Contents

What's the value?

Each figure in these equations stands for one of the digits 1 to 9.

Which is which?

This is a difficult problem—can you solve it?

1 ▯▮ × ▯▮ = ▯▮

2 ▯▮ + ▯▮ = ▮▯

3 ▯▮ + ▯▮ = ▯▮ × ▮▯

4 ▯ ÷ ▯▮ = ▯▮

5 ▯ + ▯▮ = ▯◻

6 ⊠ − ▯ = ▯◻

7 ◻▯ + ▯▮ = ◿

8 ◿ + ▯▮ = ⊠

9 ◹ + ▯▮ = ⊠

10 ⊠ ÷ ▯▯ = ▯▯

11 ▯▮ × ▯▯ = ■

▯ _____

⊠ _____

▮▯ _____

◻▯ _____

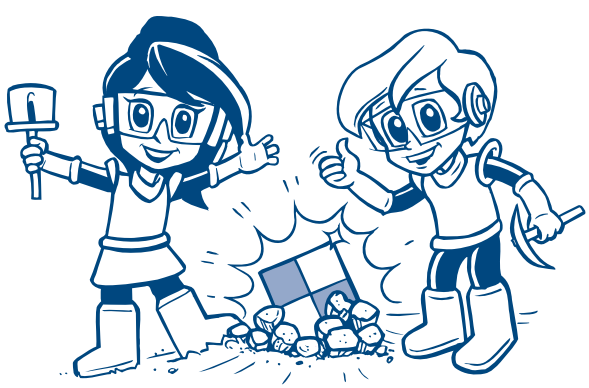
◿ _____

▯ _____

⊠ _____

▯▯ _____

▯▮ _____



Find my rule

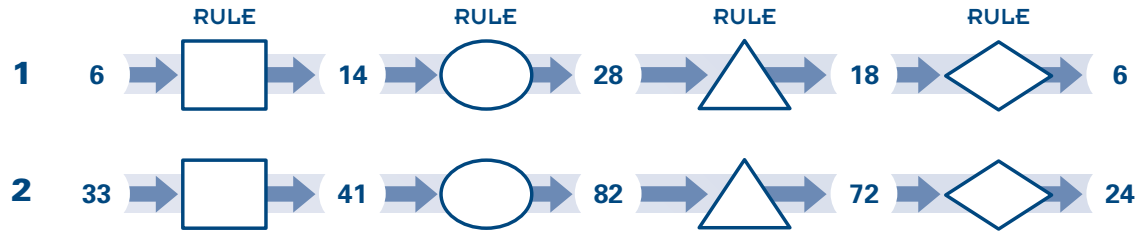
For each question, each box follows the same rule. Find the rule, write it down, and then work out which numbers are missing from the last box.

	RULE			
1	2 8 15	5 20 27	4 16 23	3
2	9 2 12	12 5 30	15 8 48	10
3	11 8 72	7 4 36	5 2 18	9
4	8 4 9	10 5 10	12 6 11	6
5	3 24 13	5 40 29	2 16 5	6
6	4 36 31	7 63 58	3 27 22	5
7	7 3 21	9 5 35	8 4 28	6
8	9 3 24	12 4 32	21 7 56	6
9	28 7 35	12 3 15	20 5 25	16
10	7 42 21	9 54 27	2 12 6	8

