

# 19. [Number Patterns]

## Skill 19.1 Completing number patterns by adding the same number.

MM7 1 1 2 2 3 3 4 4  
MM8 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,  ,  First note that each term in the pattern is increasing.

+9 +9 +9

**Rule:** Add 9 to each term.

$$29 + 9 = 38$$

$$38 + 9 = 47$$

2, 11, 20, 29, **38, 47**

Then find by how much.

**a)** Complete the pattern:

0, 4, 8, 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.

MM7 1 2 2 3 3 4 4  
MM8 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, \_\_\_, \_\_\_

$\begin{array}{c} \curvearrowright \quad \curvearrowright \quad \curvearrowright \\ -9 \quad -9 \quad -9 \end{array}$

**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,

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

$$9 - 3 = 6, \quad 6 - 3 = 3$$

**b)** Complete the pattern:

16, 14, 12, 10, 8,

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

**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.

MM7 1 1 2 2 3 3 4 4  
MM8 1 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 two terms of the pattern.

**Q.** Complete the pattern:

0.8, 1, 1.2, 1.4,  ,

**A.** 0.8, 1, 1.2, 1.4,  ,

$$+0.2 +0.2 +0.2$$

**Rule:** Subtract 9 from 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,  ,

$$+0.6 +0.6 +0.6+0.6 +0.6$$

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

**b)** Complete the pattern:

1.8, 1.5, 1.2, 0.9,  ,

$$-0.3 -0.3 -0.3 -0.3 -0.3$$

**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,  ,

.....

**i)** Complete the pattern:

0.8, 1.4, 2, 2.6,  ,

.....

**j)** Complete the pattern:

2.9, 2.5, 2.1, 1.7,  ,

.....

### Skill 19.3 Completing number patterns in table format by adding the same number.

MM7 1 1 2 2 3 3 4 4  
MM8 1 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:

High-rise buildings

No. of floors	2	3	4	5	6
No. 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.

High-rise buildings

No. of floors	2	3	4	5	6
No. of rooms	4	<b>7</b>	10	13	<b>16</b>

**a)** Complete the table:

Growth (mm)

finger nail	2	4	6	8	10
toenail	0.5	1	1.5	<b>2</b>	<b>2.5</b>

↖   ↖   ↖   ↖  
+0.5   +0.5   +0.5   +0.5

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

**b)** Complete the table:

Bouquets

white roses	2	4	6	8	10
red roses	3	6	9		

↖   ↖   ↖  
+3   +3   +3

**c)** Complete the table:

Food intake of a baby robin

No. of days	1	2	3	4	5	6
Length of worms (m)	4	8	12			

**d)** Complete the table:

Children (9 - 13)

calories (hundreds)	17	34			85
days	1	2	3	4	5

**e)** Complete the table:

Rent

No. of bedrooms	1	2	3	4	5
Cost per week (\$)	200		350	425	

**f)** Complete the table:

Shark teeth regeneration (thousands)

No. of days	10	20	30	40	50	60
Teeth regenerated	3	3.6	4.2	4.8		

**g)** Complete the table:

Exercise program

time (min)	10	15	20	25	30
energy (cal.)	240	280	320		

**h)** Complete the table:

Equilateral triangle

Side length	0.4	0.8	1.2	1.6	2	2.4
Perimeter	1.2	2.4	3.6	4.8		

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

MM7 11 22 33 44  
MM8 11 22 33 44

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

$\begin{array}{ccccccc} & \nearrow & & \nearrow & & \nearrow & \\ & \times 4 & & \times 4 & & \times 4 & \\ & \nwarrow & & \nwarrow & & \nwarrow & \end{array}$

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

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

$$16 \times 4 = 64$$

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

**a)** Complete the pattern:

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

$\begin{array}{ccccccc} & \nearrow & & \nearrow & & \nearrow & \\ & \times 3 & & \times 3 & & \times 3 & \\ & \nwarrow & & \nwarrow & & \nwarrow & \end{array}$

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

**b)** Complete the pattern:

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

$\begin{array}{ccccccc} & \nearrow & & \nearrow & & \nearrow & \\ & \times 2 & & \times 2 & & \times 2 & \\ & \nwarrow & & \nwarrow & & \nwarrow & \end{array}$

