

13. [Number Patterns]

Skill 13.1 Completing number patterns by adding, subtracting, multiplying or dividing by the same positive integer.

MMMaive 1 1 2 2 3 3 4 4
MMLime 1 1 2 2 3 3 4 4

- Look at consecutive terms of the pattern.
- Find the operation used to get from one term to the next.
Hint: Every number pattern is created by adding, subtracting, multiplying or dividing by the same positive integer.
- Define the rule (operation) of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.

Q. Complete the pattern:
135, 120, 105, 90, 75, ,

A. 135, 120, 105, 90, 75, ,
 $\begin{array}{cccccccc} & \curvearrowright & & \curvearrowright & & \curvearrowright & & \curvearrowright \\ & -15 & & -15 & & -15 & & -15 \end{array}$

Rule: Subtract 15 from each term.
The pattern is formed by subtracting 15.
 $75 - 15 = 60$
 $60 - 15 = 45$
135, 120, 105, 90, 75, 60, 45

a) What is the value of the missing term in the pattern?

| | | | | | | |
|-------------|---|---|----|----|----|---|
| term number | 1 | 2 | 3 | 4 | 5 | 6 |
| term value | 1 | 9 | 17 | 25 | 33 | ? |

$\begin{array}{ccccccccc} & & \curvearrowright & & \curvearrowright & & \curvearrowright & & \curvearrowright & & \curvearrowright \\ & & +8 & & +8 & & +8 & & +8 & & +8 \end{array}$
 $25 + 8 = 33$ $33 + 8 = 41$

b) What is the value of the missing term in the pattern?

| | | | | | | |
|-------------|----|----|---|---|----|---|
| term number | 1 | 2 | 3 | 4 | 5 | 6 |
| term value | 15 | 11 | 7 | 3 | -1 | ? |

.....

c) What is the value of the missing term in the pattern?

| | | | | | | |
|-------------|---|----|----|-----|------|---|
| term number | 1 | 2 | 3 | 4 | 5 | 6 |
| term value | 2 | 10 | 50 | 250 | 1250 | ? |

.....

d) What is the value of the missing term in the pattern?

| | | | | | | |
|-------------|----|----|----|----|----|---|
| term number | 1 | 2 | 3 | 4 | 5 | 6 |
| term value | 57 | 48 | 39 | 30 | 21 | ? |

.....

e) Complete the pattern:
3, 11, 19, 27, 35, ,
 $\begin{array}{cccccccc} & \curvearrowright & & \curvearrowright & & \curvearrowright & & \curvearrowright & & \curvearrowright & & \curvearrowright \\ & +8 & & +8 & & +8 & & +8 & & +8 & & +8 \end{array}$

.....

f) Complete the pattern:
1215, 405, 135, 45, ,
 $\begin{array}{ccccccc} & \curvearrowright & & \curvearrowright & & \curvearrowright & \\ & \div 3 & & \div 3 & & \div 3 & \end{array}$

.....

g) Complete the pattern:
1, 2, 4, 8, 16, ,
 $\begin{array}{ccccccc} & \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright & & \\ & \times 2 & \times 2 & \times 2 & \times 2 & & \end{array}$

.....

h) Complete the pattern:
3, 6, 12, 24, 48, ,
 $\begin{array}{ccccccc} & \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright & & \\ & \times 2 & \times 2 & \times 2 & \times 2 & & \end{array}$

.....

Skill 13.2 Completing number patterns by adding or subtracting variable numbers.

- Look at consecutive terms of the pattern.
- Find the operation used to get from one term to the next.
Hint: Every number pattern is created by adding or subtracting integers following a certain pattern.
- Define the rule (operation) of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.
Hint: Counting numbers, even numbers and odd numbers have patterns themselves that can become part of the rule (see below).

Q. Complete the pattern:

3, 5, 9, 15, 23, ,

A. 3, 5, 9, 15, 23, ,
 $\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \\ +2 & +4 & +6 & +8 \end{array}$

Rule: Add 2, then 4, then 6, then 8, etc.
The pattern is formed by adding consecutive even numbers.

