19. [Number Patterns]

Skill 19.1   Completing number patterns by adding the same number.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- 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. Then find by how much.

+9   +9   +9

Rule: *Add 9 to each term.*

29 + 9 = 38
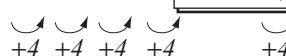
38 + 9 = 47

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

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a) Complete the pattern:

0, 4, 8, 16, | **20** , **24** |
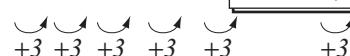
+4 +4 +4 +4   +4

16 + 4 = 20,   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, ____ , ____

- 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:

$$45, 36, 27, 18, \boxed{\underline{}, \underline{}}$$

A. *45 , 36 , 27 , 18 , ___ , ___*   First note
−9   −9   −9   that each
Rule: *Subtract 9*   term in the
from each term.   pattern is
18 − 9 = 9   decreasing.
9 − 9 = 0   Then find
*45 , 36 , 27 , 18 , **9** , **0***   by how
    much.

a) Complete the pattern:

$$18, 15, 12, 9, \boxed{\underline{6}, \underline{3}}$$
$$-3 \quad -3 \quad -3 \quad -3 \qquad -3$$

9 − 3 = 6,   6 − 3 = 3

b) Complete the pattern:

$$16, 14, 12, 10, 8, \boxed{\underline{}, \underline{}}$$
$$-2 \quad -2 \quad -2 \quad -2 \qquad -2 \quad -2$$

c) Complete the pattern:

$$20, 17, 14, 11, 8, \boxed{\underline{}, \underline{}}$$

d) Complete the pattern:

$$35, 30, 25, 20, 15, \boxed{\underline{}, \underline{}}$$

e) Complete the pattern:

$$30, 26, 22, 18, 14, \boxed{\underline{}, \underline{}}$$

f) Complete the pattern:

$$38, 32, 26, 20, \boxed{\underline{}, \underline{}}$$

g) Complete the pattern:

$$98, 88, 78, 68, \boxed{\underline{}, \underline{}}$$

h) Complete the pattern:

$$38, 31, 24, 17, \boxed{\underline{}, \underline{}}$$

i) Complete the pattern:

$$42, 34, 26, 18, \boxed{\underline{}, \underline{}}$$

j) Complete the pattern:

$$50, 41, 32, 23, \boxed{\underline{}, \underline{}}$$

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

MM4.2 **11** 22 33 44
MM5.1 **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:

0.8, 1, 1.2, 1.4, ⎢___ , ___⎢

A. *0.8 , 1 , 1.2 , 1.4 , ___ , ___*
+ 0.2 + 0.2 + 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, ⎢ **2.6** , **3.2** ⎢
+0.6 +0.6 +0.6 +0.6   +0.6

2 + 0.6 = 2.6,   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, ⎢___ , ___⎢

- 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:

$$\frac{2}{9}, \frac{3}{9}, \frac{4}{9}, \frac{5}{9}, \boxed{}\ ,\ \boxed{}$$

A. $\frac{2}{9}, \frac{3}{9}, \frac{4}{9}, \frac{5}{9}, \underline{}, \underline{}$

$+\frac{1}{9}\quad +\frac{1}{9}\quad +\frac{1}{9}$

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

Rule: *Add* $\frac{1}{9}$ *to each term.*

$$\frac{5}{9} + \frac{1}{9} = \frac{6}{9}$$
$$\frac{6}{9} + \frac{1}{9} = \frac{7}{9}$$
$$\frac{2}{9}, \frac{3}{9}, \frac{4}{9}, \frac{5}{9}, \mathbf{\frac{6}{9}}, \mathbf{\frac{7}{9}}$$

a) Complete the pattern:

$$\frac{3}{8}, \frac{4}{8}, \frac{5}{8}, \frac{6}{8}, \boxed{\frac{7}{8}}\ ,\ \boxed{\frac{8}{8}}$$

