math>\frac{\quad}{\quad}</math></p> <p>_____ <math>\frac{\quad}{\quad}</math>      _____ <math>\frac{\quad}{\quad}</math></p> <p>48 <math>11z = 50</math>      49 <math>4k = 33</math></p> <p>_____ <math>\frac{\quad}{\quad}</math>      _____ <math>\frac{\quad}{\quad}</math></p> <p>_____ <math>\frac{\quad}{\quad}</math>      _____ <math>\frac{\quad}{\quad}</math></p>

## Equations

Find the value of x

$5x = 30$

x =  .....

$7x = 21$

x =  .....

$2x = 10$

x =  .....

$3x = 30$

x =  .....

$4x = 20$

x =  .....

$6x = 24$

x =  .....

Find the value of x

$x + 8 = 20$

x =  .....

$x - 3 = 14$

x =  .....

$x + 5 = 12$

x =  .....

$x - 12 = 6$

x =  .....

$x + 7 = 13$

x =  .....

$x - 9 = 4$

x =  .....

$x + 4 = 32$

x =  .....

$x - 3 = 18$

x =  .....

$x + 6 = 25$

x =  .....

$x - 21 = 4$

x =  .....

$x + 11 = 14$

x =  .....

$x - 32 = 6$

x =  .....

I ..... solve equations.

I have found this .....

$X + 7 = 19$ <input type="text"/> <input type="text"/> $x =$	$3x - 9 = 24$ <input type="text"/> <input type="text"/> $\underline{\quad}x = \underline{\quad}$ <input type="text"/> <input type="text"/> $x =$	$4x - 9 = 43$
$X - 13 = 12$ <input type="text"/> <input type="text"/> $x =$	$9x + 3 = 39$ <input type="text"/> <input type="text"/> $\underline{\quad}x = \underline{\quad}$ <input type="text"/> <input type="text"/> $x =$	$5x - 18 = 73$
$2x + 4 = 16$ <input type="text"/> <input type="text"/> $\underline{\quad}x = \underline{\quad}$ <input type="text"/> <input type="text"/> $x =$	$5 + 4x = 37$ <input type="text"/> <input type="text"/> $\underline{\quad}x = \underline{\quad}$ <input type="text"/> <input type="text"/> $x =$	$8x + 19 = 75$
$3 + 2x = 17$ <input type="text"/> <input type="text"/> $\underline{\quad}x = \underline{\quad}$ <input type="text"/> <input type="text"/> $x =$	$6x - 5 = 67$ <input type="text"/> <input type="text"/> $\underline{\quad}x = \underline{\quad}$ <input type="text"/> <input type="text"/> $x =$	$6x + 13 = 67$
$2x - 7 = 15$ <input type="text"/> <input type="text"/> $\underline{\quad}x = \underline{\quad}$ <input type="text"/> <input type="text"/> $x =$	$3x - 7 = -1$ <input type="text"/> <input type="text"/> $\underline{\quad}x = \underline{\quad}$ <input type="text"/> <input type="text"/> $x =$	$10x + 7 = 11$ ★
$4x + 7 = 31$ <input type="text"/> <input type="text"/> $\underline{\quad}x = \underline{\quad}$ <input type="text"/> <input type="text"/> $x =$	$2x - 3 = 10$ <input type="text"/> <input type="text"/> $\underline{\quad}x = \underline{\quad}$ <input type="text"/> <input type="text"/> $x =$	$3x + 14 = 17$ ★

↑

**A little bit of  
thinking...**

↑

**A little bit  
more...**

↑

**Now you can do  
it yourself!**



## Further equations

### Exercise 15.2

Solve the equations:

**1**  $3y = 21$

**2**  $10m = 50$

**3**  $7y = 42$

**4**  $2x + 3 = 9$

**5**  $3y - 7 = 2$

**6**  $2x + 6 = 14$

**7**  $5y - 2 = 13$

**8**  $19 + 2z = 29$

**9**  $29 = 3x + 2$

**10**  $7 + 4y = 11$

**11**  $5m + 4 = 44$

**12**  $8y = 64$

**13**  $7z + 3 = 38$

**14**  $2 + 2c = 26$

**15**  $3x - 27 = 3$

**16**  $5g = 35$

**17**  $45 = 12 + 3x$

**18**  $22 + 8x = 38$

**19**  $7x + 6 = 62$

**20**  $5y - 35 = 0$

**21**  $12x + 19 = 43$

**22**  $40 = 8y$

**23**  $4z - 12 = 16$

**24**  $62 = 12x + 2$

**25**  $11c - 9 = 46$

**26**  $8m - 2 = 22$

**27**  $20 + 16t = 100$

**28**  $60 = 3x + 24$

**29**  $7y - 6 = 29$

**30**  $120 = 5y - 30$

**31**  $10p - 21 = 39$

**32**  $7s + 18 = 46$

**33**  $17 = 2s + 1$

**34**  $5z + 3 = 48$

**35**  $20x - 7 = 53$

**36**  $32 + 3z = 41$

**Solving Simple Equations 1 - EXERCISES**

Solve these equations, showing full working

1)  $a + 5 = 6$

2)  $b + 7 = 12$

3)  $c - 4 = 8$

4)  $d - 11 = 5$

5)  $a + 7 = 3$

6)  $b + 4 = 2$

7)  $c - 6 = 3$

8)  $d - 5 = 5$

9)  $2a + 3 = 5$

10)  $3b + 5 = 20$

11)  $4c - 4 = 12$

12)  $5d - 10 = 20$

13)  $3a + 3 = -6$

14)  $4b + 6 = -2$

15)  $5c - 5 = -20$

16)  $6d - 3 = 3$

17)  $3a - 1 = 1$

18)  $4b - 2 = -3$

19)  $5c + 6 = 8$

20)  $6d + 2 = 7$

21)  $3a - 4 = 4$

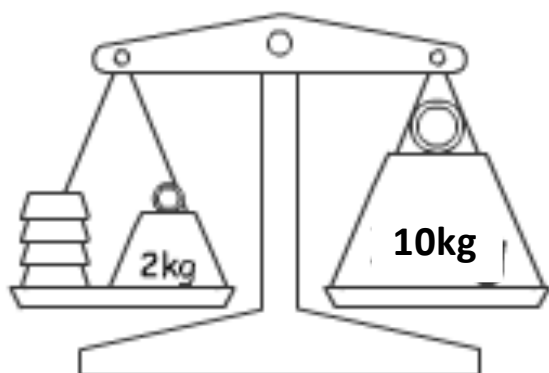
22)  $4b - 5 = 6$

23)  $5c + 4 = 10$

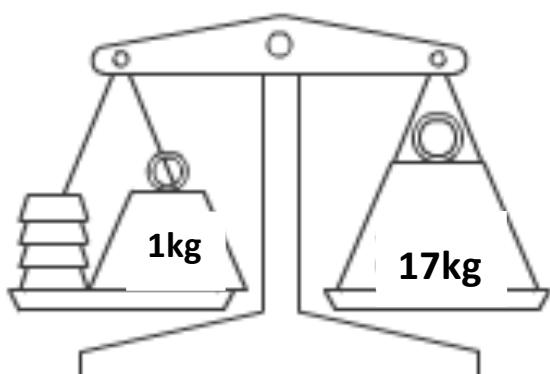
24)  $6d + 3 = 14$

**UNSURE**

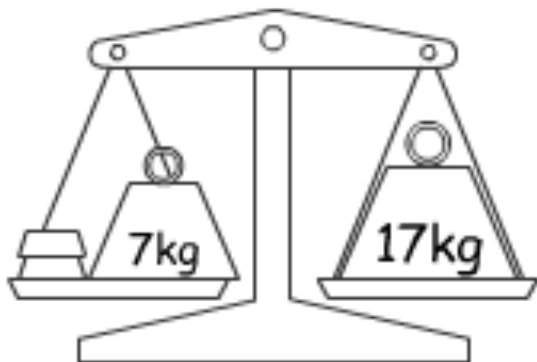
Can you find the missing weights?