$23 + 10 = 33$

$33 + 12 = 45$

3, 5, 9, 15, 23, **33**, **45**

a) Complete the pattern:

11, 13, 16, 20, 25, ,
 $\begin{array}{cccccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \\ +2 & +3 & +4 & +5 & +6 & +7 \end{array}$

$25 + 6 = 31$ $31 + 7 = 38$

b) Complete the pattern:

2, 3, 5, 8, 12, ,
 $\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \end{array}$

c) Complete the pattern:

2, 6, 14, 26, 42, ,
 $\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \end{array}$

d) Complete the pattern:

1, 3, 7, 13, 21, ,
 $\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \end{array}$

e) Complete the pattern:

1, 4, 10, 19, 31, ,
 $\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \end{array}$

f) Complete the pattern:

5, 6, 9, 14, 21, ,
 $\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \end{array}$

g) Complete the pattern:

51, 50, 47, 42, 35, ,
 $\begin{array}{cccc} \curvearrowleft & \curvearrowleft & \curvearrowleft & \curvearrowleft \end{array}$

h) Complete the pattern:

53, 50, 45, 38, 29, ,
 $\begin{array}{cccc} \curvearrowleft & \curvearrowleft & \curvearrowleft & \curvearrowleft \end{array}$

i) Complete the pattern:

10, 8, 5, 1, -4, ,
 $\begin{array}{cccc} \curvearrowleft & \curvearrowleft & \curvearrowleft & \curvearrowleft \end{array}$

j) Complete the pattern:

16, 14, 10, 4, -4, ,
 $\begin{array}{cccc} \curvearrowleft & \curvearrowleft & \curvearrowleft & \curvearrowleft \end{array}$

Skill 13.3 Completing number patterns by adding or subtracting the same positive number to integers.

- Look at consecutive terms of the pattern.
- Find the operation used to get from one term to the next.
Hint: Every number pattern is created by adding or subtracting the same positive integer.
- Define the rule (operation) of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.

Q. Complete the pattern:
21, 13, 5, -3, -11, ,

A. 21, 13, 5, -3, -11, ,
 $\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \\ -8 & -8 & -8 & -8 \end{array}$

Rule: Subtract 8 from each term.

$$-11 - 8 = -19$$

$$-19 - 8 = -27$$

$$21, 13, 5, -3, -11, \underline{-19}, \underline{-27}$$

a) Complete the pattern:
8, 5, 2, -1, -4, ,
 $\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \\ -3 & -3 & -3 & -3 \end{array}$
 $-4 - 3 = -7$ $-7 - 3 = -10$

b) Complete the pattern:
-16, -11, -6, -1, 4, ,
 $\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \\ +5 & & & \end{array}$

c) Complete the pattern:
-20, -14, -8, -2, 4, ,
 $\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \end{array}$

d) Complete the pattern:
9, 5, 1, -3, -7, ,
 $\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \end{array}$

e) Complete the pattern:
10, 7, 4, 1, -2, ,
 $\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \end{array}$

f) Complete the pattern:
-35, -28, -21, -14, -7, ,
 $\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \end{array}$

g) Complete the pattern:
-19, -15, -11, -7, -3, ,
 $\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \end{array}$

h) Complete the pattern:
30, 22, 14, 6, -2, ,
 $\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \end{array}$

i) Complete the pattern:
-21, -12, -3, 6, 15, ,
 $\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \end{array}$

j) Complete the pattern:
16, 10, 4, -2, -8, ,
 $\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \end{array}$

k) Complete the pattern:
12, 7, 2, -3, -8, ,
 $\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \end{array}$

l) Complete the pattern:
46, 34, 22, 10, -2, ,
 $\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \end{array}$

Skill 13.4 Completing number patterns by multiplying or dividing by the same integer.

- Look at consecutive terms of the pattern.
- Find the operation used to get from one term to the next.
Hint: Every number pattern is created by multiplying or dividing by the same integer.
- Define the rule (operation) of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.