$+\frac{1}{8}\quad +\frac{1}{8}\quad +\frac{1}{8}\qquad +\frac{1}{8}$

$$\frac{6}{8} + \frac{1}{8} = \frac{7}{8}, \qquad \frac{7}{8} + \frac{1}{8} = \frac{8}{8}$$

b) Complete the pattern:

$$\frac{1}{10}, \frac{3}{10}, \frac{5}{10}, \frac{7}{10}, \boxed{}\ ,\ \boxed{}$$

$+\frac{2}{10}$

c) Complete the pattern:

$$\frac{2}{11}, \frac{5}{11}, \frac{8}{11}, \frac{11}{11}, \boxed{}\ ,\ \boxed{}$$

d) Complete the pattern:

$$\frac{23}{11}, \frac{21}{11}, \frac{19}{11}, \frac{17}{11}, \boxed{}\ ,\ \boxed{}$$

e) Complete the pattern:

$$\frac{34}{13}, \frac{33}{13}, \frac{32}{13}, \frac{31}{13}, \boxed{}\ ,\ \boxed{}$$

f) Complete the pattern:

$$\frac{25}{12}, \frac{23}{12}, \frac{21}{12}, \frac{19}{12}, \boxed{}\ ,\ \boxed{}$$

g) Complete the pattern:

$$\frac{30}{11}, \frac{26}{11}, \frac{22}{11}, \frac{18}{11}, \boxed{}\ ,\ \boxed{}$$

h) Complete the pattern:

$$\frac{28}{9}, \frac{24}{9}, \frac{20}{9}, \frac{16}{9}, \boxed{}\ ,\ \boxed{}$$

Skill 19.5   Completing number patterns in table format by adding the same number.

MM4.2 11 **2** 2 33 44
MM5.1 11 **1** 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 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	7	10	13	16

a) Complete the table:

Growth (mm)

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,   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		

- 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:

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

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

$\times 4 \quad \times 4 \quad \times 4$

Rule: *Multiply each term by 4*

$4 \times 4 = 16$

$16 \times 4 = 64$

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

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

---

a) Complete the pattern:

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

$\times 3 \ \times 3 \ \times 3 \ \times 3 \qquad \times 3$

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

b) Complete the pattern:

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

$\times 2 \times 2 \times 2 \ \times 2 \qquad \times 2$

---

c) Complete the pattern:

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

d) Complete the pattern:

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

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e) Complete the pattern:

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

f) Complete the pattern:

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

---

g) Complete the pattern:

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

h) Complete the pattern:

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

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i) Complete the pattern:

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

j) Complete the pattern:

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

- 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. $640 , 320 , 160 , 80 ,$ ___ , ___

$\div 2 \quad \div 2 \quad \div 2$

Rule: *Divide each term by 2.*

$80 \div 2 = 40$

$40 \div 2 = 20$

$640 , 320 , 160 , 80 , \mathbf{40} , \mathbf{20}$

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

---

a) Complete the pattern:

$9375, 1875, 375, 75,$ | $15 , 3$ |

$\div 5 \quad \div 5 \quad \div 5 \quad \div 5 \quad \div 5$

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

b) Complete the pattern:

$128, 64, 32, 16,$ ⬚ $,$ ⬚

$\div 2 \quad \div 2 \quad \div 2 \quad \div 2 \quad \div 2$

---

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 19.8 Completing number patterns by using changing values in the rule.

MM4.2 1 1 2 2 3 **3** **4** 4
MM5.1 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:

$$3, 6, 12, 21, 33, \underline{\quad}, \underline{\quad}$$

A. $3, 6, 12, 21, 33, \underline{\quad}, \underline{\quad}$

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

Rule: *Add 3 then 6 then 9 etc. to each term.*
(i.e. consecutive multiples of 3)
$33 + 15 = 48$
$48 + 18 = 66$
$3, 6, 12, 21, 33, \mathbf{48}, \mathbf{66}$

