

19. [Number Patterns]

Skill 19.1 Completing number patterns by adding the same number.

MMBlue 1 1 2 2 3 3 4 4
MMGreen 1 1 2 2 3 3 4 4

- Look at consecutive terms of the pattern.
- Find the number and operation (in this case addition) used to get from one term to the next.
- Define the rule of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.

Q. Complete the pattern:

2, 11, 20, 29, ,

A. 2, 11, 20, 29, ,

+9 +9 +9

Rule: Add 9 to each term.

$$29 + 9 = 38$$

$$38 + 9 = 47$$

2, 11, 20, 29, 38, 47

First note that each term in the pattern is increasing. Then find by how much.

a) Complete the pattern:

4, 8, 12, 16, ,

+4 +4 +4 +4 +4

$$16 + 4 = 20, \quad 20 + 4 = 24$$

b) Complete the pattern:

1, 4, 7, 10, 13, ,

+3 +3 +3 +3 +3 +3

c) Complete the pattern:

3, 8, 13, 18, 23, ,

d) Complete the pattern:

3, 5, 7, 9, 11, ,

e) Complete the pattern:

2, 5, 8, 11, ,

f) Complete the pattern:

3, 7, 11, 15, ,

g) Complete the pattern:

3, 11, 19, 27, ,

h) Complete the pattern:

2, 9, 16, 23, ,

i) Complete the pattern:

2, 8, 14, 20, ,

j) Complete the pattern:

5, 14, 23, 32, ,

Skill 19.2 Completing number patterns by subtracting the same number.

MMBlue 1 2 2 3 3 4 4
MMGreen 1 1 2 2 3 3 4 4

- Look at consecutive terms of the pattern.
- Find the number and operation (in this case subtraction) used to get from one term to the next.
- Define the rule of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.

Q. Complete the pattern:

45, 36, 27, 18, ,

A. 45, 36, 27, 18, ,

$\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \\ -9 & -9 & -9 & \end{array}$

Rule: Subtract 9 from each term.

$$18 - 9 = 9$$

$$9 - 9 = 0$$

45, 36, 27, 18, 9, 0

First note that each term in the pattern is decreasing. Then find by how much.

a) Complete the pattern:

18, 15, 12, 9, ,

$\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \\ -3 & -3 & -3 & -3 \end{array}$

$$9 - 3 = 6,$$

$$6 - 3 = 3$$

b) Complete the pattern:

16, 14, 12, 10, 8, ,

$\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \\ -2 & -2 & -2 & -2 \end{array}$

c) Complete the pattern:

20, 17, 14, 11, 8, ,

d) Complete the pattern:

35, 30, 25, 20, 15, ,

e) Complete the pattern:

30, 26, 22, 18, 14, ,

f) Complete the pattern:

38, 32, 26, 20, ,

g) Complete the pattern:

98, 88, 78, 68, ,

h) Complete the pattern:

38, 31, 24, 17, ,

i) Complete the pattern:

42, 34, 26, 18, ,

j) Complete the pattern:

50, 41, 32, 23, ,

Skill 19.3 Completing number patterns by adding or subtracting decimal numbers.

- Look at consecutive terms of the pattern.
- Find the number and operation used to get from one term to the next.
- Define the rule of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.

Q. Complete the pattern:

0.8, 1, 1.2, 1.4, ,

A. 0.8 , 1 , 1.2 , 1.4 , ,

$$+0.2 \quad +0.2 \quad +0.2$$

Rule: Add 0.2 to each term.

$$1.4 + 0.2 = 1.6$$

$$1.6 + 0.2 = 1.8$$

0.8 , 1 , 1.2 , 1.4 , 1.6 , 1.8

First note that each term in the pattern is increasing. Then find by how much.

a) Complete the pattern:

0.2, 0.8, 1.4, 2, ,

$$+0.6 \quad +0.6 \quad +0.6+0.6 \quad +0.6$$

$$2 + 0.6 = 2.6, \quad 2.6 + 0.6 = 3.2$$

b) Complete the pattern:

1.8, 1.5, 1.2, 0.9, ,

$$-0.3 \quad -0.3 \quad -0.3 \quad -0.3 \quad -0.3$$

c) Complete the pattern:

1.5, 1.7, 1.9, 2.1, 2.3, ,

d) Complete the pattern:

1, 1.5, 2, 2.5, ,

e) Complete the pattern:

1, 1.4, 1.8, 2.2, 2.6, ,

f) Complete the pattern:

3.1, 2.9, 2.7, 2.5, ,

g) Complete the pattern:

2.9, 2.6, 2.3, 2, ,

h) Complete the pattern:

1, 2.1, 3.2, 4.3, ,

Skill 19.4 Completing number patterns in table format by adding the same number.

