

A Guide to Introduction to Number Patterns

Teaching Approach

The section, numbers and patterns in Grade 10 is more on seeing relationships between two sets of numbers. The learners are not required to use any formulae to find the n^{th} term but can be asked to derive their own formula using their own methods.

At first this may sound limiting as a teacher, but don't let that fool you. Previously we would be limited to linear sequences but now we have the freedom to explore the learners' instinctual abilities to find relationships between two variables.

A small group will be able to turn a number pattern straight into a formula but the majority will need guidance on how to do this. This should not be when you show them the answer but rather when you show the steps on how to find any formula.

One idea is to divide the learners into groups and give each group a different pattern. Some patterns may be with numbers, some in a table, and some with pictures of tiles or matchsticks. The first step to finding the relationship between two sets of numbers is to continue the pattern. They should, as a group draw the next few pictures or find the next set of numbers in the pattern.

Step two would be to talk about the pattern. The learners need to be able to describe what they've done before they are able to translate that into algebra. It's a good idea to remind them of key terminology at this time. Words like sum, product, difference, to the power of, should be used.

The next step is to translate their words into algebra. If they wrote down the previous step, it will be easier for them to make formulae. They should test their formula to see if it works before moving on. Encourage trial and error, they shouldn't be able to find the right formula on their first try and if they do, you as a teacher are not challenging them enough.

As you know, confidence plays a big role in a learner's performance in Mathematics. For this reason, allow them to do a few number patterns as group work before they move to doing it on their own. Once they are on their own, let them call on each other for guidance. The only assistance they should receive from you is reassurance that they are on the right track.

Video Summaries

Some videos have a 'PAUSE' moment, at which point the teacher or learner can choose to pause the video and try to answer the question posed or calculate the answer to the problem under discussion. Once the video starts again, the answer to the question or the right answer to the calculation is given.

Mindset suggests a number of ways to use the video lessons. These include:

- Watch or show a lesson as an introduction to a lesson
- Watch or show a lesson after a lesson, as a summary or as a way of adding in some interesting real-life applications or practical aspects
- Design a worksheet or set of questions about one video lesson. Then ask learners to watch a video related to the lesson and to complete the worksheet or questions, either in groups or individually
- Worksheets and questions based on video lessons can be used as short assessments or exercises
- Ask learners to watch a particular video lesson for homework (in the school library or on the website, depending on how the material is available) as preparation for the next days lesson; if desired, learners can be given specific questions to answer in preparation for the next day's lesson

1. Investigating Real Patterns

In this lesson we revise the different types of numbers and show that real numbers can be classified as rational or irrational.

2. Completing Number Patterns

This video focuses on investigating number patterns that include time, measurement, and exponential growth. Fairly informal methods are used to write down and describe patterns. The video also demonstrates the continuation of patterns.

3. Geometric Number Patterns

This video demonstrates patterns where there is a constant difference between consecutive terms. The concept of a constant difference is explored and used to predict the number of matches used in further diagrams.

4. Finding the n^{th} Term

This lesson introduces the concept of the n^{th} term and how to determine it.

5. From Patterns to Algebra

This lesson introduces two more formal ways of recording the patterns in sequences. The first is the use of a table of values. The second is the use of an equation that shows the relationship between an x value and a y value.

6. Patterns on the Cartesian Plane

In this lesson, we look for patterns in the number of cans in a promotional display in a shop. We identify and describe the relationship between the number of rows of cans and the number of cans.

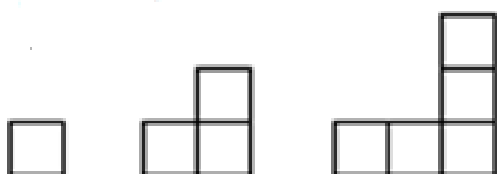
Resource Material

Resource materials are a list of links available to teachers and learners to enhance their experience of the subject matter. They are not necessarily CAPS aligned and need to be used with discretion.