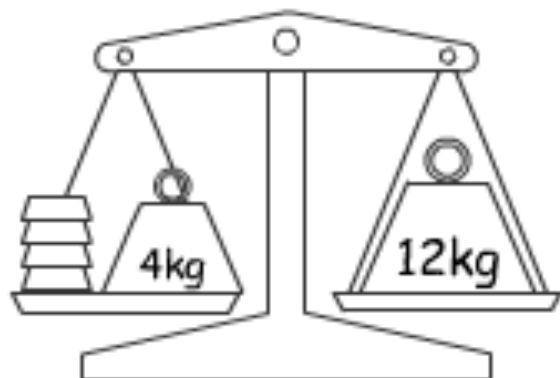
Each missing weight is .....



Each missing weight is .....



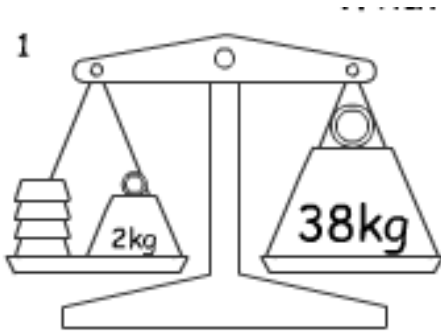
Each missing weight is .....



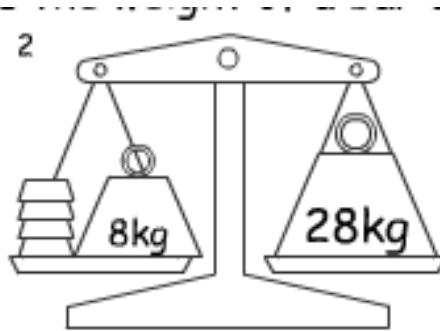
Each missing weight is .....

**CONFIDENT**

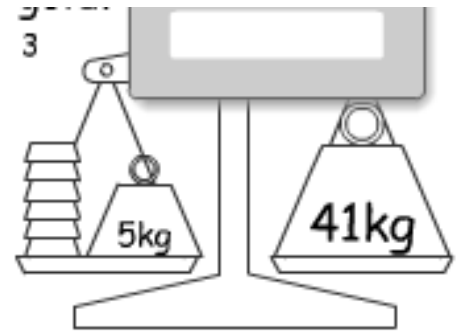
Can you find the missing weights?



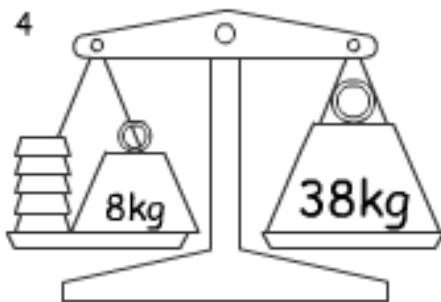
Each missing weight is .....



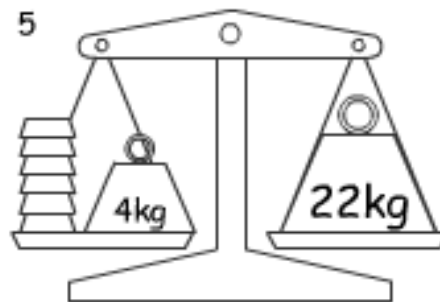
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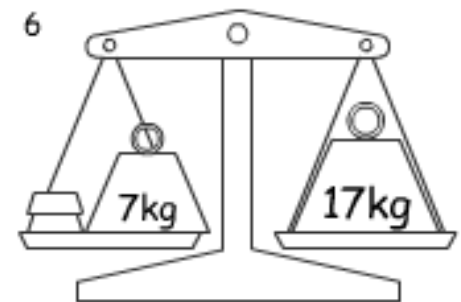
Each missing weight is .....



Each missing weight is .....

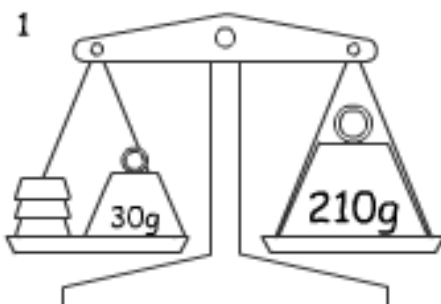


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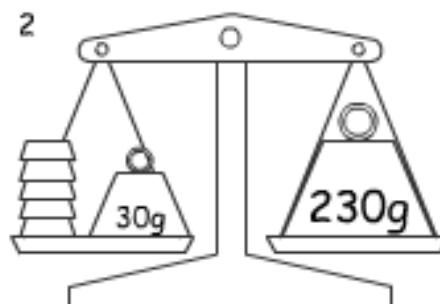


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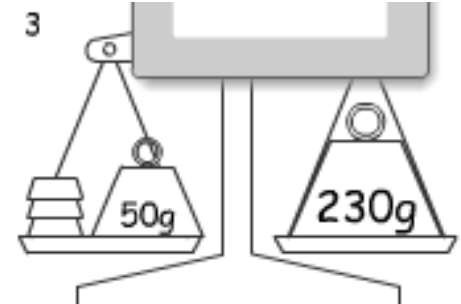
**CHALLENGE**



Each missing weight is .....

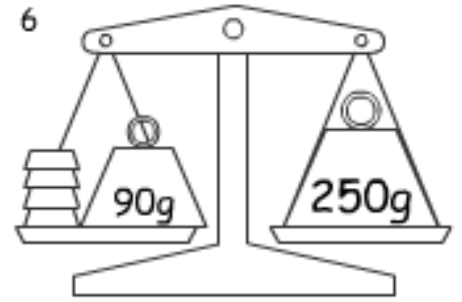
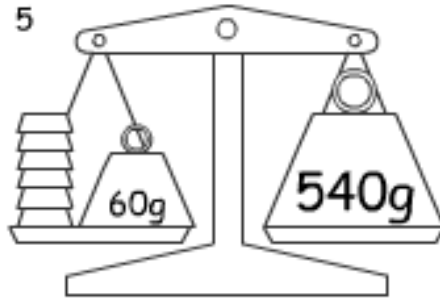
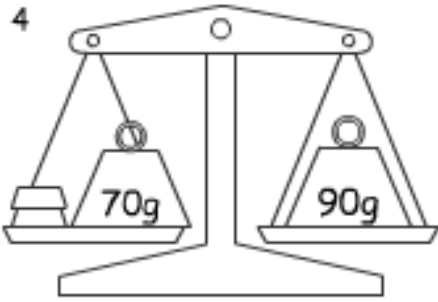


Each missing weight is .....



Each missing weight is .....