MMBlue 1 2 3 3 4 4
MMGreen 1 2 2 3 3 4 4

- Look at consecutive terms of the pattern.
- Find the number and operation used to get from one term to the next.
- Define the rule of the pattern.
- Apply this rule to the last given term and find the next term of the pattern.

Q. Complete the table:

Number of floors	2	3	4	5	6
Number of rooms	4		10	13	

A. 4, ?, 10, 13, ?

+3

Rule: Add 3 to each term.

$$4 + 3 = 7$$

$$13 + 3 = 16$$

4, 7, 10, 13, 16

First note that each term in the pattern is increasing. Then find by how much.

Number of floors	2	3	4	5	6
Number of rooms	4	7	10	13	16

a) Complete the table:

fingernail	2	4	6	8	10
toenail	0.5	1	1.5	2	2.5

+0.5 +0.5 +0.5 +0.5

$$1.5 + 0.5 = 2, \quad 2 + 0.5 = 2.5$$

b) Complete the table:

White roses	2	4	6	8	10
Red roses	3	6	9		

+3 +3 +3

c) Complete the table:

Number of days	1	2	3	4	5	6
Length of worms (ft)	14	28	42	56		

d) Complete the table:

Number of calories ($\times 100$)	17	34			85
Number of days	1	2	3	4	5

e) Complete the table:

Number of bedrooms	1	2	3	4	5
Cost per week (\$)	200		350	425	

f) Complete the table:

Number of days	10	20	30	40	50	60
Teeth regenerated	3	3.6	4.2	4.8		

g) Complete the table:

Time (min)	10	15	20	25	30
Energy (cal)	240	280	320		

h) Complete the table:

Side length	0.4	0.8	1.2	1.6	2	2.4
Perimeter	1.2	2.4	3.6			

Skill 19.5 Completing number patterns by multiplying by the same number.

MMBlue 11 2 3 3 4 4
MMGreen 11 2 2 3 3 4 4

- Look at consecutive terms of the pattern.
- Find the number and operation (in this case multiplication) used to get from one term to the next.
- Define the rule of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.

Q. Complete the pattern:

$$\frac{1}{16}, \frac{1}{4}, 1, 4, \boxed{\quad, \quad}$$

A. $\frac{1}{16}, \frac{1}{4}, 1, 4, \underline{\quad}, \underline{\quad}$

$\begin{array}{c} \curvearrowright \quad \curvearrowright \quad \curvearrowright \\ \times 4 \quad \times 4 \quad \times 4 \end{array}$

First note that each term in the pattern is increasing. Then find by how much.

Rule: Multiply each term by 4
 $4 \times 4 = 16$

$$16 \times 4 = 64$$

$$\frac{1}{16}, \frac{1}{4}, 1, 4, \underline{16}, \underline{64}$$

a) Complete the pattern:

$$2, 6, 18, 54, \boxed{162, 486}$$

$\begin{array}{c} \curvearrowright \quad \curvearrowright \quad \curvearrowright \quad \curvearrowright \\ \times 3 \quad \times 3 \quad \times 3 \quad \times 3 \end{array}$

$$54 \times 3 = 162, \quad 162 \times 3 = 486$$

b) Complete the pattern:

$$1, 2, 4, 8, \boxed{\quad, \quad}$$

$\begin{array}{c} \curvearrowright \quad \curvearrowright \quad \curvearrowright \quad \curvearrowright \\ \times 2 \quad \times 2 \quad \times 2 \quad \times 2 \end{array}$

c) Complete the pattern:

$$4, 12, 36, 108, \boxed{\quad, \quad}$$

d) Complete the pattern:

$$5, 15, 45, 135, \boxed{\quad, \quad}$$

e) Complete the pattern:

$$0.25, 0.5, 1, 2, \boxed{\quad, \quad}$$

f) Complete the pattern:

$$\frac{3}{4}, 3, 12, 48, \boxed{\quad, \quad}$$

g) Complete the pattern:

$$\frac{1}{16}, \frac{1}{8}, \frac{1}{4}, \frac{1}{2}, \boxed{\quad, \quad}$$

h) Complete the pattern:

$$\frac{2}{9}, \frac{2}{3}, 2, 6, \boxed{\quad, \quad}$$

i) Complete the pattern:

$$0.02, 0.1, 0.5, 2.5, \boxed{\quad, \quad}$$

j) Complete the pattern:

$$\frac{3}{1000}, \frac{3}{100}, \frac{3}{10}, 3, \boxed{\quad, \quad}$$

Skill 19.6 Completing number patterns by dividing by the same number.

MMBlue 1 1 2 2 3 4 4
MMGreen 1 1 2 2 3 3 4 4

- Look at consecutive terms of the pattern.
- Find the number and operation (in this case division) used to get from one term to the next.
- Define the rule of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.

Q. Complete the pattern:

640, 320, 160, 80, ,

A. 640 , 320 , 160 , 80 , ,

$\begin{array}{c} \curvearrowright \\ \div 2 \end{array}$ $\begin{array}{c} \curvearrowright \\ \div 2 \end{array}$ $\begin{array}{c} \curvearrowright \\ \div 2 \end{array}$

Rule: Divide each term by 2.

$$80 \div 2 = 40$$

$$40 \div 2 = 20$$

640 , 320 , 160 , 80 , 40 , 20

First note that each term in the pattern is decreasing. Then find by how much.

a) Complete the pattern:

9375, 1875, 375, 75, ,

$\begin{array}{c} \curvearrowright \\ \div 5 \end{array}$ $\begin{array}{c} \curvearrowright \\ \div 5 \end{array}$ $\begin{array}{c} \curvearrowright \\ \div 5 \end{array}$ $\begin{array}{c} \curvearrowright \\ \div 5 \end{array}$ $\begin{array}{c} \curvearrowright \\ \div 5 \end{array}$

$$75 \div 5 = 15, \quad 15 \div 5 = 3$$

b) Complete the pattern:

128, 64, 32, 16, ,

$\begin{array}{c} \curvearrowright \\ \div 2 \end{array}$ $\begin{array}{c} \curvearrowright \\ \div 2 \end{array}$ $\begin{array}{c} \curvearrowright \\ \div 2 \end{array}$ $\begin{array}{c} \curvearrowright \\ \div 2 \end{array}$ $\begin{array}{c} \curvearrowright \\ \div 2 \end{array}$

c) Complete the pattern:

6250, 1250, 250, 50, ,

d) Complete the pattern:

640, 320, 160, 80, 40, ,

e) Complete the pattern:

1000, 100, 10, 1, 0.1, ,

f) Complete the pattern:

729, 243, 81, 27, ,

g) Complete the pattern:

3.2, 1.6, 0.8, 0.4, ,

h) Complete the pattern:

312.5, 62.5, 12.5, 2.5, ,

i) Complete the pattern:

70,000, 7000, 700, 70, ,

j) Complete the pattern:

512, 128, 32, 8, ,

Skill 19.7 Completing number patterns by using changing values in the rule.

- Look at consecutive terms of the pattern.
- Find the number and operation used to get from one term to the next.
- Define the rule of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.

Q. Complete the pattern:

3, 6, 12, 21, 33, ,

A. 3, 6, 12, 21, 33, ,
 $\begin{array}{ccccccc} & \curvearrowright & & \curvearrowright & & \curvearrowright & & \curvearrowright \\ & +3 & & +6 & & +9 & & +12 \end{array}$

Rule: Add 3 then 6 then 9 etc. to each term.

