Mathematical Sciences: MMSC4

LESSON 2
TOPIC: PATTERNS

UNIT STANDARD: 7448

By the end of the lesson, you should be able to:
  a) To Recognise and identify different patterns
  b) To devise processes for a general rule related to patterns

Fact File
A **pattern** is a group of numbers(n), shapes, or objects that follow a rule while repeating or changing.
* To extend a pattern you can use a table or a pattern rule that relates the term number to the pattern rule.
* A **term number T_n** is the number that tells the position of an item in a pattern. For example, the pattern 2, 4, 6,8, 10, … can be shown in a table like this:
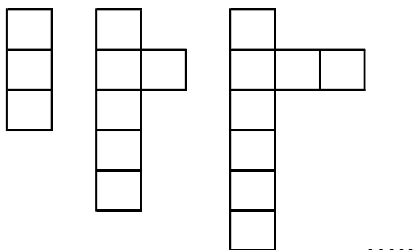
n	1	2	3	4
Pattern rule (**2n**)	2	4	6	8

  • A general rule to get any number in the pattern is multiply 2 by the term number.
    $10\text{th term} = 2 \times 10$
    $\qquad\qquad = 20$
A **common difference** is the difference between any two consecutive terms in a pattern. Not all patterns have a common difference.

Let us first consider the following patterns, extend them by two terms or figures

4   7   10….

3   6   12……

  • Now ask yourself what is the twentieth term (T_{20}) of each of the above patterns?
  • Would it be easy for one to continue with the patterns up until hundredth term?

I am sure you have found the task to be difficult, and it would be harder with geometric pattern. Hence we need to find the general rule or general formula, which will help us to find the twentieth term.

Starting with the first pattern

$$T_1 \quad T_2 \quad T_3 \quad T_4 \quad T_5$$
$$4 \qquad 7 \qquad 10 \quad 13 \qquad 16$$

$$+3 \qquad +3 \qquad +3 \qquad +3$$
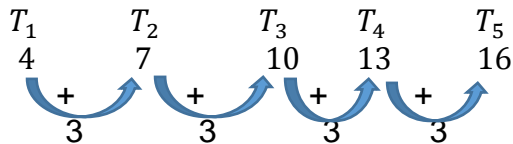
Now we ask ourselves the following questions:
a) What did we do to obtain the next two terms and term zero(T_0)?
b) What is the general rule?

Answering question (a)
we need to find the common difference that is
$T_2 - T_1 = T_4 - T_3$
$7 - 4 = 13 - 10 = 3$
So this tells us that difference of any two consecutive terms of the pattern, equal to 3
So, to find T_0 **we need to go back by 3 or subtract term one** (T_1) by 3
Hence $T_0 = T_1 - 3$
$\qquad = 4 - 3$
$\qquad = 1$
Answering question (b) What is the general rule?

We then multiply n by the common difference 3 and add term zero, to obtain the general rule: $T_n = 3n + T_0$
$\qquad = 3n + 1$
Thus, $T_{20} = 3(20) + 1 = 61$

Example 2
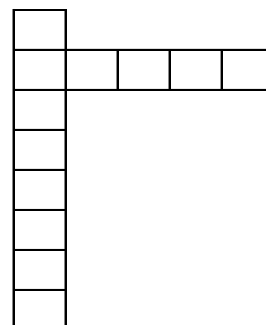
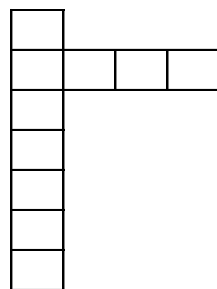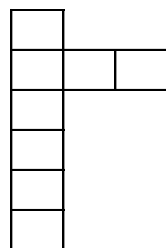Considering the geometric pattern, we have the following
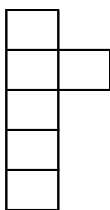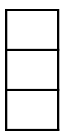
figure 1   figure 2   figure 3   figure 4   figure 5

To find the general rule, we first need to describe the pattern.

Hence, we find that to get the next term, two blocks are added to the previous figure.

Therefore, it is increasing by two blocks which is our common difference (d).

So, it means Term zero $(T_0) = T_1 - 2$

$$= 3\ blocks - 2 blocks$$
$$= 1\ block$$

Therefore, we multiply (n) by the common difference $d = 2$ and add term zero, to obtain the nth tern

$$T_n = d(n) + T_0$$
$$= 2n + 1$$
$$T_{20} = 2(20) + 1$$
$$= 41$$

Example 3

3   6   12   24   48

×2   ×2   ×2   ×2
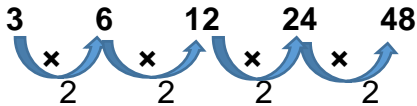
Step 1 describing a pattern

