SCIENTIFIC CALC

12.04 Find the rule

You can use a scientific calculator to find the rule for a pattern in a table. This only works for rules which increase at a constant rate. These are called linear rules, because when you graph them you get a straight line (linear) graph.

This kind of rule can be written as follows.

output = _____ × input + _____ or output = _____ × input – _____

Example 1

Find the rule for the table and calculate the missing output values

Input	Output
0	
1	16
2	44
3	72
10	
16	

Output = _____ × input + _____

Look for consecutive values in the inputs.

Think	Calculator steps	Answer
1 and 2 are consecutive inputs. Subtract the outputs.	44 – 16 =	28
2 and 3 are also consecutive inputs. Subtract the outputs.	72 – 44 =	28
The numbers are going up by 28s The rule starts output = 28 × input + ____ or 28 × input – ____		
Count back until you get to an input of 0. This is one step.	16 – 28 =	–12
The second part of the rule is – 12. The rule is output = 28 × input – 12		

Think	Calculator steps	Answer
Put the rest of the inputs in the rule. input = 10, output = 28 × input – 12	28 × 10 – 12 =	268
input = 16, output = 28 × input – 12	28 × 16 – 12 =	436

Fill in the table.

Input	Output
0	–12
1	16
2	44
3	72
10	268
16	436

For **Questions 1** to **6**, find the rule for the table and calculate the missing output values.

1

Input	Output
0	
1	20
2	26
3	32
12	
20	

2

Input	Output
0	
2	5
3	17
5	29
8	
12	

3

Input	Output
0	
2	60
5	120
6	140
7	160
10	

4

Input	Output
0	
10	85
11	100
12	115
25	
100	

5

Input	Output
0	
10	
14	202
15	179
16	156
18	

6

Input	Output
0	45
1	63
2	81
6	
15	
40	

When there are no consecutive values, divide by the number of 'steps' to work out what the outputs would be going up by. You should do this at least twice to check the outputs are going up by a constant value.

Example 1

Find the rule for the table and calculate the missing output values

Input	Output
0	
3	16
5	28
9	
11	64
33	

Output = _____ × input + _____

Look for consecutive values in the inputs.

Think	Calculator steps	Answer
3 and 5 are two steps. Subtract the outputs and divide by 2.	(28 – 16) ÷ 2 = 6	6
5 and 11 are 6 steps (11 – 5 = 6). Subtract the outputs and divide by 6.	(64 – 28) ÷ 6 = 6	6
The numbers are going up by 6's The rule starts output = 6 × input + ____ or 6 × input – ____		
Count back from 3 until you get to an input of 0. This is 3 steps.	16 – 3 × 6 = –2	–2
The second part of the rule is – 2. The rule is output = 6 × input – 2		
Think	**Calculator steps**	**Answer**
Put the rest of the inputs in the rule. input = 9, output = 6 × input – 2	6 × 9 – 2 =	52
input = 33, output = 6 × input – 2	6 × 33 – 2 =	196

Fill in the table.

Input	Output
0	–2
3	16
5	28
9	52
11	64
33	196

For **Questions 7** to **12**, find the rule for the table and calculate the missing output values.

7

Input	Output
0	
4	32
6	56
10	104
15	
27	

8

Input	Output
0	
5	2
8	29
12	
21	146
35	182

9

Input	Output
0	
2	
5	133
7	165
10	213
18	

10

Input	Output
0	
10	265
12	219
19	58
25	
132	

11

Input	Output
0	12
7	61
10	82
15	
21	
35	

12

Input	Output
0	
2	76
8	10
11	
15	
40	–342

Answers

1 output = 6 × input + 14

Input	Output
0	14
1	20
2	26
3	32
12	86
20	134

2 output = 12 × input – 19

Input	Output
0	–19
2	5
3	17
5	29
8	77
12	125

3 output = 20 × input + 20

Input	Output
0	20
2	60
5	120
6	140
7	160
10	220

4 output = 15 × input – 65

Input	Output
0	– 65
10	85
11	100
12	115
25	310
100	1435

5 output = –23 × input + 524

Input	Output
0	524
10	294
14	202
15	179
16	156
18	110

6 output = 18 × input + 45

Input	Output
0	45
1	63
2	81
6	153
15	315
40	765

7 output = 12 × input – 16

Input	Output
0	–16
4	32
6	56
10	104
15	164
27	308

8 output = 9 × input – 43

Input	Output
0	–43
5	2
8	29
12	65
21	146
35	182

9 output = 16 × input + 53

Input	Output
0	53
2	85
5	133
7	165
10	213
18	341

10 output = –23 × input + 495

Input	Output
0	495
10	265
12	219
19	58
25	–80
132	–2541

11 output = 7 × input + 12

Input	Output
0	12
7	61
10	82
15	117
21	159
35	257

12 output = –11 × input + 98

Input	Output
0	98
2	76
8	10
11	–23
15	–67
40	–342