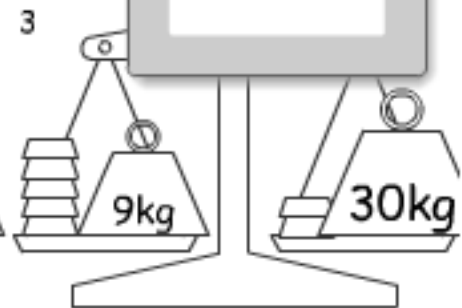
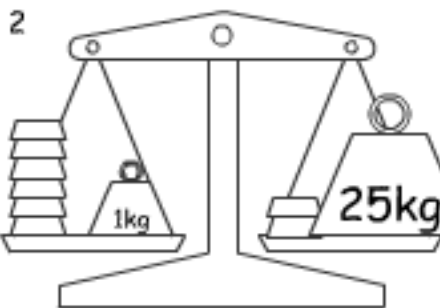
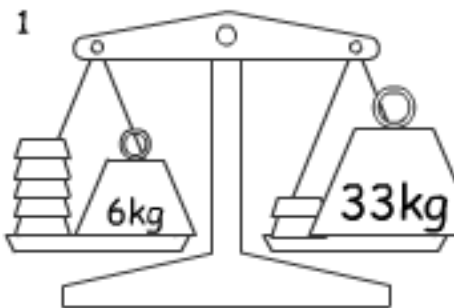
**EXTRA CHALLENGE**



Each missing weight is .....

Each missing weight is .....

Each missing weight is .....

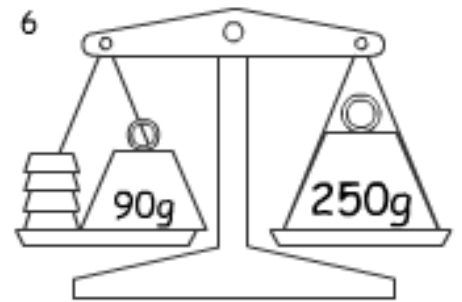
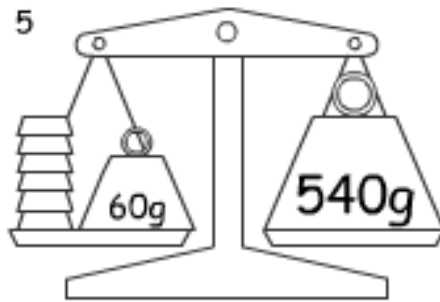
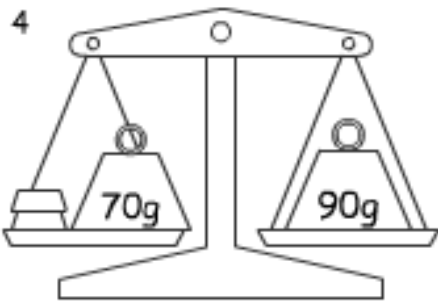


Each missing weight is .....

Each missing weight is .....

Each missing weight is .....

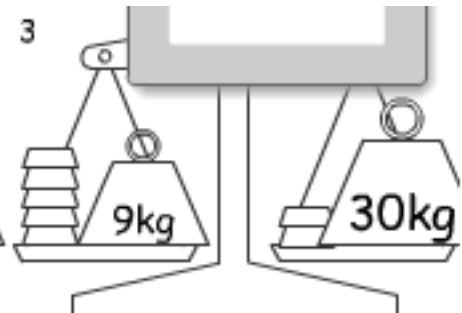
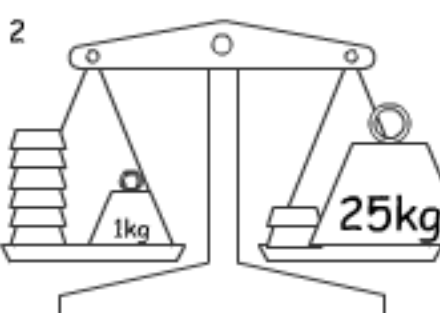
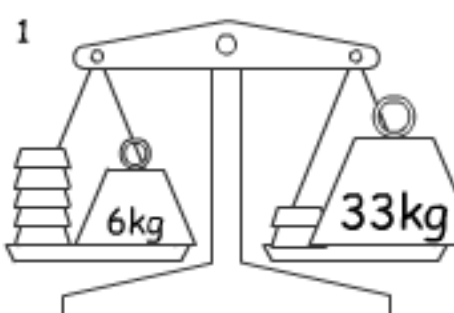
**EXTRA CHALLENGE**



Each missing weight is .....

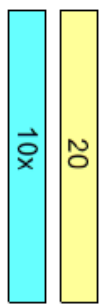
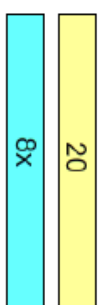
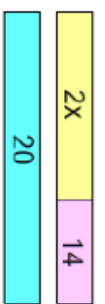
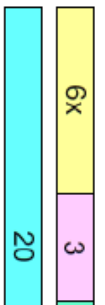
Each missing weight is .....

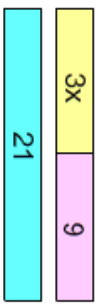
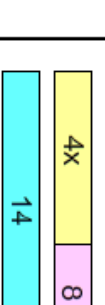
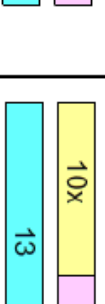
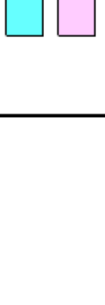
Each missing weight is .....



**Solving Equations**

For each picture, write an equation to describe it and then solve it. \*\*\*\*\*NOTE! The pictures are not drawn to scale\*\*\*\*\*

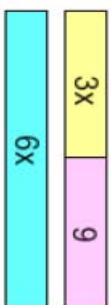
Picture 	Picture 	Picture 	Picture 
Equation	Equation	Equation	Equation
Solution <b>X =</b>	Solution	Solution	Solution

Picture 	Picture 	Picture 	Picture 
Equation	Equation	Equation	Equation $2x + 17 = 27$
Solution	Solution	Solution	Solution

**Jumbled Answers: X = 4 0.5 1.5 1.5 2.5 3 5 2**

Picture	Picture	Picture	Picture
Equation $8x + 5 = 25$	Equation $10x + 2 = 12$	Equation $5x - 6 = 19$	Equation $4x - 2 = 8$
Solution	Solution	Solution	Solution




Picture	Picture	Picture	Picture
Equation $8x - 7 = 9$	Equation $6x - 2 = 7$	Equation	Equation
Solution	Solution	Solution	Solution