Q. Complete the pattern:

$$\frac{3}{49}, \frac{3}{7}, 3, 21, 147, \boxed{\quad, \quad}$$

A. $\frac{3}{49}, \frac{3}{7}, 3, 21, 147, \underline{\quad}, \underline{\quad}$

$$\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \\ \times 7 & \times 7 & \times 7 & \times 7 \end{array}$$

Rule: Multiply each term by 7.

$$147 \times 7 = 1029$$

$$1029 \times 7 = 7203$$

$$\frac{3}{49}, \frac{3}{7}, 3, 21, 147, \underline{1029}, \underline{7203}$$

a) Complete the pattern:

$$288, -144, 72, -36, 18, \boxed{\quad, \quad}$$

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

$$18 \div (-2) = -9 \quad -9 \div (-2) = 4.5$$

b) Complete the pattern:

$$2, -6, 18, -54, 162, \boxed{\quad, \quad}$$

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

c) Complete the pattern:

$$-1, 5, -25, 125, \boxed{\quad, \quad}$$

$$\begin{array}{ccc} \curvearrowright & \curvearrowright & \curvearrowright \end{array}$$

d) Complete the pattern:

$$-200,000, 20,000, -2,000, 200, \boxed{\quad, \quad}$$

$$\begin{array}{ccc} \curvearrowright & \curvearrowright & \curvearrowright \end{array}$$

e) Complete the pattern:

$$\frac{1}{6}, 1, 6, 18, \boxed{\quad, \quad}$$

$$\begin{array}{ccc} \curvearrowright & \curvearrowright & \curvearrowright \end{array}$$

f) Complete the pattern:

$$\frac{3}{5}, 3, 15, 75, \boxed{\quad, \quad}$$

$$\begin{array}{ccc} \curvearrowright & \curvearrowright & \curvearrowright \end{array}$$

g) Complete the pattern:

$$\frac{7}{4}, \frac{7}{2}, 7, 14, 28, \boxed{\quad, \quad}$$

$$\begin{array}{ccc} \curvearrowright & \curvearrowright & \curvearrowright \end{array}$$

h) Complete the pattern:

$$\frac{1}{64}, \frac{1}{8}, 1, 8, 64, \boxed{\quad, \quad}$$

$$\begin{array}{ccc} \curvearrowright & \curvearrowright & \curvearrowright \end{array}$$

i) Complete the pattern:

$$\frac{2}{81}, \frac{2}{9}, 2, 18, 162, \boxed{\quad, \quad}$$

$$\begin{array}{ccc} \curvearrowright & \curvearrowright & \curvearrowright \end{array}$$

j) Complete the pattern:

$$\frac{11}{100}, \frac{11}{10}, 11, 110, \boxed{\quad, \quad}$$

$$\begin{array}{ccc} \curvearrowright & \curvearrowright & \curvearrowright \end{array}$$

Skill 13.5 Completing number patterns involving decimals and fractions.

- Look at consecutive terms of the pattern.
- Find the operation used to get from one term to the next.
Hint: Every number pattern is created by adding, subtracting, multiplying or dividing by rational numbers (whole numbers, fractions or decimals).
- Define the rule (operation) of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.

Q. Complete the pattern:

$$\frac{5}{18}, \frac{1}{2}, \frac{13}{18}, \frac{17}{18}, 1\frac{1}{6}, \boxed{\quad, \quad}$$

A. $\frac{5}{18}, \frac{1}{2}, \frac{13}{18}, \frac{17}{18}, 1\frac{1}{6}, \underline{\quad}, \underline{\quad}$

Look at the 3rd and 4th terms: their difference is $\frac{4}{18}$

Rule: Add $\frac{4}{18}$ to each term.

$$1\frac{1}{6} + \frac{4}{18} = \frac{7}{6} + \frac{4}{18} = \frac{21}{18} + \frac{4}{18} = \frac{25}{18} = 1\frac{7}{18}$$

$$\frac{25}{18} + \frac{4}{18} = \frac{29}{18} = 1\frac{11}{18}$$

$$\frac{5}{18}, \frac{1}{2}, \frac{13}{18}, \frac{17}{18}, 1\frac{1}{6}, \underline{1\frac{7}{18}}, \underline{1\frac{11}{18}}$$

a) Complete the pattern:

$$1, 2, 3.5, 5.5, 8, \boxed{\quad, \quad}$$

$\begin{array}{cccccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \\ +1 & +1.5 & +2 & +2.5 & +3 & +3.5 \end{array}$

$$8 + 3 = 11 \qquad 11 + 3.5 = 14.5$$

b) Complete the pattern:

$$0.8, 2, 3.4, 5, 6.8, \boxed{\quad, \quad}$$

$\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \\ +1.2 & & & \end{array}$

c) Complete the pattern:

$$1.5, 3.5, 6, 9, 12.5, \boxed{\quad, \quad}$$

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

d) Complete the pattern:

$$4, 5.5, 7.5, 10, 13, \boxed{\quad, \quad}$$

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

e) Complete the pattern:

$$1.75, 3.5, 7, 14, \boxed{\quad, \quad}$$

$\begin{array}{ccc} \curvearrowright & \curvearrowright & \curvearrowright \end{array}$

f) Complete the pattern:

$$1\frac{1}{4}, 2\frac{1}{2}, 5, 10, \boxed{\quad, \quad}$$

$\begin{array}{ccc} \curvearrowright & \curvearrowright & \curvearrowright \end{array}$

g) Complete the pattern:

$$36, 18, 9, \frac{9}{2}, \frac{9}{4}, \boxed{\quad, \quad}$$

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

h) Complete the pattern:

$$32, 8, 2, \frac{1}{2}, \frac{1}{8}, \boxed{\quad, \quad}$$

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

i) Complete the pattern:

$$3\frac{1}{4}, 4, 4\frac{3}{4}, 5\frac{1}{2}, 6\frac{1}{4}, \boxed{\quad, \quad}$$

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

j) Complete the pattern:

$$\frac{8}{15}, \frac{4}{5}, 1\frac{1}{15}, 1\frac{1}{3}, 1\frac{3}{5}, \boxed{\quad, \quad}$$

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

Skill 13.6 Finding a term in a number pattern.

- Draw a table and list the given terms and also the position each term occupies in the pattern.
- Look for a relationship between consecutive terms and/or between the term and its position in the pattern.
- Based on this relationship, find the requested term in the pattern.

Q. Find the 30th term in the pattern
2, 4, 6, 8, 10,

A.

| position | 1 st | 2 nd | 3 rd | 4 th | 5 th | ..... | 30 th |
|--------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------|------------------|
| term | 2 | 4 | 6 | 8 | 10 | | ? |
| relationship | 1×2 | 2×2 | 3×2 | 4×2 | 5×2 | | 30×2 |

Relationship: each term = twice its position.
The 30th term of the pattern is $2 \times 30 = 60$

a) Find the 20th term in the pattern
5, 7, 9, 11, 13,

| position | 1 st | 2 nd | 3 rd | 4 th | 5 th | ..... | 20 th |
|--------------|------------------|------------------|------------------|------------------|------------------|-------|-------------------|
| term | 5 | 7 | 9 | 11 | 13 | | ? |
| relationship | $1 \times 2 + 3$ | $2 \times 2 + 3$ | $3 \times 2 + 3$ | $4 \times 2 + 3$ | $5 \times 2 + 3$ | | $20 \times 2 + 3$ |

Relationship: term = position \times 2 + 3

20th term = $20 \times 2 + 3$ =

b) Find the 15th term in the pattern
5, 10, 15, 20, 25,

| position | 1 st | 2 nd | 3 rd | 4 th | 5 th | ..... | 15 th |
|--------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------|------------------|
| term | 5 | 10 | 15 | 20 | 25 | | ? |
| relationship | 1×5 | 2×5 | 3×5 | 4×5 | 5×5 | | |

Relationship: term =

15th term =

c) Find the 20th term in the pattern
8, 13, 18, 23, 28,

| position | 1 st | 2 nd | 3 rd | 4 th | 5 th | ..... | 20 th |
|--------------|------------------|------------------|------------------|------------------|------------------|-------|------------------|
| term | 8 | 13 | 18 | 23 | 28 | | ? |
| relationship | $1 \times 5 + 3$ | $2 \times 5 + 3$ | $3 \times 5 + 3$ | $4 \times 5 + 3$ | $5 \times 5 + 3$ | | |

Relationship: term =

20th term =

d) Find the 25th term in the pattern
4, 6, 8, 10, 12,

| position | 1 st | 2 nd | 3 rd | 4 th | 5 th | ..... | 25 th |
|--------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------|------------------|
| term | 4 | 6 | 8 | 10 | 12 | | ? |
| relationship | | | | | | | |

