

Chapter 3 Patterns and Sequences

Multiple Choice Section

- Which one of the following is correct about the description of the pattern of the numbers 1 024, 256, 64, 16, 4?
 - The first number is 1 024, the next number is formed by multiplying the previous number by 4. This pattern goes on.
 - The first number is 1 024, the next number is formed by dividing the previous number by 4. This pattern goes on.
 - The first number is 1 024, the next number is formed by subtracting 768 from the previous number. This pattern goes on.
 - The first number is 1 024, the next number is formed by subtracting 256 from the previous number. This pattern goes on.

- Which of the following must be correct?
 - 49 is a square number.
 - 81 is a square number.
 - 99 is not a square number.

A. I only B. II only C. I and II D. I, II and III

- How many square number(s) is/are there from 260 to 300?

A. 1 B. 2 C. 3 D. 4

- Which one of the following must be correct?
 - Both 6 and 50 are triangular numbers.
 - Both 4 and 45 are triangular numbers.
 - Both 12 and 21 are triangular numbers.
 - Both 1 and 78 are triangular numbers.

- Using the pattern of triangular numbers, determine how many of the following numbers are triangular numbers.
35, 12, 27, 231

A. 1 B. 2 C. 3 D. 4

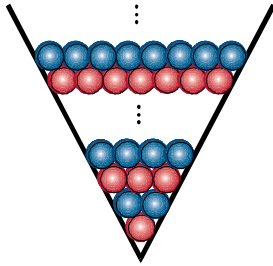
- Which one of the following shows that a square number can be divided into the sum of two consecutive triangular numbers?

A. $400 = 378 + 22$ B. $400 = 300 + 100$ C. $400 = 210 + 190$ D. $400 = 153 + 247$

7. Which one of the following is correct about the number 1?

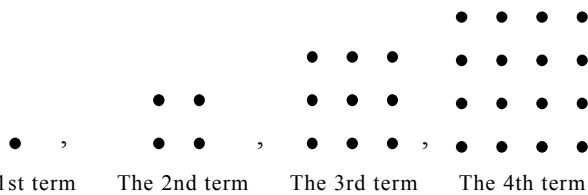
- A. It is a triangular number, but not a square number.
- B. It is a square number, but not a triangular number.
- C. It is both a triangular number and a square number.
- D. It is neither a triangular number nor a square number.

8. As shown in the diagram below, a V-shaped pen-holder holds red and blue pens, alternating colours with each layer. The bottom layer has one red pen, and each layer has one more pen than the layer below it. If there are 35 layers, how many pens of each colour are there?



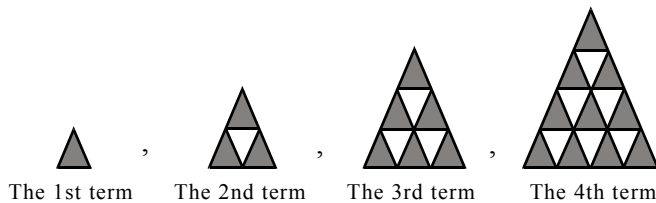
- A. 306 red pens, 324 blue pens
- B. 324 red pens, 324 blue pens
- C. 306 red pens, 306 blue pens
- D. 324 red pens, 306 blue pens

9. The following is the first four terms of the square sequence. Suppose you have 700 dots to form the largest possible square. Which term in the sequence is the square you produced?



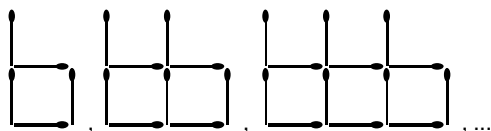
- A. The 24th term
- B. The 25th term
- C. The 26th term
- D. The 27th term

10. The following is a sequence of figures.



- How many grey triangles are there in the 13th figure?
- A. 66
 - B. 78
 - C. 91
 - D. 94

11. The following figures are formed by matches of equal length.



What sequence is formed by the numbers of matches in the figures?