   The pattern is increasing by a factor of 2, meaning that to get the next term we multiply the previous term by a factor of 2
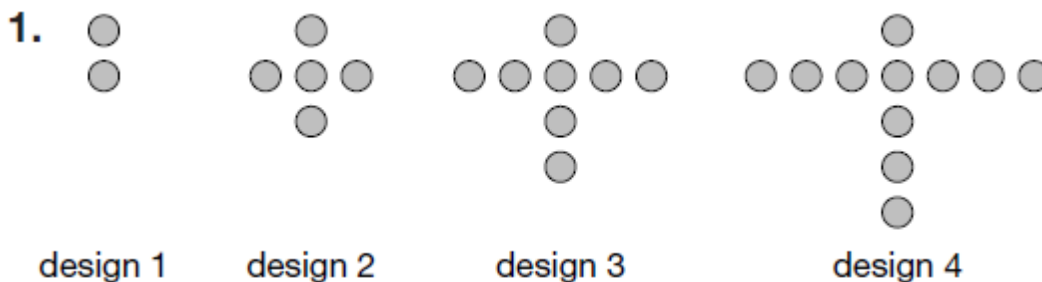
Hence, $T_2 \div T_1 = T_4 \div T_3$

$$6 \div 3 = 24 \div 12$$
$$2 = 2$$

Thus, we say 2 is the common ratio (r)

Step 2 find the general rule

$$T_n = first\ term(T_1) \times \frac{(common\ ration(r))^n}{common\ ratio(r)}$$
$$T_n = 3 \times \frac{2^n}{2}$$

Activity 1

1.

design 1   design 2   design 3   design 4

a) Complete the following table to show the number of dots in design 1 to 4

| Design number	Number of dots
1	
2	
3	
4	

b) Write the first term and common difference
c) Describe the pattern
d) Determine the term zero (T_0)
e) Find the general rule
f) How many dots are in design 12?

2. Determine the 20th term in each pattern. Use the general rule. Show your work.

a) 2,   7,   12,   17,   ….
b) 2.2,   4.4,   6.6,   8.8   ….
c) 21,   27,   33,   39   …..
d) R1.25   R1.75   R2.25   R2.75,   ……
e) 72,   24,   8,   2,   …..

ACTIVITY 2

1. Carefully study the patterns made below using bricks. Use them to answer questions
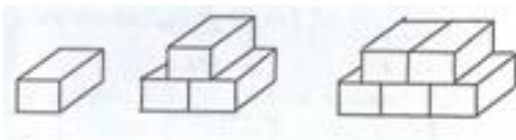
 1   2   3

 1.1) Describe in words how the pattern continues
 1.2) How many bricks are needed for:
    (a) Pattern 4
    (b) Pattern 5
    (c) Pattern 10
    (d) Pattern 50
 1.3) Which pattern number can be built from:
    (a) 55 bricks
    (b) 101 bricks
    (c) 200 bricks

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2.
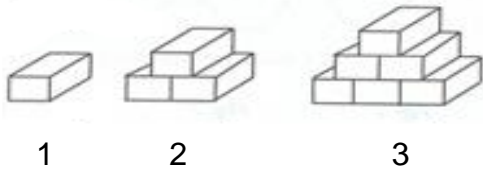

1   2   3

2.1 Describe in words how the pattern continues
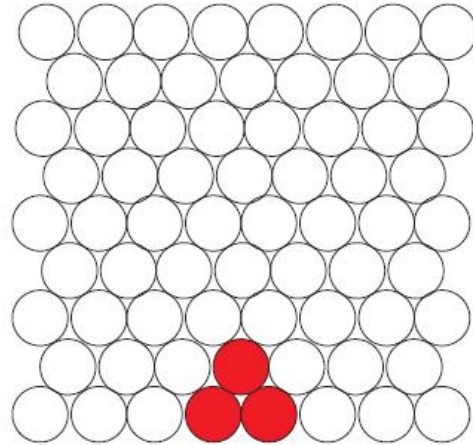2.2 How many bricks are needed for:
    (a) Pattern 4
    (b) Pattern 5
    (c) Pattern 10
    (d) Pattern 50

2.3 Which pattern number can be built from:
   a) 55 bricks
   (b) 101 bricks
   (c) 200 bricks

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ACTIVITY 3

Triangular patterns are often found in beadwork, baskets and pottery.

1) Study the beaded love letter above. Use two different colours to copy the pattern onto the circles on the right.

2) How many red beads are there in Pattern 1?

3) How many black beads are there in Pattern 2?

Pattern 1
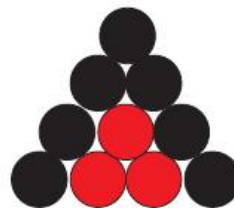
Pattern 2

4) Use your drawing to work out the number of red beads there would be in Pattern 3. Write the total on the table below.

5) How many black beads would there be in Pattern 4? Fill in the total on the table.

6) Use your table to work out how many beads there would be in Pattern 5 and Pattern 6. Check if you are right by drawing each pattern.

Pattern Number	Number of new beads
1	3
2	7
3	
4	
5	
6	

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