**Jumbled Answers:** X= 1 2.5 2 2.5 3 5 1.5 6

# Solving One Step Equations - Division

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 Find the value for the letter that will make these equations true.	 Now solve these equations showing working	 Use the same method only this time the questions involve decimals
1 $\frac{d}{2} = 5$ $d =$ _____	Examples $\frac{d}{7} = 8$ $\frac{v}{11} = 5$ $\times 7$ $\times 11$ $d = 56$ $v = 55$	Examples $\frac{k}{4} = 3.2$ $\frac{n}{2.1} = 5$ $\times 4$ $\times 2.1$ $k = 12.8$ $n = 10.5$
2 $\frac{t}{6} = 3$ _____	17 $\frac{x}{9} = 6$ 18 $\frac{h}{15} = 3$	33 $\frac{a}{2} = 3.4$ 34 $\frac{e}{4.3} = 3$
3 $\frac{b}{4} = 3$ _____	19 $\frac{q}{12} = 10$ 20 $\frac{c}{7} = 9$	35 $\frac{h}{7.1} = 6$ 36 $\frac{t}{3} = 5.2$
4 $\frac{c}{5} = 3$ _____	21 $\frac{k}{5} = 15$ 22 $\frac{w}{20} = 4$	37 $\frac{n}{2.9} = 7$ _____
5 $\frac{f}{6} = 4$ _____	23 $\frac{n}{6} = 21$ 24 $\frac{b}{10} = 17$	38 $\frac{q}{4.7} = 5$ _____
6 $\frac{n}{10} = 4$ _____	25 $\frac{m}{53} = 2$ 26 $\frac{d}{4} = 25$	39 $\frac{t}{3} = 9.6$ _____
7 $\frac{p}{7} = 3$ _____	27 $\frac{y}{31} = 3$ 28 $\frac{a}{5} = 40$	40 $\frac{b}{0.8} = 4$ _____
8 $\frac{q}{6} = 8$ _____	29 $\frac{p}{4} = 12$ 30 $\frac{e}{10} = 13$	41 $\frac{k}{5} = 7.4$ _____
9 $\frac{k}{5} = 10$ _____	31 $\frac{f}{9} = 8$ 32 $\frac{h}{6} = 30$	_____
10 $\frac{j}{2} = 9$ _____	_____	_____
11 $\frac{v}{3} = 8$ _____	_____	_____
12 $\frac{m}{12} = 3$ _____	_____	_____
13 $\frac{y}{8} = 4$ _____	_____	_____
14 $\frac{h}{7} = 6$ _____	_____	_____
15 $\frac{r}{2} = 17$ _____	_____	_____
16 $\frac{u}{20} = 8$ _____	_____	_____



**Exercise 1**

1. Copy the equation and find the value of  $x$  by solving these equations :-

a  $x + 2 = 6$

b  $x + 5 = 11$

c  $x + 6 = 13$

d  $x + 7 = 20$

e  $x - 1 = 6$

f  $x - 2 = 21$

g  $x - 20 = 0$

h  $x - 30 = 20$

i  $x + 7 = 7$

j  $x - 8 = 0$

k  $x + 12 = 13$

l  $x - 50 = 50$

m  $7 - x = 2$

n  $4 + x = 9$

o  $8 - x = 0$

p  $25 + x = 60$

q  $14 - x = 11$

r  $35 + x = 35$

Remember that  $4x$  means  $4 \times x$ .

Three examples are shown opposite of solving equations involving multiplication.

$$4x = 40$$

$$x = 10$$

$$7x = 21$$

$$x = 3$$

$$9x = 45$$

$$x = 5$$

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

a  $3x = 15$

b  $4m = 28$

c  $5p = 40$

d  $7q = 21$

e  $6t = 36$

f  $8a = 80$

g  $3b = 33$

h  $8d = 56$

i  $2x = 9$

j  $2p = 21$

k  $4p = 18$

l  $6m = 27$

m  $10x = 55$

n  $8t = 12$

o  $14p = 21$

p  $20b = 70$

q  $100c = 150$

r  $2n = 19$

## Exercise 2

1. Find the value of  $x$  by solving these equations :-

Set down your working carefully.

a  $2x + 3 = 5$

b  $3x + 6 = 21$

c  $4x + 7 = 23$

d  $5x + 2 = 42$

e  $2x - 4 = 6$

f  $3x - 3 = 24$

g  $4x - 1 = 35$

h  $3x - 6 = 0$

i  $6x - 1 = 53$

j  $7x - 2 = 68$

k  $8x + 4 = 28$

l  $9x - 2 = 61$

m  $2x - 12 = 2$

n  $4x + 10 = 22$

o  $5x + 20 = 20$

p  $3x - 5 = 55$

q  $7x - 7 = 0$

r  $2x - 5 = 0$

s  $5x - 1 = 24$

t  $4x + 5 = 19$

u  $6x - 3 = 24$

2. Look at the picture showing 2 rods end to end :-



- a Write down an expression, in terms of  $x$ , for the total length of the 2 rods.
- b Given that the total length of the rods is actually 14 centimetres :-
- (i) make up an equation involving  $x$ .
- (ii) solve it to find the value of  $x$ .
3. I've got 30p and David told me he has  $x$  p. Together we have 42p.
- a Make up an equation using this information.
- b Now solve it to determine how much David has.
4. There were  $x$  marbles in a bag. 7 were removed and I found that there were then 14 left.
- a Make up an equation about the marbles.
- b Now solve it to determine how many there were to begin with.



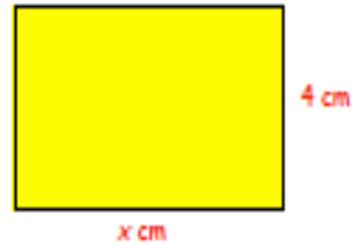
5. To find the area of a rectangle you **multiply** its length by its breadth.

a Write down an expression for the area of this rectangle in terms of  $x$ .

b If the actual area is  $24 \text{ cm}^2$ ,

(i) write down an equation involving  $x$ ,

(ii) solve it to find the value of  $x$ .



6. Find the value of  $x$  in each case :-

a  $\frac{1}{2}x = 7$

b  $\frac{1}{3}x = 9$

c  $\frac{1}{4}x = 20$

d  $\frac{1}{6}x = 10$

e  $\frac{1}{10}x = 5$

f  $\frac{1}{8}x = 12$

g  $\frac{1}{6}x = 11$

h  $\frac{1}{6}x = 20$

i  $\frac{1}{2}x = 3\frac{1}{2}$

j  $\frac{1}{2}x + 1 = 6$

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

l  $\frac{1}{4}x - 8 = 1$

m  $\frac{1}{2}x - 2 = 1$

n  $\frac{1}{6}x + 1 = 3$

o  $\frac{1}{10}x - 10 = 10$



# GOT IT!

Solve:

1.  $x - 1 = 4$     7.  $h - 2 = 7$

2.  $y + 1 = 4$     8.  $x + 3 = 8$

3.  $d - 4 = 3$     9.  $y - 7 = 1$

4.  $k - 6 = 1$     10.  $g - 8 = 0$

5.  $r + 5 = 10$     11.  $c - 9 = 7$

6.  $p - 3 = 5$     12.  $d + 2 = 2$



Extension Task:  
Create your own equations for your classmate to solve.



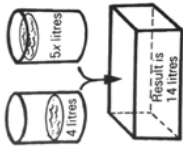
# SMASHED IT!

Form an equation and solve:

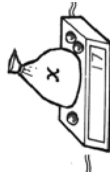
1.



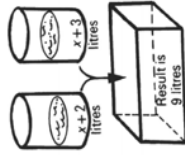
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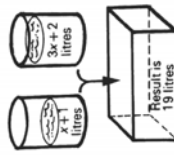
7.



3.



8.



4.



9.

5.



10.



# MASTERED IT!

1.  $3x + 2x = 20$

2.  $6t + 6 + t = 27$

3.  $8d + 2 - d + 3 = 19$

4.  $3u - 6 + 2u = 4$

5.  $46 = 3f - 2 + 5f$

6.  $54 = 17 + 3n + 2 + 2n$

7.  $17y + 56 = 56$

8.  $2r + 1 = 21$

9.  $9d + 10 = 64$

10.  $6a = 9$

11.  $12a - 35 = 5a$

12.  $20x - 18 = 12x + 30$



Extension Task:  
Create your own equations for your classmate to solve.