- A. Square sequence
- B. Geometric sequence
- C. Arithmetic sequence
- D. Triangular sequence

12. Find the next three terms of the sequence 100, 98.1, 96.2, 94.3, ...

- A. 92.1, 90.2, 88.3
- B. 92.2, 90.3, 88.4
- C. 92.3, 90.4, 88.5
- D. 92.4, 90.5, 88.6

13. Find the next three terms of the sequence 0.002, 0.01, 0.05, 0.25, ...

- A. 0.5, 2.5, 12.5
- B. 1.05, 5.25, 26.25
- C. 1.25, 6.25, 31.25
- D. 1.5, 7.5, 37.5

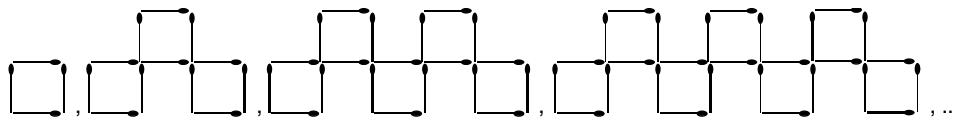
14. Find the 4th term of the sequence 1, 3, 9, □, 81, ...

- A. 30
- B. 36
- C. 24
- D. 27

15. In the square sequence 1, 4, 9, 16, ... , if the n th term is 225 and the m th term is 324, find the values of n and m .

- A. $n = 15$ and $m = 18$
- B. $n = 16$ and $m = 19$
- C. $n = 14$ and $m = 18$
- D. $n = 225$ and $m = 324$

16. The following is a sequence of figures formed by matches of equal length.



The 1st figure The 2nd figure The 3rd figure The 4th figure

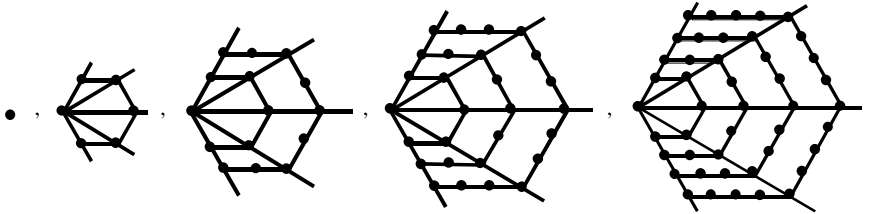
Find the number of squares in the 10th figure.

- A. 10
- B. 17
- C. 18
- D. 19

17. Find the 12th term of the Fibonacci sequence 1, 1, 2, 3, 5, 8, ...

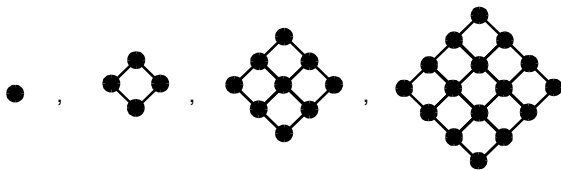
- A. 47
- B. 81
- C. 142
- D. 144

18. A number that can be arranged to form the following regular hexagon is called hexagonal number. It can be represented by the sum of the terms of an arithmetic sequence with a common difference 4. Find the 15th hexagonal number.



1 $6 = 1 + 5$ $15 = 1 + 5 + 9$ $28 = 1 + 5 + 9 + 13$ $45 = 1 + 5 + 9 + 13 + 17$
 A. 425 B. 430 C. 435 D. 436

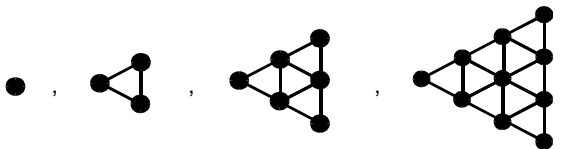
19. The following is the first four terms of a sequence. Find the total number of dots in the 3rd term, the 10th term and the 12th term.



The 1st term The 2nd term The 3rd term The 4th term

- A. 225 B. 235 C. 248 D. 253

20. The following is the first four terms of a sequence. Find the total number of dots in the 4th term, the 6th term and the 10th term.