**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.

MM7 11 22 **3** 3 44  
MM8 11 **2** 2 33 44

- 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, \_\_\_\_\_, \_\_\_\_\_

$\begin{array}{ccccccc} & \curvearrowright & & \curvearrowright & & \curvearrowright & \\ & \div 2 & & \div 2 & & \div 2 & \end{array}$

**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,

$\begin{array}{ccccccc} & \curvearrowright & & \curvearrowright & & \curvearrowright & \\ & \div 5 & & \div 5 & & \div 5 & \end{array}$

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

**b)** Complete the pattern:

128, 64, 32, 16,

$\begin{array}{ccccccc} & \curvearrowright & & \curvearrowright & & \curvearrowright & \\ & \div 2 & & \div 2 & & \div 2 & \end{array}$

**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:

70000, 7000, 700, 70,

**j)** Complete the pattern:

512, 128, 32, 8,

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

MM7 11 22 33 44  
MM8 11 22 33 44

- 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.**  $3, 6, 12, 21, 33, \_, \_$  First note that each term in the pattern is increasing. Then find by how much.

$+3 \quad +6 \quad +9 \quad +12$

**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**

**a)** Complete the pattern:

18, 20, 24, 30, 38,  ,

$+2 \quad +4 \quad +6 \quad +8 \quad +10 \quad +12$

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

**b)** Complete the pattern:

2, 6, 14, 26, 42,  ,

$+4 \quad +8 \quad +12 \quad +16 \quad +? \quad +?$

**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,  ,

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

**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.

MM7 11 22 33 44  
MM8 11 22 33 44

- 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,  ,

$\begin{array}{ccccccc} & \curvearrowright & & \curvearrowright & & \curvearrowright & \\ & -4 & & -4 & & -4 & \end{array}$

**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,  ,

$\begin{array}{ccccccccc} & \curvearrowright & & \curvearrowright & & \curvearrowright & & \curvearrowright & & \curvearrowright & \\ & -8 & & -8 & & -8 & & -8 & & -8 & \end{array}$

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

**b)** Complete the pattern:

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

$\begin{array}{ccccccccc} & \curvearrowright & & \curvearrowright & & \curvearrowright & & \curvearrowright & & \curvearrowright & \\ & +3 & & +3 & & +3 & & +3 & & +3 & \end{array}$

**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).

EITHER

- Find the terms in order until you get to the required 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 ...



**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	$6 \times 1 + 2$	$6 \times 2 + 2$	$6 \times 3 + 2$	$6 \times 4 + 2$		$6 \times 8 + 2$

Relationship: 6 times the term number + 2

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

**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	$2 \times 1 - 1$	$2 \times 2 - 1$	$2 \times 3 - 1$	$2 \times 4 - 1$		$2 \times 14 - 1$

Relationship: 2 times the term number - 1

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

**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).

MM7 11 22 33 44  
MM8 11 22 33 44

**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.

MM7 11 22 33 44  
MM8 11 22 33 44

- 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 ( $n = 10$ ).

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

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

$$\begin{aligned} & n + 5 \\ = & \phantom{20} + 5 = \boxed{\phantom{00}} \end{aligned}$$

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

$$\begin{aligned} & \phantom{n} - 8 \\ = & \phantom{13} - 8 = \boxed{\phantom{00}} \end{aligned}$$

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

$$\begin{aligned} & \phantom{n} + 8 \\ = & \phantom{16} + 8 = \boxed{\phantom{00}} \end{aligned}$$

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

$$\begin{aligned} & 2n + 1 \\ = & 2 \times 20 + 1 = \boxed{\phantom{00}} \end{aligned}$$

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

$$\begin{aligned} & 50 - 5n \\ = & 50 - 5 \times 6 = \boxed{\phantom{00}} \end{aligned}$$

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

$$\begin{aligned} & 5n + 7 \\ = & 5 \times 9 + 7 = \boxed{\phantom{00}} \end{aligned}$$

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

$$\begin{aligned} & 14 - 2n \\ = & 14 - 2 \times 6 = \boxed{\phantom{00}} \end{aligned}$$

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

$$\begin{aligned} & n^2 + 1 \\ = & 10^2 + 1 = \boxed{\phantom{00}} \end{aligned}$$

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

$$\begin{aligned} & n^2 + 6 \\ = & 8^2 + 6 = \boxed{\phantom{00}} \end{aligned}$$