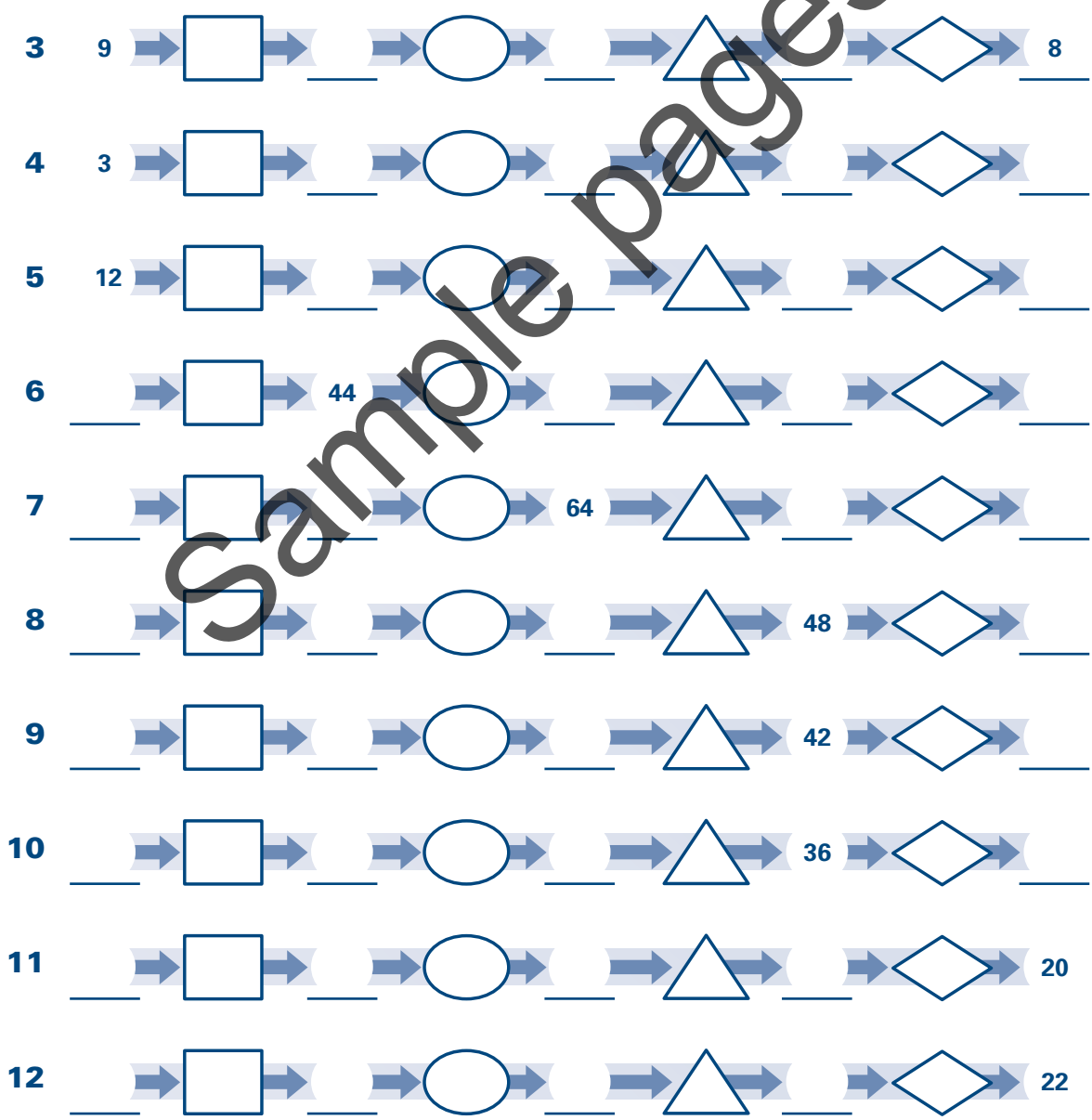
Missing numbers

All these exercises follow the same rule.

First find the rule for each shape by working through exercises 1 and 2.



Using this rule, find the missing numbers in exercises 3 to 12.



Number squares

Find the value of the letters A, B, C, D, E and F in these squares. The sum of each row and column is given, and only the numbers 1, 2, 3, 4, 5 and 6 have been used. Starting with the value of one letter given for each square, work out the value of the other letters.

Guess and check will be a very useful strategy.

1

D	C	A	10
A	B	E	9
B	A	F	10
11	6	12	

A	B	C	D	E	F
				4	

			10
		4	9
			10
11	6	12	

2

D	A	C	12
E	C	D	11
B	D	E	8
8	12	11	

A	B	C	D	E
				2

			12
2			11
		2	8
8	12	11	

3

D	A	E	6
B	C	E	11
A	D	B	8
8	9	8	

A	B	C	D	E
1				

	1		6
			11
1			8
8	9	8	

4

E	B	A	12
D	A	C	6
C	E	D	7
7	12	6	

A	B	C	D	E
3				

		3	12
	3		6
			7
7	12	6	

5

A	D	E	9
F	B	C	12
E	F	B	9
12	7	11	

A	B	C	D	E	F
5					

5			9
			12
			9
12	7	11	

Find the value

Find the value of the letters A, B, C, D and E in these squares.

The sum of each row and column is given, and only the numbers 1, 2, 3, 4 and 5 have been used. Starting with the value of the one letter given for each square, work out the value of the other letters.

1

A	A	C	B	10
B	E	B	D	17
E	E	C	D	11
B	D	A	C	12
15	12	9	14	

A	B	C	D	E
2				

2	2			10
				17
				11
		2		12
15	12	9	14	

2

D	A	D	B	8
C	C	A	B	12
E	D	C	A	12
A	E	B	C	13
12	12	10	11	

A	B	C	D	E
		4		

				8
4	4			12
		4		12
			4	13
12	12	10	11	

3

E	D	C	A	11
E	C	B	A	10
D	A	C	E	11
C	A	B	D	12
12	10	10	12	

A	B	C	D	E
				3

3				11
3				10
			3	11
				12
12	10	10	12	

4

B	B	D	C	15
D	D	A	C	13
E	A	C	E	9
E	C	B	D	14
15	12	12	12	

A	B	C	D	E
			5	

		5		15
5	5			13
				9
			5	14
15	12	12	12	

Investigating magic squares

A square is said to be magic when the numbers in all horizontal, vertical and diagonal lines have the same sum.