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

---

a) Complete the pattern:

$$18, 20, 24, 30, 38, \boxed{48, 60}$$

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

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

b) Complete the pattern:

$$2, 6, 14, 26, 42, \underline{\quad}, \underline{\quad}$$

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

c) Complete the pattern:

$$49, 46, 40, 31, \underline{\quad}, \underline{\quad}$$

d) Complete the pattern:

$$45, 33, 23, 15, 9, \underline{\quad}, \underline{\quad}$$

e) Complete the pattern:

$$14, 13, 10, 9, 6, \underline{\quad}, \underline{\quad}$$

f) Complete the pattern:

$$1, 3, 7, 9, 13, \underline{\quad}, \underline{\quad}$$

g) Complete the pattern:

$$3, 4, 7, 12, 19, \underline{\quad}, \underline{\quad}$$

h) Complete the pattern:

$$144, 100, 64, 36, \underline{\quad}, \underline{\quad}$$

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

i) Complete the pattern:

$$1, 9, 25, 49, \underline{\quad}, \underline{\quad}$$

j) Complete the pattern:

$$343, 216, 125, 64, \underline{\quad}, \underline{\quad}$$

Skill 19.9   Completing number patterns involving negative integers by adding or subtracting the same integer.

MM4.2 11 22 33 4**4**
MM5.1 11 22 3**3** 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:

$$3, -1, -5, -9, \boxed{\underline{}, \underline{}}$$

A. 3 , -1 , -5 , -9 , ___ , ___
           -4 -4 -4

Rule: *Subtract 4 from each term.*

$-9 - 4 = -13$

$-13 - 4 = -17$

$3, -1, -5, -9, \mathbf{-13}, \mathbf{-17}$

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

a) Complete the pattern:

$$29, 21, 13, 5, -3, \boxed{-11, -19}$$
$-8 -8 -8 -8 -8 -8$

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

b) Complete the pattern:

$$-17, -14, -11, -8, -5, \boxed{\underline{}, \underline{}}$$
$+3 +3 +3 +3 +3 +3$

c) Complete the pattern:

$$-22, -17, -12, -7, -2, \boxed{\underline{}, \underline{}}$$

d) Complete the pattern:

$$1, -1, -3, -5, -7, \boxed{\underline{}, \underline{}}$$

e) Complete the pattern:

$$10, 6, 2, -2, \boxed{\underline{}, \underline{}}$$

f) Complete the pattern:

$$-13, -7, -1, 5, \boxed{\underline{}, \underline{}}$$

g) Complete the pattern:

$$17, 8, -1, -10, \boxed{\underline{}, \underline{}}$$

h) Complete the pattern:

$$-23, -16, -9, -2, \boxed{\underline{}, \underline{}}$$

i) Complete the pattern:

$$7, 3, -1, -5, \boxed{\underline{}, \underline{}}$$

j) Complete the pattern:

$$-23, -15, -7, 1, \boxed{\underline{}, \underline{}}$$

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 ...*

  +6   +6   +6

Rule: *Add 6 to each term.*

$26 + 6 = 32$

$32 + 6 = 38$

$38 + 6 = 44$

$44 + 6 = \mathbf{50}$

*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 $6 \times 8 + 2 = \mathbf{50}$

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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

---

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:

$\dfrac{1}{2}, \dfrac{1}{4}, \dfrac{1}{6}, \dfrac{1}{8}, ...$

....

....

l) Find the 8th term in the pattern:

$\dfrac{1}{2}, \dfrac{1}{4}, \dfrac{1}{8}, \dfrac{1}{16}, ...$

....

....

- 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 ($n = 15$).

A. $15 + n$
$= 15 + 15$ ⟵ (substitute $n = 15$)
$= \boldsymbol{30}$

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

$n - 4$
$= 10 - 4$ $= \boxed{6}$

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

$n + 5$
$=$ $= \boxed{}$

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

$=$ $= \boxed{}$

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

$=$ $= \boxed{}$

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

$=$ $= \boxed{}$

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

$=$ $= \boxed{}$

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

$=$ $= \boxed{}$

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

$=$ $= \boxed{}$

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

$=$ $= \boxed{}$

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

$=$ $= \boxed{}$