The 1st term The 2nd term The 3rd term The 4th term

- A. 82 B. 83 C. 86 D. 91

21. Starting from the third term of the sequence \square , $\frac{7}{8}$, \square , $4\frac{3}{4}$, $8\frac{5}{8}$, $13\frac{3}{8}$, \square , ... , each term is the sum of the previous two terms. Fill in the boxes with suitable numbers in respective order.

- A. 3 , $3\frac{7}{8}$, 22 B. $3\frac{7}{8}$, 3 , 22 C. 3 , $3\frac{7}{8}$, 21 D. $2\frac{7}{8}$, $3\frac{7}{8}$, 22

22. The pattern of a set of numbers is as follows:

The 2nd number equals the 1st number times 2 and then add 2. The 3rd number equals the 2nd number times 2 and then add 2, etc.

Which of the following can be the set of numbers?

- A. 4, 6, 8, 10, 12 B. 1, 2, 4, 10, 22
C. 2, 6, 14, 20, 54 D. 1, 4, 10, 22, 46

23. Starting from the third term of the sequence 5, 1, 6, 7, 13, 20, 33, ..., each term is the sum of the previous two terms. Find the sum of all even-ordered terms in the first 15 terms.

- A. 3 079 B. 1 537 C. 1 536 D. 1 517

24. Which of the following is/are the number pattern of the sequence 3, 12, 27, 48, 75, ... ?

- I. $3(n + 3)$
II. $3n^2$
III. $(n + 2)^2$
A. I only B. II only C. III only D. I and II

25. Which of the following is/are the number pattern of the sequence $\frac{5}{3}, \frac{10}{8}, \frac{17}{15}, \frac{26}{24}, \frac{37}{35}, \dots$?

- I. $\frac{n+4}{n+2}$
II. $\frac{(n+1)^2+1}{(n+1)^2-1}$
III. $\frac{(3n)^2-4}{n^2+2}$
A. I only B. II only C. III only D. I and II

26. Which of the following is/are the number pattern of the sequence

$$\frac{2 \times 1^2 - 1}{5}, \frac{2 \times 2^2 - 1}{6}, \frac{2 \times 3^2 - 1}{7}, \frac{2 \times 4^2 - 1}{8}, \frac{2 \times 5^2 - 1}{9}, \frac{2 \times 6^2 - 1}{10}, \dots ?$$

- I. $\frac{2n^2-1}{n+4}$
II. $\frac{(2n)^2-n}{n+4}$
III. $\frac{n(2n-1)}{n+4}$
A. I only B. II only C. III only D. I and II

27. Find the number pattern, in terms of n , of the sequence $2, \frac{5}{2}, \frac{10}{3}, \frac{17}{4}, \dots$

- A. $\frac{n^2+1}{n}$ B. $\frac{2n+1}{n}$ C. $\frac{n+3}{n}$ D. $\frac{n^2+2}{n}$

28. Find the number pattern of the sequence $2, 2+3 \times 1, 2+3 \times 2, 2+3 \times 3, \dots$

- A. $2+3n$ B. $2+3(n-1)$ C. $2+3(n+1)$ D. $3n+1$

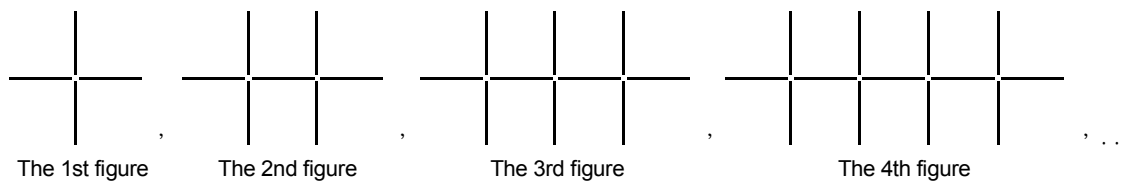
29. If the number pattern of a sequence is $3n^2+1$, find the first four terms of the sequence.