This is an example of a magic square. It has a magic sum of 15.

8	1	6
3	5	7
4	9	2

1 **a** If we add 2 to each number in the example square above, we get the square on the left. Is it still magic?

10	3	8
5	7	9
6	11	4

yes no

b Now add 10 to each number in the example square above. Is it still magic?

yes no

2 Investigate what happens to the example square when you:

a subtract 1 from each number; **b** multiply each number by 2, 3 or 5;

c divide each number by 2.

Is the square still magic in each case?

3 Can you find the rule between the centre number and the magic sum?

4 Investigate what happens to this 4 X 4 magic square when to each number you:

1	14	7	12
15	4	9	6
10	5	16	3
8	11	2	13

a add 1, 3, 10 or any number;

b subtract 1, $\frac{1}{2}$;

c multiply by 2, 10 or any number;

d divide by 2.

Is the square still magic in every case?

5 Can you make these squares, in which some numbers are missing, into magic squares? Work out which numbers you must put in the empty boxes so that all lines—horizontal, vertical and diagonal—will have the same total. You must first find each magic sum.

a

8		2	
	5		3
	4	9	
1		7	12

b

8	15		5
	11		4
	6	7	
	10	3	

c

33	5		27
11		21	
	15		
9	29		3

See *Teacher's Book* for diagram masters.

Patterns and sequences

Each set in this exercise follows a particular pattern. Find the pattern and write down the next three numbers and the rule each pattern follows.

1 9, 18, 27, 36, _____ , _____ , _____ Rule _____

2 65, 59, 53, 47, _____ , _____ , _____ Rule _____

3 1, 2, 4, 8, _____ , _____ , _____ Rule _____

4 1, 3, 7, 13, 21, _____ , _____ , _____ Rule _____

5 1, 3, 7, 15, 31, _____ , _____ , _____ Rule _____

6 $\frac{1}{10}$, 1, 10, 100, _____ , _____ , _____ Rule _____

7 $\frac{1}{5}$, 1, 5, 25, _____ , _____ , _____ Rule _____

8 1, 4, 9, 16, _____ , _____ , _____ Rule _____

9 64, 32, 16, 8, _____ , _____ , _____ Rule _____

10 81, 27, 9, 3, _____ , _____ , _____ Rule _____

11 80, 40, 20, 10, _____ , _____ , _____ Rule _____

12 1, 3, 6, 10, _____ , _____ , _____ Rule _____

13 24, 12, 6, 3, _____ , _____ , _____ Rule _____

14 0·02, 0·04, 0·06, 0·08, _____ , _____ , _____ Rule _____

15 0·03, 0·08, 0·13, 0·18 _____ , _____ , _____ Rule _____

16 6·4, 3·2, 1·6, 0·8, 0·4, _____ , _____ , _____ Rule _____

17 1, 2, 5, 10, 17, _____ , _____ , _____ Rule _____

18 1, 8, 10, 17, 19, _____ , _____ , _____ Rule _____

19 10, 11, 20, 21, 30, _____ , _____ , _____ Rule _____

20 64, 32, 36, 18, 22, 11, _____ , _____ , _____ Rule _____

21 32, $\frac{16}{3}$, $\frac{8}{9}$, $\frac{4}{27}$, _____ , _____ , _____ Rule _____

22 1, 1, 2, 3, 5, 8, _____ , _____ , _____ Rule _____

What's my rule?

In every exercise there is a rule that relates each number in the first row to the number immediately below it.

Find the rule and then work out the missing number.

1

					RULE
3	8	2	7	4	
9	24	6	21		

2

					RULE
3	8	2	7	4	
12	32	8	28		

3

3	8	2	7	4	
7	17	5	15		

4

3	8	2	7	4	
8	23	5	20		

5

3	8	2	7	4	
29	79	19	69		

6

3	8	2	7	4	
16	41	11	36		

7

5	8	2	7	6	
25	64	4	49		

8

8	20	12	24	16	
2	5	3	6		

9

20	18	12	14	6	
10	9	6	7		

10

5	8	2	7	6	
55	88	22	77		

11

5	3	4	9	7	
16	10	13	28		

12

5	3	4	9	7	
26	10	17	82		

13

5	3	4	9	7	
19	11	15	35		

14

5	3	4	9	7	
56	34	45	100		

15

50	35	40	25	15	
10	7	8	5		

16

6	3	7	2	4	
61	31	71	21		

17

6	3	7	2	4	
35	8	48	3		

18

6	3	7	12	4	
37	19	43	73		

19

5	8	2	7	6	
46	73	19	64		

20

5	3	4	9	7	
37	23	30	65		

Number sentences

With the symbols +, –, ×, ÷ and ( ), and any three of the numbers 3, 4, 5, 12 and 15, complete each exercise to make it a true number sentence. You may use a number only once in each sentence.