1 Investigating Real Patterns	http://mathforum.org/workshops/usi/pascal/index.html	An in-depth exploration of Pascals Triangle.
	http://www.youtube.com/watch?feature=endscreen&NR=1&v=03uC9bhX0Rc	A video on the Golden Mean, Fibonacci series and Fibonacci
	http://www.goldennumber.net/fibonacci-series/	Interesting information on Fibonacci and the sequence.
2 Completing Number Patterns	http://www.fuelthebrain.com/Game/play.php?ID=15	Basic patterns can be explored in this interactive game involving a washing line and a dog.
	http://www.kidsmathgamesonline.com/numbers/codegame.html	Basic patterns can be explored in this interactive game involving solving the combination of a lock.
	http://www.counton.org/explorer/patterns/	Interesting number patterns.
3 Geometric Number Patterns	http://similar minds.com/intelligence-number-door.html	More complex patterns that need to be done online. A good challenge.
4 Finding the nth Term	http://www.dadsworksheets.com/v1/Worksheets/Number%20Patterns.html	A large variety of worksheets with patterns.
5 From Patterns to Algebra	http://www.worksheetworks.com/math/numbers/patterns.html	A worksheet generator. It does not ask the learner to find the nth term but the teacher could easily take the exercise to the next level.
6 Patterns on the Cartesian Plane	http://www.youtube.com/watch?v=ShfgwVSYK6o	A video of a teacher going through a number pattern that has a constant second difference.
	http://www.youtube.com/watch?v=lo3mrd0xaR4	A video of patterns made by doing certain operations with numbers. A teacher could pause it at many spots and ask the learners to continue the pattern.

Task

Question 1



Consider the above pattern.

1.1 Draw the next three pictures in the pattern.

1.2 Complete the following table that compares the number of the drawing in the pattern to the number of squares in each drawing:

Number of Drawing	1	2	3	4	5	6
Number of Squares	1	3	5			

1.3 Describe the pattern in words.

1.4 Using any method you like, find the number of squares that would be in the 25th picture.

Question 2



The pattern above has been made with matches. We will be comparing the number of matches to the number of rectangles in the following questions.

2.1 Use the table to compare the number of rectangles in each diagram, to the number of matches. If necessary, draw the next few diagrams to help you.

Number of Rectangles	1	2	3	4	5	6
Number of Matches	11					

2.2 Explain the relationship between the number of rectangles and the number of matches.

2.3 Use this explanation to set up a formula to calculate the n th term where n is the number of rectangles.

Question 3

George builds a wooden fence around his property. His fence is made up of two parts, the posts which go into the ground, and the bars that go across, joining the posts. Each day he manages to put one post into the ground and link it to the posts already there by using the bars. His progress looks like this:

Day One



Day Two



Day Three



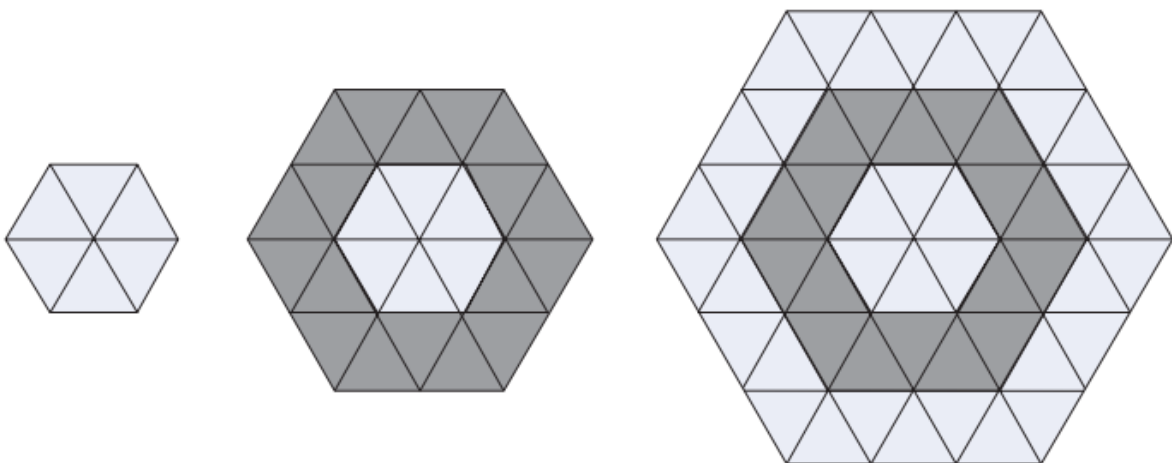
- 3.1 Draw what the fence will look like after 10 days of working on it.
- 3.2 How many posts will George have put in by the end of the tenth day?
- 3.3 How many bars will George have put in by the end of the tenth day?
- 3.4 Use your observations to predict how many pieces of wood he will need for twenty days worth of work. Assume that every bar and post is a separate piece of wood.