## Workout

Question 1: Solve the following equations

(a)  $w + 5 = 7$       (b)  $c + 2 = 10$       (c)  $a - 1 = 6$       (d)  $x - 4 = 5$

(e)  $x + 4 = 13$       (f)  $3w = 12$       (g)  $2x = 18$       (h)  $\frac{w}{2} = 6$

(i)  $\frac{x}{4} = 7$       (j)  $5y = 30$       (k)  $x + 10 = 40$       (l)  $2x = 34$

(m)  $x - 9 = 7$       (n)  $\frac{m}{6} = 8$       (o)  $w - 15 = 35$       (p)  $\frac{x}{10} = 5$

(q)  $11y = 55$       (r)  $2x = 11$       (s)  $b + 6 = 4$       (t)  $\frac{x}{3} = 1.5$

(u)  $4y = 10$       (v)  $10g = 37$       (w)  $a - 7 = -3$       (x)  $v + 2 = -6$

(y)  $\frac{w}{4} = 2.7$       (z)  $5y = 24$

Question 2 Solve the following equations

(a)  $2x + 3 = 9$       (b)  $3w - 1 = 14$       (c)  $7y + 2 = 30$

(d)  $5x + 20 = 35$       (e)  $6c - 12 = 48$       (f)  $8m - 4 = 20$

(g)  $7w + 13 = 90$       (h)  $12p - 18 = 30$       (i)  $9w - 5 = 67$

(j)  $10a + 40 = 100$       (k)  $9x - 24 = 84$       (l)  $7w + 1 = 1$

(m)  $6x - 19 = 5$       (n)  $3w + 4 = 43$       (o)  $\frac{x}{3} + 1 = 5$

(p)  $\frac{c}{2} - 4 = 6$       (q)  $\frac{x}{10} + 3 = 9$       (r)  $\frac{n}{9} - 8 = 1$

(s)  $\frac{x}{4} - 7 = 14$       (t)  $\frac{c}{3} + 8 = 40$       (u)  $\frac{x}{5} - 26 = 19$

Question 3: Solve the following equations

(a)  $2m + 8 = 15$

(b)  $10w - 3 = 45$

(c)  $4x + 5 = 7$

(d)  $5w + 11 = 19$

(e)  $8x + 2 = 30$

(f)  $4x + 11 = 3$

(g)  $6w + 20 = 2$

(h)  $2w - 9 = -6$

(i)  $3c + 8 = -13$

(j)  $\frac{x}{3} + 6 = 1$

(k)  $\frac{w}{2} + 8 = 3$

(l)  $\frac{m}{8} + 7 = -1$

(m)  $\frac{1}{2}x + 3 = 15$

(n)  $\frac{1}{4}m - 7 = 2$

(o)  $\frac{1}{3}x - 2 = -6$

Question 4: Solve the following equations

(a)  $\frac{x+1}{2} = 9$

(b)  $\frac{x-3}{4} = 8$

(c)  $\frac{m-8}{5} = 3$

(d)  $\frac{2x}{3} = 6$

(e)  $\frac{3x}{5} = 30$

(f)  $\frac{5x}{4} = 20$

(g)  $\frac{2x}{7} + 2 = 12$

(h)  $\frac{8x}{3} - 9 = 7$

(i)  $\frac{3x}{10} - 4 = 8$

(j)  $\frac{10m+20}{15} = 6$

(k)  $\frac{2x+5}{3} = 7$

(l)  $\frac{7x-5}{10} = 10$

Question 5: Solve the following equations

(a)  $16 - y = 5$

(b)  $5 + x = 13$

(c)  $10 - 3x = 1$

(d)  $38 - 4m = 14$

(e)  $9 + 7x = 51$

(f)  $11 - 5x = 21$

(g)  $18 - 3a = 6$

(h)  $21 = 7 + 4f$

(i)  $44 = 58 - 8g$

## Workout

Question 1: I think of a number.  
I multiply the number by 3 and then add 5.  
The answer is 29.

- (a) Form an equation in terms of  $x$ .
- (b) Solve the equation to find the original number.

Question 2: I think of a number.  
I multiply the number by 5 and then subtract 2.  
The answer is 58.

- (a) Form an equation in terms of  $x$ .
- (b) Solve the equation to find the original number.

Question 3: I think of a number.  
I divide the number by 2 and then add 1.  
The answer is 7.

- (a) Form an equation in terms of  $x$ .
- (b) Solve the equation to find the original number.

Question 4: Gregory is  $x$  years old.  
Daisy is 2 years older than Gregory  
The sum of their ages is 40.



- (a) Form an equation in terms of  $x$
- (b) Solve the equation and work out Gregory's and Daisy's ages.

Question 5: Robert is  $x$  years old.  
Hannah is 7 years younger than Robert  
The sum of their ages is 61.

- (a) Form an equation in terms of  $x$
- (b) Solve the equation and work out Robert's and Hannah's ages.

## Equations: Forming and Solving

### Video 115 on Corbettmaths

Question 6: Michael is  $x$  years old.  
Jenny is twice as old as Michael  
The sum of their ages is 57.

- (a) Form an equation in terms of  $x$
- (b) Solve the equation and work out Michael's and Jenny's ages.

Question 7: Fiona is  $x$  years old.  
Thomas is 3 years older than Fiona.  
Cara is twice as old as Fiona.  
The sum of their ages is 51.

- (a) Form an equation in terms of  $x$
- (b) Solve the equation and work out Fiona's, Thomas's and Cara's ages.

Question 8: Alan is  $x$  years old.  
Barry is ten years younger than Alan.  
Kevin is double Alan's age.  
The sum of their ages is 54.

- (a) Form an equation in terms of  $x$
- (b) Solve the equation and work out Alan's, Barry's and Kevin's ages.

Question 9: Rebecca is  $x$  years old.  
Mary is 8 years older than Rebecca.  
Jill is three times older than Mary.  
The sum of their ages is 67.

- (a) Form an equation in terms of  $x$
- (b) Solve the equation and work out Rebecca's, Mary's and Jill's ages.

Question 10: Andy has  $x$  pence.  
Kelly has 7 pence more than Andy.  
Georgia has 9 pence less than Andy.  
The total amount of money they have is £1.48



- (a) Form an equation in terms of  $x$
- (b) Solve the equation and work out how much money each has.



## Equations: Forming and Solving

Video 115 on Corbettmaths

Question 11: Billy has  $x$  pounds.

Liam has twice as much money as Billy.

Nicola has three times as much money as Liam.

The total amount of money they have is £180

- (a) Form an equation in terms of  $x$
- (b) Solve the equation and work out how much money each has.

Question 12: Farmer Jones has  $x$  sheep

Farmer Smith has 100 more sheep than Farmer Jones.

Farmer White has twice as many sheep as Farmer Jones.

In total there are 2500 sheep.



- (a) Form an equation in terms of  $x$
- (b) Solve the equation and work out how many sheep each farmer has.

Question 13: The cost of a TV is £ $x$

The cost of a DVD player is £45 less than a TV.

The total cost of the TV and DVD player is £235

- (a) Form an equation in terms of  $x$
- (b) Find the cost of a TV

Question 14: The sum of three consecutive numbers is 51.

- (a) Form an equation in terms of  $x$
- (b) Solve the equation and work out each number.

Question 15: The sum of five consecutive numbers is 110.