Example: _____ – (_____ ÷ _____) = 7 12 – (15 ÷ 3) = 7

1 _____ ÷ _____ – _____ = 0

2 _____ × _____ – _____ = 0

3 (_____ + _____) ÷ _____ = 1

4 (_____ – _____) ÷ _____ = 1

5 (_____ – _____) × _____ = 3

6 (_____ + _____) ÷ _____ = 3

7 (_____ + _____) ÷ _____ = 5

8 _____ ÷ _____ + _____ = 6

9 _____ – _____ + _____ = 7

10 (_____ – _____) × _____ = 8

11 _____ – (_____ ÷ _____) = 9

12 (_____ – _____) × _____ = 9

13 _____ ÷ _____ + _____ = 10

14 _____ – (_____ ÷ _____) = 11

15 _____ + _____ + _____ = 12

16 _____ + _____ × _____ = 17

17 _____ × _____ + _____ = 23

18 (_____ – _____) × _____ = 24

19 (_____ + _____) × _____ = 27

20 (_____ – _____) × _____ = 40

Letter values

In the following exercises, the letters represent digits. No digit is repeated in any one exercise. Find the value of each letter.

1

$$\begin{array}{r} B\,1 \\ \times\quad B \\ \hline 2\,B\,B \end{array}$$

B = _____

2

$$\begin{array}{r} C\,1 \\ \times\quad C \\ \hline 3\,C\,C \end{array}$$

C = _____

3

$$\begin{array}{r} 4\,A \\ \times\quad A \\ \hline 2\,7\,A \end{array}$$

A = _____

4

$$\begin{array}{r} M\,N \\ \times\quad 3 \\ \hline 6\,9 \end{array}$$

M = _____

N = _____

5

$$\begin{array}{r} U\,V\,W \\ \times\quad\quad 6 \\ \hline 1\,4\,8\,2 \end{array}$$

U = _____

V = _____

W = _____

6

$$\begin{array}{r} P \\ +\ Q \\ \hline R\,R \end{array}$$

P = _____

Q = _____

R = _____

7

$$\begin{array}{r} D \\ E \\ +\ F \\ \hline D\,F \end{array}$$

D = _____

E = _____

F = _____

8

$$\begin{array}{r} J\,K \\ +\ K \\ \hline K\,J \end{array}$$

J = _____

K = _____

9

$$\begin{array}{r} L\,G \\ +\quad L \\ \hline G\,H\,H \end{array}$$

G = _____

H = _____

L = _____

10

$$\begin{array}{r} C\,D \\ C\,D \\ C\,D \\ +\,C\,D \\ \hline E\,C \end{array}$$

C = _____

D = _____

E = _____

11

$$\begin{array}{r} Y\,Y \\ W\,W \\ +\ X\,X \\ \hline W\,X\,Y \end{array}$$

W = _____

X = _____

Y = _____

12

$$\begin{array}{r} P\,Q \\ P\,Q \\ +\ Q\,P \\ \hline S\,S\,S \end{array}$$

P = _____

Q = _____

S = _____

13

$$\begin{array}{r} W\,T\,W \\ -\ V\,W \\ \hline W\,T \end{array}$$

W = _____

T = _____

V = _____

14

$$\begin{array}{r} L\,M\,N \\ L\,M\,N \\ +\ L\,M\,N \\ \hline N\,N\,N \end{array}$$

L = _____

M = _____

N = _____

15

$$\begin{array}{r} A\,A\,B \\ +\ B\,B\,A \\ \hline B\,B\,B\,D \end{array}$$

A = _____

B = _____

D = _____

Who am I?

To discover who I am, you must eliminate impossibilities.

1 I am the only even prime number. _____

2 I am the only number that is neither prime nor composite. _____

3 I am the only two-digit, odd composite number less than 20. _____

4 I am a two-digit number. I am a square number.
I am greater than 29. I am less than 42. _____

5 I am a two-digit number. I am less than 40.
I am exactly divisible by 3 and 10. _____

6 I am the smallest number exactly divisible by 2, 3 and 4. _____

7 I am a square number. I am a two-digit number.
The sum of my digits is 7. I am divisible by 5. _____

8 I am a two-digit number, less than 25. I am even.
The sum of my digits is 9. I am exactly divisible by 3. _____

9 I am a two-digit number. The sum of my digits is 3.
I am exactly divisible by 5 and 2. _____

10 I am a two-digit number, less than 30.
I am exactly divisible by 6 and 8. _____

11 I am a two-digit number. I am exactly divisible by 4 and 5.
When I am divided by 9, I leave a remainder of 6. _____

12 I am a two-digit odd number. I am one less than a square number.
I am divisible by 7. _____

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100