Question 4

- 4.1 Identify the following number pattern:
1; 1; 2; 3; 5; 8; 13;...
- 4.2 Find the next five terms in the number pattern.
- 4.3 Describe the number pattern in words.

Question 5

Consider the pattern and answer the questions below.



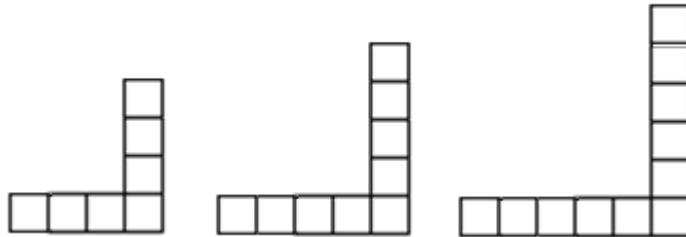
- 5.1 Draw the fourth diagram
- 5.2 Find the relationship between the number of triangles used (y) and the number of the diagram (x).
- 5.3 Write this as an equation.

Task Answers

Number Patterns Task Answers

Question 1

1.1.



1.2.

Pattern Number	1	2	3	4	5	6
Number of Squares	1	3	5	7	9	11

1.3. Every time the pattern is drawn, two more squares are added. The first drawing had one square.

1.4. $1 + 2(24) = 49$

There would be 49 squares in the 25th picture.

Question 2

2.1.

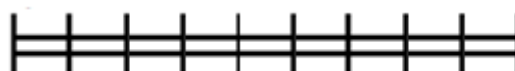
Number of Rectangles	1	2	3	4	5	6
Number of Matches	11	22	33	44	55	66

2.2. For every rectangle, there are 11 matches.

2.3. $T_n = 11n$

Question 3

3.1.



- 3.2. 10
- 3.3. 18
- 3.4. 20 days gives George enough time to put in 20 posts. To connect these posts, he will need 38 bars. In total, he will need 58 pieces of wood. His fence should look something like this:

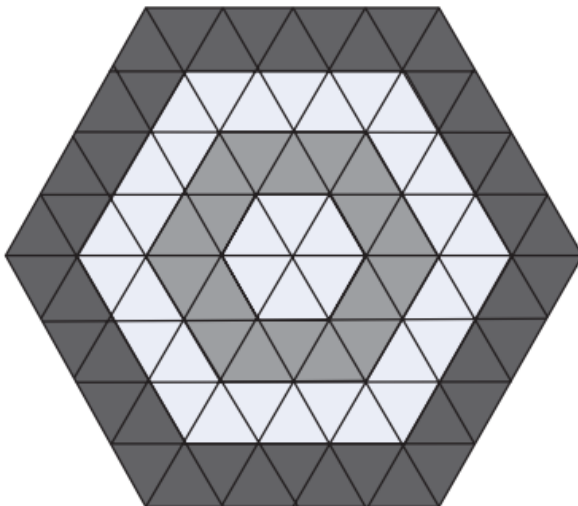


Question 4

- 4.1. This is the Fibonacci sequence.
- 4.2. 21; 34; 55; 89; 144
- 4.3. Each term is equal to the sum of the previous two terms.

Question 5

5.1.



5.2.

Diagram number = x	1	2	3	4
Number of triangles = y	6	24	54	96
Pattern	$1^2 \times 6$	$2^2 \times 6$	$3^2 \times 6$	$4^2 \times 6$

5.3. $y = 6x^2$

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