- (a) Form an equation in terms of  $x$
- (b) Solve the equation and work out each number.

Question 16: A rectangular field is 7 metres longer than wide.

The perimeter of the field is 106m.

- (a) Find the dimensions of the field.
- (b) Find the area of the field.

Question 17: A rectangular field is 20 metres longer than wide.

The perimeter of the field is 280m.

- (a) Find the dimensions of the field.
- (b) Find the area of the field.

# Using equations

## Exercise 15.4

Express each problem as an equation. Solve the equation.

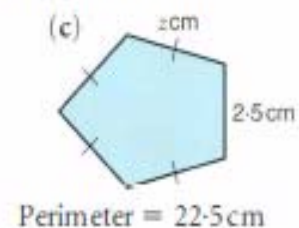
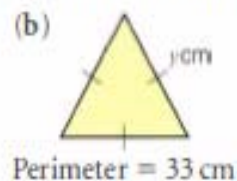
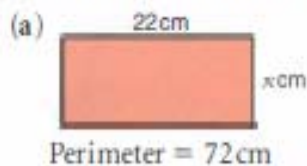
- 1 When 5 is added to  $p$  the result is 19. Find  $p$ .
- 2 When 13 is subtracted from  $x$  the result is 5. Find  $x$ .
- 3 When 31 is subtracted from  $q$  this leaves 16. Find  $q$ .
- 4 The product of 8 and  $x$  is 64. What number is  $x$ ?
- 5 The quotient of 28 and  $x$  is 7. Find  $x$ .
- 6 The quotient of 54 and  $z$  is 9. What number is  $z$ ?
- 7 There are  $n$  passengers on a bus. 6 get off at a bus stop. If 25 passengers remain on the bus, what number is  $n$ ?
- 8 When  $m$  is multiplied by itself the result is 81. Find  $m$ .
- 9 The sum of  $y$  and 13 is 52. What is the value of  $y$ ?
- 10 The product of 9 and  $z$  is 63. What is the value of  $z$ ?
- 11 The quotient of 36 and  $x$  is 2. What is the value of  $x$ ?
- 12 A teacher gives  $x$  coloured pencils each to 8 girls. He gives away 56 pencils in total. How many pencils did each girl receive?
- 13 A rectangle is 8 centimetres long and  $y$  centimetres wide. If the area of the rectangle is 40 square centimetres, find the width.
- 14 The area of a square is 121 square metres. If its length is  $x$  metres, find the value of  $x$ .

Multiply to find the product.

Divide to find the quotient.



- 15 Form an equation for each perimeter and solve it to find the missing dimension.



- 16 Susan has 6 bags of marbles each containing  $y$  marbles. She also has 3 loose marbles. In total she has 57 marbles. How many are there in each bag?
- 17 Colin employs 8 workers each earning  $m$  pounds per week. He has extra payroll costs of £120 per week. If his total pay costs each week are £2120, find the value of  $m$ .



# Solving Equations

## Video 110 on Corbettmaths

### Apply

Question 1: The equation  $9x = 27$  has an answer of  $x = 3$ .  
Write down five different equations with an answer of  $x = 3$ .

Question 2: Ronald is  $x$  years old.  
His friend Colin is 3 years older than than Ronald.  
Colin is 19 years old.  
(a) Write down an equation for this information.  
(b) Solve your equation to find how old Ronald is.

Question 3: Hannah is  $n$  years old.  
Her aunt Emily is three times older than Hannah.  
Emily is 48 years old.  
(a) Write down an equation for this information.  
(b) Solve your equation to find how old Ronald is.

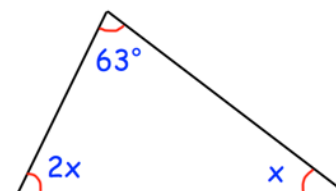


Question 4: Sam thinks of a number,  $n$ .  
He multiplies his number by 7 and then adds 3 to the result.  
His final answer is 45.  
(a) Write down an equation for this information.  
(b) Solve your equation to find the number,  $n$ .

Question 5: A rectangular field has a perimeter of 150m.  
The field is 15 metres longer than it is wide.  
The width of the field is  $x$  metres.  
(a) Write down an equation for this information.  
(b) Solve your equation to find the width of the field  
(c) Find the length of the field



Question 6: Shown is a triangle.  
The three angles add up to give  $180^\circ$   
(a) Write down an equation for this information  
(b) Solve your equation to find  $x$ .



Question 7: The sum of each row is given.  
Find  $a$ ,  $b$ ,  $c$  and  $d$ .

$a$	$a$	$a$	$a$	24
$a$	$a$	$b$	$b$	28
$b$	$c$	$c$	$c$	29
$a$	$b$	$c$	$d$	31

## Solving Equations

Answer the questions in your exercise book, writing out the question each time.

You must attempt at least 5 questions and the challenge question before moving on to the next section.

### ***Step 1: I can solve simple equations by looking at them***

1.  $x + 4 = 9$

2.  $y + 7 = 16$

3.  $3 + x = 9$

4.  $a - 4 = 2$

5.  $2w = 44$

6.  $9 = g + 7$

7.  $10 = d - 3$

8.  $3z = 18$

9.  $1 = k + 2$

10.  $11 = x + 23$

11.  $c + 8 = 7$

12.  $c - 3 = 7$

13.  $7p = 77$

14.  $f \div 2 = 6$

15.  $10 = w \div 3$

**CHALLENGE QUESTION:**  $-30 = 2m$

### ***Step 2: I can understand and apply a method to solving equations.***

1.  $3x + 1 = 13$

2.  $5a - 3 = 27$

3.  $2x - 3 = 13$

4.  $2y + 4 = 10$

5.  $3 + 2x = 27$

6.  $9 + 6x = 33$

7.  $44 = 5m + 4$

8.  $59 = 11a + 4$

9.  $51 = 6c - 3$

10.  $17 + 7x = 24$

11.  $5t + 13 = 78$

12.  $112 = 4 + 9f$

13.  $92 = 9r - 7$

14.  $14d - 20 = 50$

15.  $5t + 12 = 12$

**CHALLENGE QUESTION:**  $\frac{r}{6} - 7 = 2$

### ***Step 3: I can confidently apply a method to solving equations when the answer is not a positive integer.***

1.  $2x + 8 = 2$

2.  $3 = 6p + 21$

3.  $3x + 8 = 12$

4.  $15 = 6v + 7$

5.  $7 = 9k + 25$

6.  $23 = 49 - 7x$

7.  $2 = 3e + 17$

8.  $8 = 8 - 3h$

9.  $14 = 7 + 3g$

10.  $8 = 4n + 5$

11.  $6 - 3d = 15$

12.  $9 - 2a = 17$

13.  $20 - 2t = 30$

14.  $9 - 7j = 22$

15.  $5d + 12 = 3$

**CHALLENGE QUESTION:**  $3r + 9 = 2$

**Step 4: I can form equations from a word problem and solve them.**

Example:

A gardener plants  $m$  cabbages. He plants 5 more turnips than cabbages.

a) Write an expression for the number of turnips.

a.  $m + 5$

b) The gardener has planted 15 vegetables altogether. How many cabbages did he plant?

b. In total, he has  $m$  cabbages and  $m + 5$  turnips.

$$m + m + 5 = 15$$

$$2m + 5 = 15$$

$$2m + 5 - 5 = 15 - 5$$

$$2m = 10$$

$$m = 5$$

1. Sally has  $f$  bags of lego. Each bag contains 22 blocks.

a) Write an expression for the number of lego blocks Sally has.

b) John gives her 9 extra blocks. Write an expression for the number of blocks Sally now has.

c) Sally counts and has 119 blocks. Use this information to form an equation and work out how many bags of lego Sally started with.