(i.e. consecutive multiples of 3)

$$33 + 15 = 48$$

$$48 + 18 = 66$$

3, 6, 12, 21, 33, 48, 66

First note that each term in the pattern is increasing. Then find by how much.

a) Complete the pattern:

18, 20, 24, 30, 38, ,
 $\begin{array}{ccccccc} & \curvearrowright & & \curvearrowright & & \curvearrowright & & \curvearrowright & & \curvearrowright \\ & +2 & & +4 & & +6 & & +8 & & +10 & & +12 \end{array}$

$$38 + 10 = 48, \quad 48 + 12 = 60$$

b) Complete the pattern:

2, 6, 14, 26, 42, ,
 $\begin{array}{ccccccc} & \curvearrowright & & \curvearrowright & & \curvearrowright & & \curvearrowright & & \curvearrowright \\ & +4 & & +8 & & +12 & & +16 & & +? & & +? \end{array}$

c) Complete the pattern:

49, 46, 40, 31, ,

d) Complete the pattern:

45, 33, 23, 15, 9, ,

e) Complete the pattern:

14, 13, 10, 9, 6, ,

f) Complete the pattern:

1, 3, 7, 9, 13, ,

g) Complete the pattern:

3, 4, 7, 12, 19, ,

h) Complete the pattern:

144, 100, 64, 36, ,

$$144 = 12^2, \quad 100 = 10^2, \quad 64 = 8^2$$

i) Complete the pattern:

1, 9, 25, 49, ,

j) Complete the pattern:

343, 216, 125, 64, ,

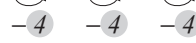
Skill 19.8 Completing number patterns involving negative integers by adding or subtracting the same integer.

- Look at consecutive terms of the pattern.
- Find the number and operation used to get from one term to the next.
- Define the rule of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.

Q. Complete the pattern:

3, -1, -5, -9, ,

A. 3, -1, -5, -9, ,



Rule: Subtract 4 from each term.

$-9 - 4 = -13$

$-13 - 4 = -17$

3, -1, -5, -9, -13, -17

First note that each term in the pattern is decreasing. Then find by how much.

a) Complete the pattern:

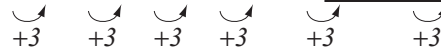
29, 21, 13, 5, -3, -11, -19



$-3 - 8 = -11$, $-11 - 8 = -19$

b) Complete the pattern:

-17, -14, -11, -8, -5, ,



c) Complete the pattern:

-22, -17, -12, -7, -2, ,

d) Complete the pattern:

1, -1, -3, -5, -7, ,

e) Complete the pattern:

10, 6, 2, -2, ,

f) Complete the pattern:

-13, -7, -1, 5, ,

g) Complete the pattern:

17, 8, -1, -10, ,

h) Complete the pattern:

-23, -16, -9, -2, ,

i) Complete the pattern:

7, 3, -1, -5, ,

j) Complete the pattern:

-23, -15, -7, 1, ,

Skill 19.9 Finding a term in a number pattern (1).

MMBlue 1 1 2 2 3 3 4 4
MMGreen 1 1 2 2 3 3 4 4

EITHER

- Find the terms in order until you get to the desired term.

OR

- Draw up a table and match the term numbers with the given terms in the pattern.
- Use observation and trial and error to find a relationship between the term number and its value in the pattern.
- Based on this relationship, find the requested term in the pattern.

Q. Find the 8th term in the pattern:

8, 14, 20, 26, ...

A. 8, 14, 20, 26, ...
 $+6 \quad +6 \quad +6$

Rule: Add 6 to each term.

$26 + 6 = 32$

$32 + 6 = 38$

$38 + 6 = 44$

$44 + 6 = 50$

8, 14, 20, 26,, **50**

First note that each term in the pattern is increasing. Then find by how much. Count on.

OR

term number	1	2	3	4	.....	8
pattern	8	14	20	26		?
relationship	$6 \cdot 1 + 2$	$6 \cdot 2 + 2$	$6 \cdot 3 + 2$	$6 \cdot 4 + 2$		$6 \cdot 8 + 2$

Relationship: 6 times the term number + 2

The 8th term of the pattern is $6 \cdot 8 + 2 = 50$

a) Find the 14th term in the pattern:

1, 3, 5, 7, ...