- A. 10, 37, 82, 145 B. 4, 7, 10, 13
C. 4, 13, 28, 49 D. 16, 49, 100, 169

30. If the number pattern of a sequence is $2(n+2)^2$, find the first term, third term and sixth term.

- A. 18, 50, 128 B. 36, 100, 256
C. 16, 64, 196 D. 8, 32, 98

31. The following is a sequence of figures formed by matches of equal length.



Now we have 31 matches, can we form a figure in the sequence (using all matches)? If yes, which figure is it in the sequence?

- A. Yes, the 9th figure
B. Yes, the 10th figure
C. Yes, the 11th figure
D. No

32. If the n th term of the sequence $1^2+1, 2^2+2, 3^2+3, 4^2+4, 5^2+5, 6^2+6, \dots$ is 462, find the value of n .

- A. 18 B. 19 C. 20 D. 21

33. Which of the following is/are the number pattern of the sequence $\frac{3 \times 5}{2}, \frac{8 \times 10}{4}, \frac{13 \times 15}{6}, \frac{18 \times 20}{8}, \dots$?

- I. $\frac{5}{2}(5n-2)$ II. $\frac{15}{2}+(n-1)$ III. $\frac{5}{2}n-5$
A. I only B. II only C. III only D. I, II and III

34. Find the number pattern of the sequence 1, 3, 6, 10, ...

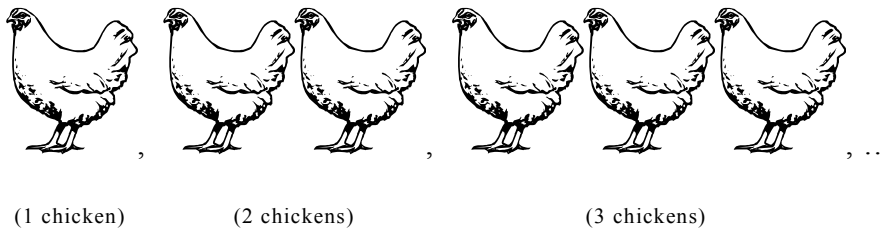
- A. $2n+1$ B. $\frac{n(n-1)}{2}$ C. $2n-1$ D. $\frac{n(n+1)}{2}$

35. Find the number pattern of the sequence $2, 2\frac{1}{2}, 3\frac{1}{3}, 4\frac{1}{4}, \dots$

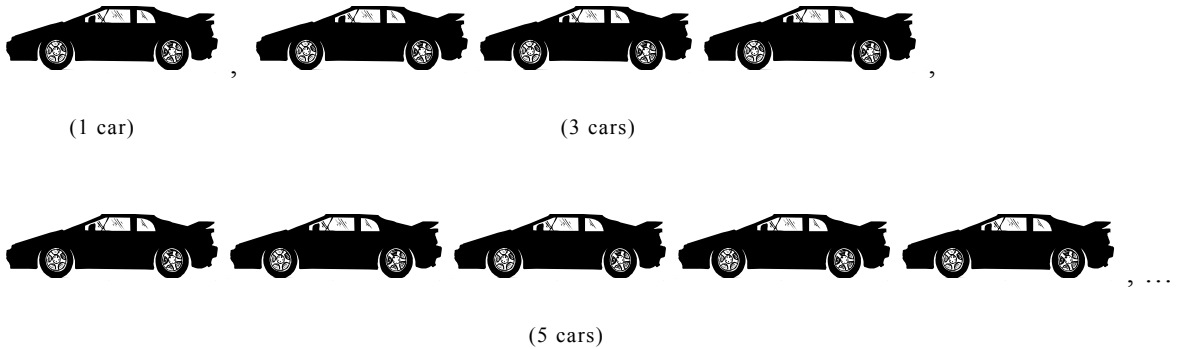
- A. $2n + \frac{1}{n}$ B. $n + \frac{1}{2n}$ C. $2n-1$ D. $n + \frac{1}{n}$

Section A(1)

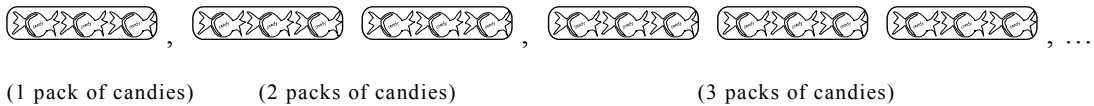
1. (a) Describe the pattern of the numbers of chicken legs in the following figures.