2. Michael gets paid  $\pounds y$  per week for his paper round. After four weeks he gets paid, but  $\pounds 2$  is deducted for lateness.

a) Write an expression for the amount Michael gets paid.

b) When he opens his pay packet, he finds he has been paid  $\pounds 22$ . Write and solve an equation to find out how much Michael is paid per week.

3. A sports team is taken to a competition in  $p$  cars. Each car contains 4 members of the team, except for the last car which only contains 1 team member.

a) Write an expression for the number of people in the team.

b) The manager checks names off as car arrive and all 17 players arrive. Write and solve an equation to find out how many cars were full.

c) How many cars were used in total?

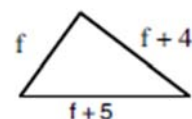
4. Sarah thinks of a number,  $x$ . She doubles it and subtracts 5. She gets 27. What was her original number?

5. A triangular playground has its sides measured. The sides are  $f$  metres,  $f + 4$  metres and  $f + 5$  metres.

a) Write an expression for the perimeter of the playground.

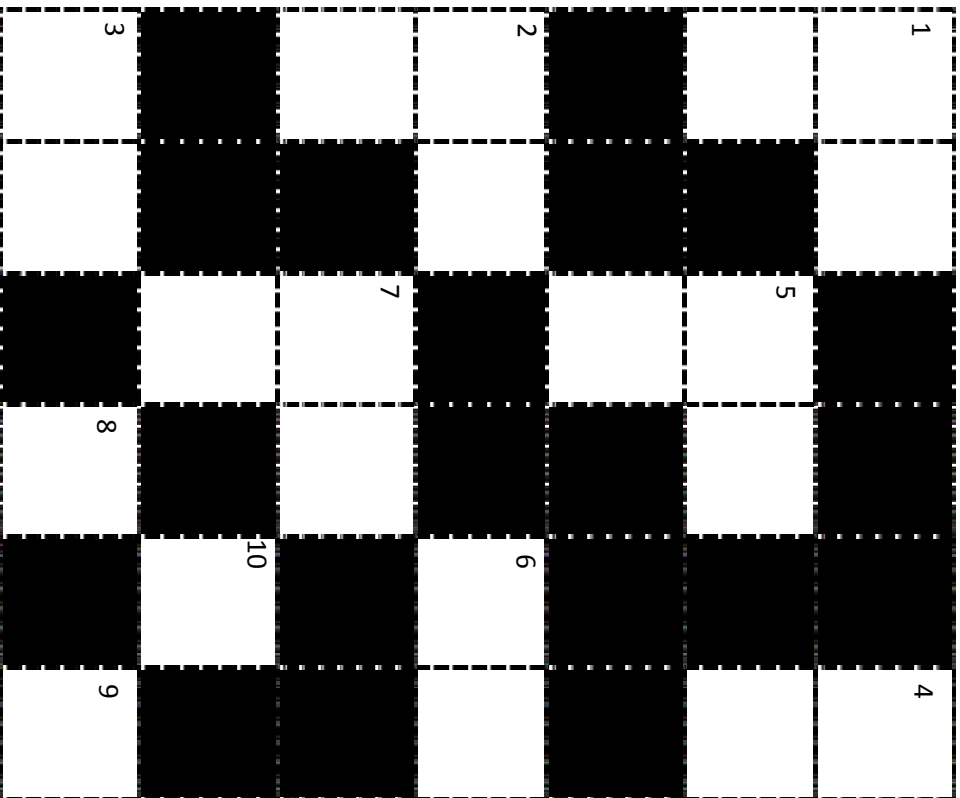
b) The perimeter is 51 metres. Form a suitable equation using this information.

c) What are the lengths of all three sides of the playground?



$n \div 8 = 2$	$4n = 20$	$12 - n = 9$	$6n = 18$	$24 \div n = 4$
$n + 7 = 12$	$4n = 28$	$n + 4 = 20$	$13 - n = 7$	$8 + n = 15$
$n \div 8 = 2$	$4n = 20$	$12 - n = 9$	$6n = 18$	$24 \div n = 4$
$n + 7 = 12$	$4n = 28$	$n + 4 = 20$	$13 - n = 7$	$8 + n = 15$
$n \div 8 = 2$	$4n = 20$	$12 - n = 9$	$6n = 18$	$24 \div n = 4$
$n + 7 = 12$	$4n = 28$	$n + 4 = 20$	$13 - n = 7$	$8 + n = 15$

# Equations CrossNumber



## Across

## Down

1.  $2m = 100$

1.  $n - 5 = 50$

2.  $n - 8 = 5$

2.  $2m - 4 = 20$

3.  $2 + n = 16$

4.  $\frac{n}{3} = 20$

4.  $3m - 1 = 17$

5.  $\frac{2n}{2} = 30$

5.  $\frac{n}{6} = 6$

7.  $n - 7 = 18$

6.  $\frac{100}{n} = 10$

10.  $2 + 3n = 11$

7.  $n - 10 = 12$

8.  $\frac{3m}{4} = 6$

9.  $n + 5 = 2$

Exercise 1 : Match these worded expressions with the corresponded algebraic expression

- |  |                                    |
|--|------------------------------------|
| 1) any number add five   | a) $3(k + 6)$                      |
| 2) any number added to six and then times by three                   | b) $(d + 10)^2$                    |
| 3) a number divided by another                                       | c) $5f + 2g$                       |
| 4) a number added to two times another number all multiplied by five | d) $5\left(\frac{e}{6} + 3\right)$ |
| 5) a number add ten all squared                                      | e) $n + 5$                         |
| 6) a number divided by six added to three then all times by five     | f) $\frac{7b}{h}$                  |
| 7) five times a number added to two times another number             | g) $h^2 - a^2$                     |
| 8) a number times by three then add six                              | h) $3d^2$                          |
| 9) a number times by three then all squared                          | i) $6y$                            |
| 10) a number add ten then multiply by two                            | j) $\frac{g}{z}$                   |
| 11) one number divided by another number then times by seven         | k) $(3y)^2$                        |
| 12) a number times by itself then times by three                     | l) $\frac{w}{k + 3}$               |
| 13) the difference between two square numbers                        | m) $5(b + 2c)$                     |
| 14) a number add three all divided into another number               | n) $2(k + 10)$                     |
| 15) three times a number then times by two                           | o) $3m + 6$                        |



Exercise 2 :

write these using letters (algebra) (a)

- 1) a number add three
- 2) four times a number
- 3) five less than a number
- 4) add two different numbers
- 5) a number minus two all multiplied by three
- 6) a number times another number
- 7) a number plus seven then times by two
- 8) a number divided by four

Exercise 3 :

write these relations using letters (algebra)

- 1) two numbers add up to 8
- 2) a number squared add another number equals 20
- 3) the difference between two numbers is 4
- 4) 4 times a number plus 3 times another number equals 12
- 5) a number times another number equals 10
- 6) a number divided by another number equals 3
- 7) a number times 2, add 4, equals another number
- 8) a number squared minus 3 equals a number add 1