Relationship: term =

25th term =

e) Find the 20th term in the pattern
1, 4, 7, 10, 13,

| position | 1 st | 2 nd | 3 rd | 4 th | 5 th | ..... | 20 th |
|--------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------|------------------|
| term | 1 | 4 | 7 | 10 | 13 | | ? |
| relationship | | | | | | | |

Relationship: term =

20th term =

f) Find the 8th term in the pattern
1, 2, 4, 8, 16,

| position | 1 st | 2 nd | 3 rd | 4 th | 5 th | ..... | 8 th |
|--------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------|-----------------|
| term | 1 | 2 | 4 | 8 | 16 | | ? |
| relationship | | | | | | | |

Relationship: term =

8th term =

Skill 13.7 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 t_{40} needs to be found, the value of n is 40.
- Substitute the value of n in the formula for the general rule of the pattern t_n
- Calculate the value of the particular term of the sequence.

Q. If the rule of a pattern is $t_n = \frac{n}{4} - 9$
find t_{60}

A. t_{60} is the 60th term of the sequence.

$$t_n = \frac{n}{4} - 9 \quad \text{substitute } n = 60$$

$$t_{60} = \frac{60}{4} - 9$$

$$= 15 - 9$$

$$= 6$$

a) If the general rule of a sequence is $t_n = 5n - 4$
find t_{30}

$$t_{30} = 5 \times 30 - 4 \quad n = 30$$

$$= 150 - 4 = \boxed{}$$

b) If the general rule of a sequence is $t_n = 4n - 7$
find t_{15}

$$t_{15} = = \boxed{}$$

c) If the general rule of a sequence is $t_n = 8 - 5n$,
find t_{10}

$$t_{10} = $$

$$= = \boxed{}$$

d) If the general rule of a sequence is $t_n = 25 - n$
find t_{40}

$$t_{40} = $$

$$= = \boxed{}$$

e) If the general rule of a sequence is $t_n = 15n$
find t_{30}

$$t_{30} = $$

$$= = \boxed{}$$

f) If the general rule of a sequence is $t_n = 40n$
find t_{25}

$$t_{25} = $$

$$= = \boxed{}$$

g) If the general rule of a sequence is $t_n = -\frac{2n}{7}$
find t_{35}

$$t_{35} = $$

$$= = \boxed{}$$

h) If the general rule of a sequence is $t_n = \frac{n}{3} + 1$
find t_{21}

$$t_{21} = $$

$$= = \boxed{}$$

i) If the general rule of a sequence is $t_n = -6(n - 3)$
find t_{23}

$$t_{23} = $$

$$= = \boxed{}$$

j) If the general rule of a sequence is $t_n = 3(n - 6)$
find t_{24}

$$t_{24} = $$

$$= = \boxed{}$$

Skill 13.8 Finding two or more terms of a sequence given its general rule.

- Identify the values of n for the requested terms of the sequence.
Hint: If $n \geq 3$ and the first 3 terms need to be found, the values of n are 3, 4 and 5.
- Substitute the values of n in the formula for the general rule of the sequence t_n
- Calculate the values of the particular terms of the sequence.

Q. Write the first four terms of the sequence where $t_n = 4 - n^2$ and $n \geq 2$

A. $n \geq 2$ means that the first four terms are t_2, t_3, t_4 and t_5
 $n = 2 \Rightarrow t_2 = 4 - 2^2 = 4 - 4 = 0$
 $n = 3 \Rightarrow t_3 = 4 - 3^2 = 4 - 9 = -5$
 $n = 4 \Rightarrow t_4 = 4 - 4^2 = 4 - 16 = -12$
 $n = 5 \Rightarrow t_5 = 4 - 5^2 = 4 - 25 = -21$
 The first 4 terms are: **0, -5, -12, -21**

a) Write the first three terms of the sequence where $t_n = 20 - 7n$ and $n \geq 1$

$n = 1 \Rightarrow t_1 = 20 - 7 \cdot 1 = 20 - 7 = 13$
.....

$n = 2 \Rightarrow t_2 =$
.....