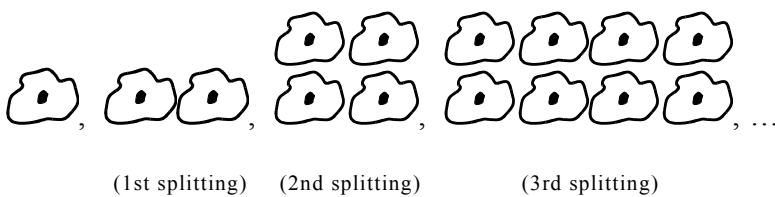
(b) Describe the pattern of the numbers of wheels in the following figures.



2. (a) Describe the pattern of the numbers of candies in the following figures.



(b) Describe the pattern of the numbers of cells under cell splittings.



3. Describe the patterns of the following numbers.

(a) 1, 8, 15, 22, 29

(b) -8, -4, 0, 4, 8

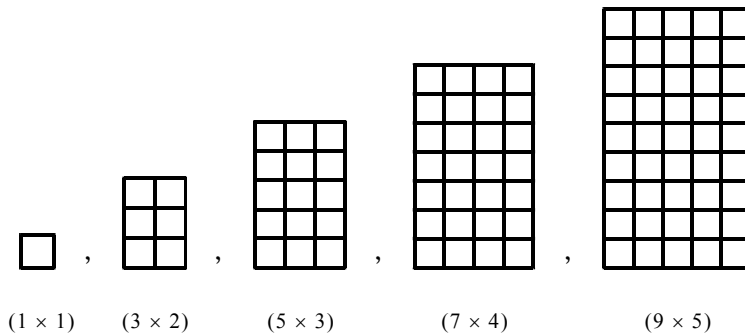
4. Describe the patterns of the following numbers.

(a) 2, 6, 18, 54, 162

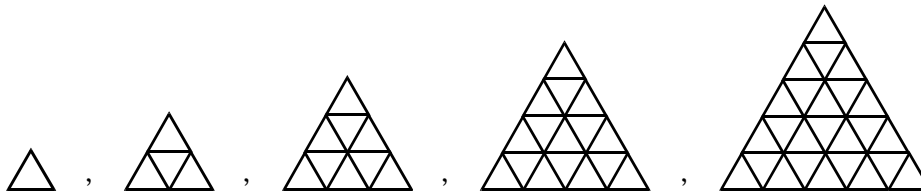
(b) 224, 112, 56, 28, 14

5. According to the sides of the following figures, describe the patterns of the figures.

(a) (All the small squares in the following figures have the same size.)



(b) (All the small triangles in the following figures have the same size.)

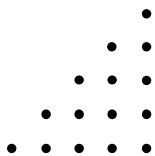


6. (a) List all triangular numbers from 20 to 60.

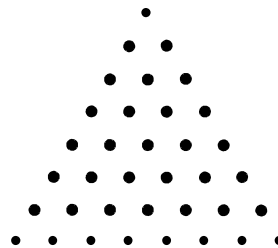
(b) List all square numbers from 30 to 110.

7. The following triangles are formed by dots. Using the pattern of triangular numbers, find the number of dots in each of the following figures.

(a)

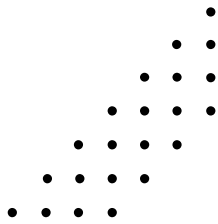


(b)

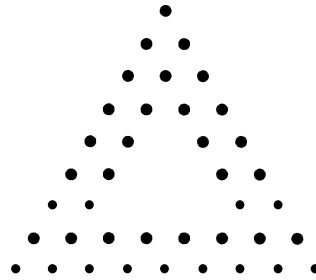


8. The following figures are formed by removing some dots from a triangle. Using the pattern of triangular numbers, find the number of dots in each of the following figures.