## Find the Mystery Number!

### Rules

- You must make both sides of the equals sign the same
- You must use the same number in each box within a question, e.g.

$$\boxed{5} + \boxed{5} + \boxed{5} + 10 = \boxed{5} + 20$$

A.  $\boxed{\phantom{0}} + \boxed{\phantom{0}} + \boxed{\phantom{0}} + 2 = \boxed{\phantom{0}} + 8$

B.  $\boxed{\phantom{0}} + \boxed{\phantom{0}} + 3 = \boxed{\phantom{0}} + \boxed{\phantom{0}} + \boxed{\phantom{0}} + 2$

C.  $6 + \boxed{\phantom{0}} + 12 = \boxed{\phantom{0}} + \boxed{\phantom{0}} + 14$

D.  $\boxed{\phantom{0}} + \boxed{\phantom{0}} + 19 = \boxed{\phantom{0}} + 29$

E.  $\boxed{\phantom{0}} + 23 = \boxed{\phantom{0}} + \boxed{\phantom{0}} + \boxed{\phantom{0}} + 15$

F.  $\boxed{\phantom{0}} + \boxed{\phantom{0}} + 8 = \boxed{\phantom{0}} + 14$

G.  $\boxed{\phantom{0}} + 3 + \boxed{\phantom{0}} = \boxed{\phantom{0}} + 8$

H.  $20 + 7 + \boxed{\phantom{0}} = 17 + \boxed{\phantom{0}} + \boxed{\phantom{0}} + \boxed{\phantom{0}} + 4$

I.  $42 + \boxed{\phantom{0}} = \boxed{\phantom{0}} + \boxed{\phantom{0}} + 36$

J.  $\boxed{\phantom{0}} + \boxed{\phantom{0}} + \boxed{\phantom{0}} + 10 = \boxed{\phantom{0}} + \boxed{\phantom{0}} + 20$

K.  $12 + \square = \square + 12$

L.  $16 + \square + \square = 16 + \square + 2$

M.  $\square + \square + 8 = 10 + \square + 3$

N.  $\square + \square = 18$

O.  $12 - \square = \square + 2$

P.  $\square + \square + \square + 50 = \square + \square + 100$

Q.  $\square + \square + 3 = 13 + \square + 10$

R.  $16 - \square = \square - 0$

S.  $\square + \square - 3 = \square + 2$

T.  $\square + \square + \square + 2 = 17 - \square$

U.  $\square + \square + \square + 14 = \square + \square + 36$

V.  $50 - \square = \square + 42$

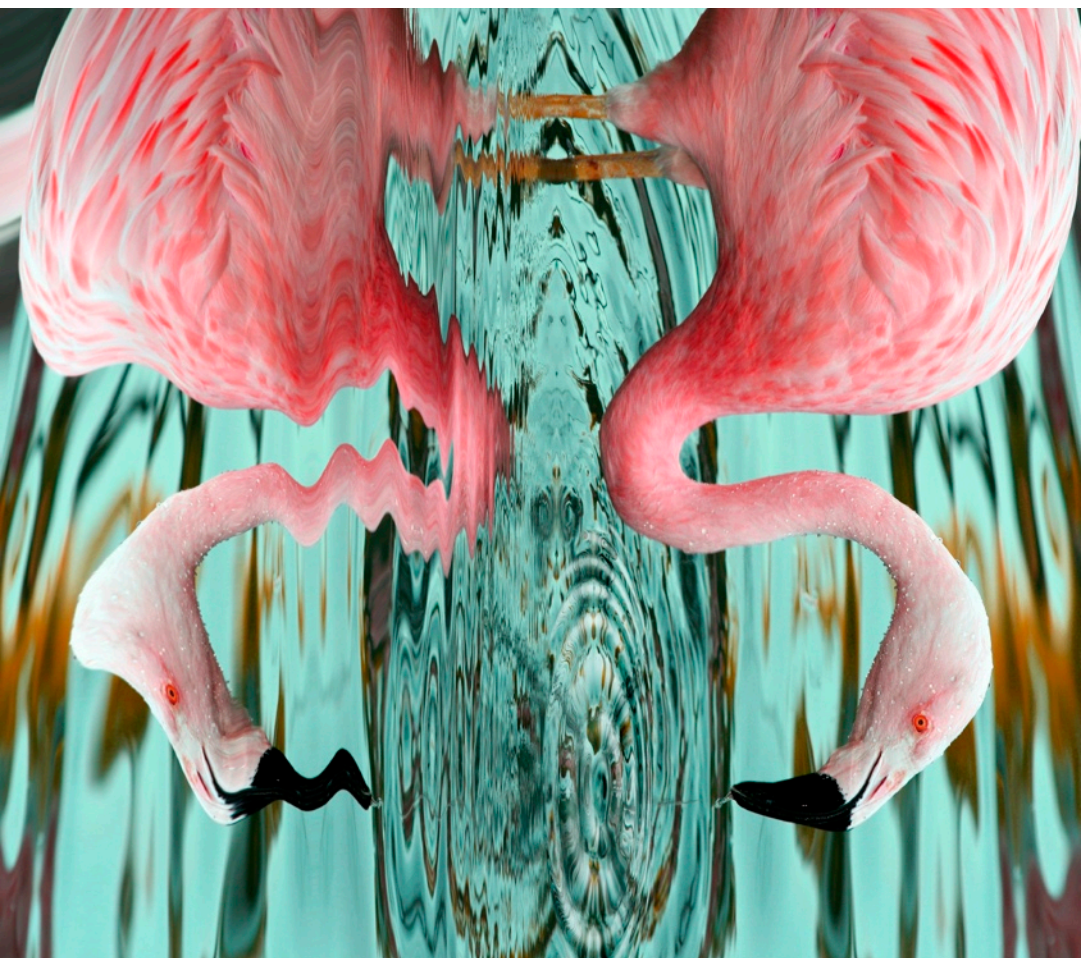
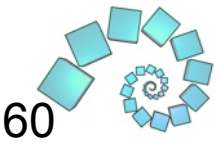
## The solution is...

Find a route through the maze where all the equations that you choose have the same solution.

Do not move diagonally.

<b>Start with: <math>2(x+2) = 15</math></b>	$4(x+0.5)=24$	$2x - 7 = 4$	$3(2x) = 30$	$2x \div 7 = 2$
$2x = 18$	$4x \div 4 = 7$	$3x - 0.5 = 16$	$5x - 0.5 = 25$	$3x + 9 = 35$
$3x - 1 = 11$	$9x + 2 = 17$	$4x \div 11 = 2$	$2(x+0.25) = 4$	$3x \div 3 = 7$
$4x \div 10 = 4$	$x - 4 = 9$	$5(2x+1) = 60$	$(3x - 1) \div 0.5 = 31$	$7x + 5 = 12$
$3(x + 1) = 33$	$4x \div 12 = 2$	$3(x + 2) = 11$	$1 + x = 6.5$	$5(x + 5) = 10$
$2x \div 2 = 2$	$9x - 3 = 3$	$7x - 1 = 10$	$6x \div 11 = 3$	<b>Finish</b>

# Think of Two Numbers



Think of two whole numbers under 10

Take one of them and add 1

Multiply by 5

Add 1 again

Double your answer

Subtract 1

Add your second number

Add 2

Double again

Subtract 8

Halve this number and tell me your answer

**From your answer I can work out both**

**your numbers very quickly. How?**