$n = 3 \Rightarrow t_3 =$
.....

b) Write the first three terms of the sequence where $t_n = n^2 - 6$ and $n \geq 2$

$n = 2 \Rightarrow t_2 =$
.....

$n = 3 \Rightarrow t_3 =$
.....

$n = 4 \Rightarrow t_4 =$
.....

c) Write the first four terms of the sequence where $t_n = (-2)^n$ and $n \geq 1$

$n = 1 \Rightarrow t_1 =$
.....

$n = 2 \Rightarrow t_2 =$
.....

.....

.....

d) Write the first four terms of the sequence where $t_n = 9 - n^2$ and $n \geq 3$

$n = 3 \Rightarrow t_3 =$
.....

$n = 4 \Rightarrow$
.....

.....

.....

e) Write the first four terms of the sequence where $t_n = -\frac{3n}{2}$ and $n \geq 4$

$n = 4 \Rightarrow$
.....

.....

.....

.....

f) Write the first four terms of the sequence where $t_n = \frac{5n}{6}$ and $n \geq 3$

$n =$
.....

.....

.....

.....

Skill 13.9 Finding the general rule of a sequence t_n (1).

To decide which general formula is true for the values shown in the table:

- Substitute the values for n (first row in the table) in the general formula.
- Check if the results match the term values (t_n) given in the second row of the table.

To express t_n in terms of n :

EITHER

- Look for a relationship between consecutive terms and/or between the term and its position in the sequence.

Hints: This relationship is an expression of n involving one or more operations, i.e. $t_n = n - 6, 2n, 4n + 2$

OR

- Find the difference between consecutive terms of the sequence (common difference).
- Write the term “common difference $\cdot n$ ” in the expression.
- Check the result by substituting a random value for n into the formula.
- Adjust the expression by adding, subtracting, multiplying or dividing by a constant.
- Check the result by substituting all values for $n = 1, 2, 3, 4, 5$ into the final formula.

Q. Express t_n in terms of n given the table of values for the sequence.

| | | | | | | | |
|----------------|---|---|---|----|----|------|-----|
| number (n) | 1 | 2 | 3 | 4 | 5 | .... | n |
| term t_n | 1 | 5 | 9 | 13 | 17 | .... |  |

$\begin{matrix} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \\ +4 & +4 & +4 & +4 & +4 \end{matrix}$

A. *common difference = 4*
 $\Rightarrow t_n$ contains $4n$

If $t_n = 4n$ and $n = 1 \Rightarrow t_1 = 4 \cdot 1 = 4 \neq 1$

If $t_n = 4n - 3$ — Adjust by subtracting 3

$n = 1 \Rightarrow t_1 = 4 \cdot 1 - 3 = 1$ (true)

$n = 2 \Rightarrow t_2 = 4 \cdot 2 - 3 = 5$ (true)

$n = 3 \Rightarrow t_3 = 4 \cdot 3 - 3 = 9$ (true)

$n = 4 \Rightarrow t_4 = 4 \cdot 4 - 3 = 13$ (true)

$n = 5 \Rightarrow t_5 = 4 \cdot 5 - 3 = 17$ (true)

The general term is $t_n = 4n - 3$

a) The rule for the general term of this sequence is:

- A) $5n + 2$ B) $2n - 5$
C) $5n + 5$ D) $2n + 5$

| | | | | | | | |
|----------------|---|---|----|----|----|----|------|
| number (n) | 1 | 2 | 3 | 4 | 5 | 6 | .... |
| term t_n | 7 | 9 | 11 | 13 | 15 | 17 | .... |

A $n = 1 \Rightarrow t_1 = 5 \cdot 1 + 2 = 7 \Rightarrow$ true

$n = 2 \Rightarrow t_2 = 5 \cdot 2 + 2 = 12 \Rightarrow$ false

B $n = 1 \Rightarrow t_1 = 2 \cdot 1 - 5 = -3 \Rightarrow$ false

C $n = 1 \Rightarrow t_1 = 5 \cdot 1 + 5 = 10 \Rightarrow$ false

D $n = 1 \Rightarrow t_1 = 2 \cdot 1 + 5 = 7 \Rightarrow$ true

$n = 2 \Rightarrow t_2 = 2 \cdot 2 + 5 = 9 \Rightarrow$ true

$n = 3 \Rightarrow t_3 = 2 \cdot 3 + 5 = 11 \Rightarrow$ true

*$n = 4 \Rightarrow t_4 = 2 \cdot 4 + 5 = 13 \Rightarrow$ **D***

b) The rule for the general term t_n of this pattern is:

- A) $3n - 4$ B) $3n + 4$
C) $4n + 3$ D) $4n - 3$

| | | | | | | | |
|----------------|---|----|----|----|----|----|------|
| number (n) | 1 | 2 | 3 | 4 | 5 | 6 | .... |
| term t_n | 7 | 10 | 13 | 16 | 19 | 22 | .... |

A

Skill 13.9 Finding the general rule of a sequence t_n (2).MMMaive 1 1 2 2 3 3 4 4
MMLime 1 1 2 2 3 3 4 4

- c) Express
- t_n
- in terms of
- n
- given the table of values for the sequence.

| | | | | | | | |
|----------------|---|----|----|----|----|-----|----------|
| number (n) | 1 | 2 | 3 | 4 | 5 | ... | n |
| term t_n | 8 | 10 | 12 | 14 | 16 | ... | $2n + 6$ |

common difference = 2

$$t_n = 2n \Rightarrow t_1 = 2 \cdot 1 = 2 \text{ (false)}$$

adjust $t_n = 2n + 6 \Rightarrow t_3 = 2 \cdot 3 + 6 = 12 \text{ (true)}$

- d) Express
- t_n
- in terms of
- n
- given the table of values for the sequence.

| | | | | | | | |
|----------------|---|---|---|---|---|-----|-----|
| number (n) | 1 | 2 | 3 | 4 | 5 | ... | n |
| term t_n | 5 | 4 | 3 | 2 | 1 | ... | |

common difference = 1

$$t_n = n \Rightarrow t_1 = 1 \text{ (false)}$$

adjust $t_n = 6 - n \Rightarrow t_4 = 6 - 4 = 2 \text{ (true)}$

- e) Express
- t_n
- in terms of
- n
- given the table of values for the sequence.

| | | | | | | | |
|----------------|---|---|---|----|----|-----|-----|
| number (n) | 1 | 2 | 3 | 4 | 5 | ... | n |
| term t_n | 2 | 5 | 8 | 11 | 14 | ... | |

common difference =

$$t_n =$$

adjust $t_n =$

- f) Express
- t_n
- in terms of
- n
- given the table of values for the sequence.

| | | | | | | | |
|----------------|---|---|----|----|----|-----|-----|
| number (n) | 1 | 2 | 3 | 4 | 5 | ... | n |
| term t_n | 5 | 9 | 13 | 17 | 21 | ... | |

common difference =

$$t_n =$$

adjust $t_n =$

- g) Express
- t_n
- in terms of
- n
- given the table of values for the sequence.

| | | | | | | | |
|----------------|---|----|----|----|----|-----|-----|
| number (n) | 1 | 2 | 3 | 4 | 5 | ... | n |
| term t_n | 5 | 10 | 15 | 20 | 25 | ... | |

common difference =

$$t_n =$$

- h) Express
- t_n
- in terms of
- n
- given the table of values for the sequence.

| | | | | | | | |
|----------------|---|----|----|----|----|-----|-----|
| number (n) | 1 | 2 | 3 | 4 | 5 | ... | n |
| term t_n | 8 | 11 | 14 | 17 | 20 | ... | |

common difference =

$$t_n =$$

- i) Express
- t_n
- in terms of
- n
- given the table of values for the sequence.

| | | | | | | | |
|----------------|---|---|---|----|----|-----|-----|
| number (n) | 1 | 2 | 3 | 4 | 5 | ... | n |
| term t_n | 2 | 1 | 0 | -1 | -2 | ... | |

common difference =

$$t_n =$$

- j) Express
- t_n
- in terms of
- n
- given the table of values for the sequence.

| | | | | | | | |
|----------------|----|----|----|-----|-----|-----|-----|
| number (n) | 1 | 2 | 3 | 4 | 5 | ... | n |
| term t_n | -3 | -6 | -9 | -12 | -15 | ... | |

common difference =

$$t_n =$$