(a)



(b)



9. Divide each of the following square numbers into the sum of two consecutive triangular numbers.

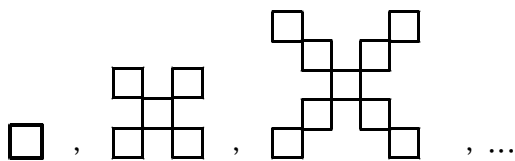
(a) 64

(b) 81

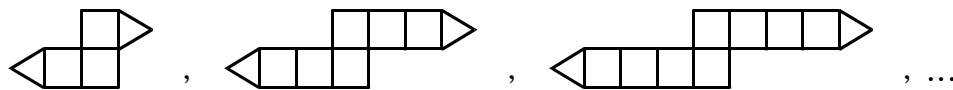
(c) 121

10. The following figures are made up of matches of the same length. For each sequence of figures, draw the next three figures.

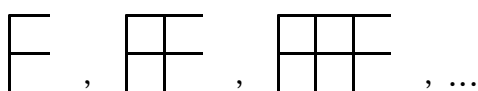
(a)



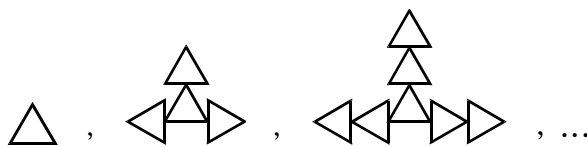
(b)



(c)



(d)



11. In each of the following sequences, write down its pattern and find the next three terms. What kind of sequences are they?

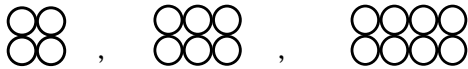
(a) 5, 11, 17, 23, ...

(b) 2, 8, 32, 128, ...

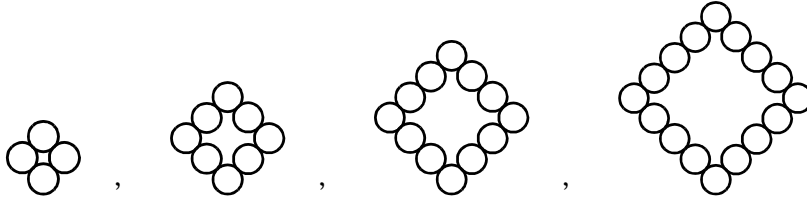
- 12.** In each of the following sequences, write down its pattern and find the next three terms. What kind of sequences are they?
- (a) 91, 87, 83, 79, ... (b) 120, 60, 30, 15, ...
- 13.** Write down the first 10 Fibonacci numbers.
- 14.** Find the number patterns of the following sequences.
- (a) $1 \times 4 + 2, 2 \times 4 + 2, 3 \times 4 + 2, 4 \times 4 + 2, \dots$
- (b) $1 \times 2 - 3, 2 \times 2 - 3, 3 \times 2 - 3, 4 \times 2 - 3, \dots$
- 15.** Find the number patterns of the following sequences.
- (a) 3, 7, 11, 15, 19, ...
- (b) 98, 91, 84, 77, 70, ...
- (c) 2, 13, 24, 35, 46, ...
- 16.** Find the number patterns of the following sequences.
- (a) $\frac{1}{3}, \frac{1}{9}, \frac{1}{27}, \frac{1}{81}, \dots$ (b) -6, 12, -18, 24, ...
- 17.** According to the sequence $\frac{1}{3}, \frac{3}{7}, \frac{5}{11}, \frac{7}{15}, \dots$, write down
- (a) the following two terms. (b) the number pattern.
- 18.** Write down the number pattern of the sequence $\frac{1}{5}, \frac{2}{3}, \frac{3}{1}, -\frac{4}{1}, -\frac{5}{3}, \dots$
- 19.** (a) $2 + 4 = 6; 6 + 8 = 14; 4 + 8 = 12; 2 + 8 = 10; 10 + 12 = 22$
According to the above results, observe the pattern of the sum of any two even numbers.
- (b) $2 \times 8 = 16; 4 \times 10 = 40; 6 \times 8 = 48; 10 \times 6 = 60; 8 \times 4 = 32$
According to the above results, observe the pattern of the product of any two even numbers.