27

term number	1	2	3	4	.....	14
pattern	1	3	5	7		27
relationship	$2 \cdot 1 - 1$	$2 \cdot 2 - 1$	$2 \cdot 3 - 1$	$2 \cdot 4 - 1$		$2 \cdot 14 - 1$

Relationship: 2 times the term number - 1

The 14th term of the pattern is $2 \cdot 14 - 1 = 27$

b) Find the 12th term in the pattern:

2, 3, 4, 5, ...

term number	1	2	3	4	.....	12
pattern	2	3	4	5		?
relationship	$1 + 1$					

Relationship:

The 12th term of the pattern is

c) Find the 20th term in the pattern:

2, 4, 6, 8, 10, ...

term number	1	2	3	4	.....	20
pattern	2	4	6	8		?
relationship						

Relationship:

The 20th term of the pattern is

d) Find the 15th term in the pattern:

5, 10, 15, 20, 25, ...

term number	1	2	3	4	.....	15
pattern	5	10	15	20		?
relationship						

Relationship:

The 15th term of the pattern is

Skill 19.9 Finding a term in a number pattern (2).

MMBlue 1 1 2 2 3 3 4 4
MMGreen 1 1 2 2 3 3 4 4

e) Find the 18th term in the pattern:

14, 24, 34, 44, 54, ...

term number	1	2	3	4	.....	18
pattern	14	24	34	44		?
relationship						

Relationship:
.....The 18th term of the pattern is
.....

f) Find the 10th term in the pattern:

1, 8, 27, 64, ...

term number	1	2	3	4	.....	10
pattern	1	8	27	64		?
relationship						

Relationship:
.....The 10th term of the pattern is
.....

g) Find the 14th term in the pattern:

5, 7, 9, 11, 13, ...

term number	1	2	3	4	.....	14
pattern	5	7	9	11		?
relationship						

.....
.....

h) Find the 12th term in the pattern:

2, 5, 8, 11, 14, ...

term number	1	2	3	4	.....	12
pattern	2	5	8	11		?
relationship						

.....
.....

i) Find the 11th term in the pattern:

3, 7, 11, 15, 19, ...

term number	1	2	3	4	.....	11
pattern	3	7	11	15		?
relationship						

.....
.....

j) Find the 20th term in the pattern:

12, 14, 16, 18, ...

term number	1	2	3	4	.....	20
pattern	12	14	16	18		?
relationship						

.....
.....

k) Find the 10th term in the pattern:

 $\frac{1}{2}, \frac{1}{4}, \frac{1}{6}, \frac{1}{8}, \dots$
.....

l) Find the 8th term in the pattern:

 $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \dots$
.....

Skill 19.10 Finding a particular term of a sequence given its general rule.

- Identify the value of n for the requested term of the sequence.
Hint: If the 20th term needs to be found, the value of n is 20.
- Substitute the value of n in the formula for the general rule of the pattern.
- Calculate the value of the particular term of the sequence.

Q. If the general rule of a pattern is $15 + n$ find the 15th term ($n = 15$).

$$\begin{aligned} \text{A. } & 15 + n \\ & = 15 + 15 \quad \text{substitute } n = 15 \\ & = 30 \end{aligned}$$

a) If the general rule of a pattern is $n - 4$ find the 10th term ($n = 10$).

$$\begin{aligned} & n - 4 \\ & \dots\dots\dots \\ & = 10 - 4 = \boxed{6} \end{aligned}$$

b) If the general rule of a pattern is $n + 5$ find the 20th term ($n = 20$).

$$\begin{aligned} & n + 5 \\ & \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

c) If the general rule of a pattern is $n - 8$ find the 13th term ($n = 13$).

$$\begin{aligned} & \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

d) If the general rule of a pattern is $n + 8$ find the 16th term ($n = 16$).

$$\begin{aligned} & \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

e) If the general rule of a pattern is $2n + 1$ find the 20th term ($n = 20$).

$$\begin{aligned} & \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

f) If the general rule of a pattern is $50 - 5n$ find the 6th term ($n = 6$).

$$\begin{aligned} & \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

g) If the general rule of a pattern is $5n + 7$ find the 9th term ($n = 9$).

$$\begin{aligned} & \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

h) If the general rule of a pattern is $14 - 2n$ find the 6th term ($n = 6$).

$$\begin{aligned} & \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

i) If the general rule of a pattern is $n^2 + 1$ find the 10th term ($n = 10$).

$$\begin{aligned} & \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

j) If the general rule of a pattern is $n^2 + 6$ find the 8th term ($n = 8$).

$$\begin{aligned} & \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$