20. According to the following ways of putting the coins, describe the patterns of the number of coins and the number of points of contact.

(a)



(b)

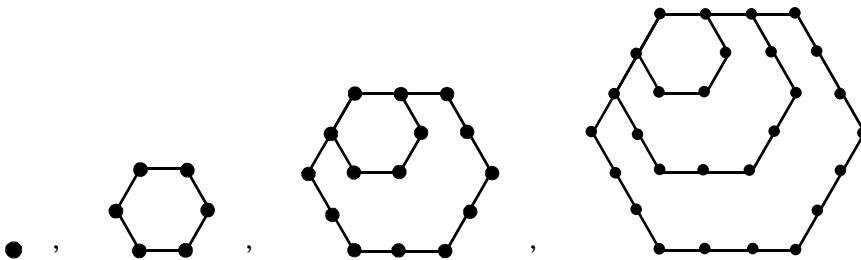


Section A(2)

21. Write down all numbers of the following kind(s) from 1 to 60.

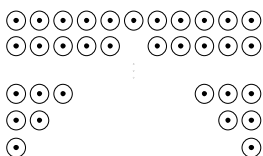
- (a) Triangular number
- (b) Fibonacci number
- (c) Triangular and Fibonacci numbers

22. Observe the pattern of the following hexagonal numbers.



Write down all the hexagonal numbers from 50 to 120.

23. The figure shows some targets on a board. The circular targets are arranged 2, 4, 6, ... in a bottom-up order and the number of targets in the last row is 11. The shooting is starting from the bottom.



- (a) There are 6 rows of targets on the board. How many targets are there?
- (b) If the first 4 rows have been shot, how many targets are left?

24. Draw figures under a certain pattern to represent each of the following sequences.

(a) $1 \times 2 + 1, 2 \times 2 + 1, 3 \times 2 + 1, \dots$ (b) $1 \times 5 - 2, 2 \times 5 - 2, 3 \times 5 - 2, \dots$

25. (a) Write down the sixth term, the twelfth term and the eighteenth term of Fibonacci sequence.

(b) What is their highest common factor?

26. Each of the following is a number pattern of a sequence, find the first four terms of each sequence.

(a) $3n + 1$ (b) 4^n (c) n^3 (d) $\frac{n(n+1)}{3}$

27. Each of the following is a number pattern of a sequence, find the first four terms of each sequence.

(a) $(5n)^2$ (b) $n^2 + 3n$

28. (a) Write down the number pattern of the sequence 101, 92, 83, ...

(b) Find the twentieth term of that sequence.

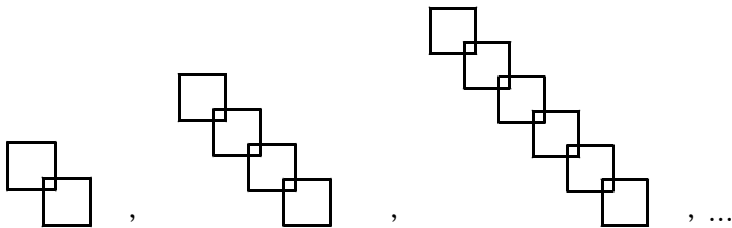
29. (a) Write down the number pattern of the sequence 1, 7, 13, ...

(b) If the n th term is 67, find the value of n .

30. (a) Write down the number pattern of the sequence 4, 8, 12, ...

(b) If the n th term is 1 024, find the value of n .

31. (a) The following figures are under a certain pattern, draw the next two figures.



(b) With reference to the figures in (a), complete the following table.

| | | | | | |
|-----------------------------------------|---|---|---|---|----|
| <i>Number of squares</i> | 2 | 4 | 6 | 8 | 10 |
| <i>Number of points of intersection</i> | | | | | |

(c) Find the number of points of intersection of 24 squares without drawing the diagram.