

Sequences

What do I need to be able to do?

- Describe and continue sequences diagrammatically
- Predict and check the next term of a sequence
- Describe the term-to-term rule of a sequence in words
- Recognise linear and non-linear sequences
- Find missing terms in sequences

Keywords & definitions:

Sequence: items or numbers put in a pre-decided order

Term: a single number or variable

Position: the place something is located

Rule: instructions that relate two variables

Difference: the gap between two terms

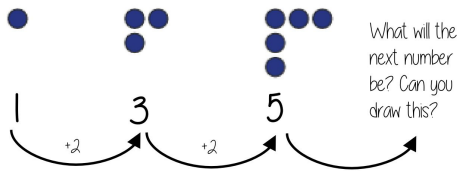
Linear/Arithmetic: the difference between terms is same value each time

Non-linear: the difference between terms increases or decreases in different amounts

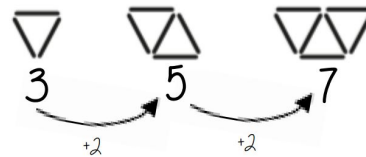
Geometric: a sequence where each term is found by multiplying the previous one by a fixed non zero number

Describe and continue a sequence diagrammatically

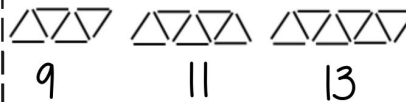
Count the number of circles or lines in each image



Predict and check terms



CHECK – draw the next terms



Predictions:

Look at your pattern and consider how it will increase.

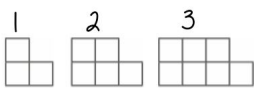
e.g. How many lines in pattern 6?

Prediction - 13

If it is increasing by 2 each time - in 3 more patterns there will be 6 more lines

Sequence in a table and graphically

Position: the place in the sequence



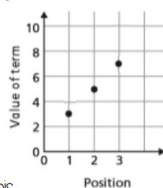
Term: the number or variable (the number of squares in each image)

In a table

Position	1	2	3
Term	3	5	7

+2 +2

Graphically



Because the terms increase by the same addition each time this is **linear** – as seen in the graph

Linear and Non Linear Sequences

Linear Sequences – increase by addition or subtraction and the same amount each time

Non-linear Sequences – do not increase by a constant amount – quadratic, geometric and Fibonacci

- Do not plot as straight lines when modelled graphically
- The differences between terms can be found by addition, subtraction, multiplication or division

Fibonacci Sequence – look out for this type of sequence

0 1 1 2 3 5 8 ...

Each term is the sum of the previous two terms.

Continue Linear Sequences

7, 11, 15, 19...

How do I know this is a linear sequence?

It increases by adding 4 to each term

How many terms do I need to make this conclusion?

At least 4 terms – two terms only shows one difference not if this difference is constant (a common difference).

How do I continue the sequence?

You continue to repeat the same difference through the next positions in the sequence



Continue non-linear Sequences

1, 2, 4, 8, 16 ...

How do I know this is a non-linear sequence?

It increases by multiplying the previous term by 2 – this is a geometric sequence because the constant is multiply by 2

How many terms do I need to make this conclusion?

At least 4 terms – two terms only shows one difference not if this difference is constant (a common difference).

How do I continue the sequence?

You continue to repeat the same difference through the next positions in the sequence



Explain term-to-term rule

How you get from term to term

Try to explain this in full sentences not just with mathematical notation.

Use key maths language – doubles, halves, multiply by two, add four to the previous term etc.

To explain a whole sequence you need to include a term to begin at...

The next term is found by tripling the previous term. The sequence begins at 4.

4, 12, 36, 108...
First term
x3 x3 x3

Finding Missing Terms

Work out the term-to-term rule by looking at how you get from one term to another

Fill in the gaps using the term-to-term rule

1, 2, 4, 8, 16, 32
x2 x2 x2 x2 x2

8, 11, 16, 23, 32
+3 +5 +7 +9

Work out the missing values in the linear sequence.

80, 71, 62, 53, ...
-9 -9 -9
-27

Retrieval Quiz

1. Look at the sequence of circles:



Draw the next two terms in this sequence. What is the number of circles in the 5th term?

2. Consider the sequence of triangles:



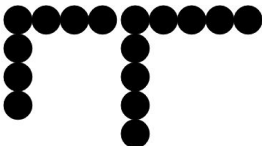
Predict the number of lines in the 7th pattern.

Draw the 8th and 9th patterns to check your prediction.

3. Describe the term-to-term rule for the following sequence in words: 4, 12, 36, 108, ...
4. Identify whether the following sequences are linear or non-linear:
a) 2, 4, 6, 8, ... b) 1, 3, 6, 10, ... c) 5, 10, 20, 40, ...
5. What is a "non-linear sequence"? Explain in your own words.
6. Fill in the missing terms in the following sequence: 3, 6, 12, __, __, 96
7. Fill in the missing terms in the following sequence: 10, 14, 20, __, 38
8. Work out the missing values in this linear sequence: 88, __, __, 52, ...
9. A sequence starts with the terms 2, 5, 8, 11, ... What is the 7th term in this sequence?
10. Explain what a "term" is in the context of sequences.

Retrieval Quiz

Answers

1.  9
2. 15 
3. Multiplying each term by 3
4. a) linear b) non-linear c) non-linear
5. A sequence where the difference changes between terms
6. 24, 48
7. 28
8. 76, 64
9. 20
10. A single number or variable in a sequence

Place Value and Ordering Decimals

What do I need to be able to do?

Recognise and write the place value of any digit in an integer up to one billion in words and figures (including decimals)

Work out intervals on a number line

Position integers and decimals on a number line

Round integers to the nearest power of 10 and 1 significant figure

Order and compare two numbers using $=$, $\neq$, $<$, $>$, $\leq$ and $\geq$ up to one billion

Write 10, 100, 1000 etc as powers of 10

Write positive integers and decimals in the form $A \times 10^n$

Investigate negative powers of 10

Keywords & definitions:

Integer: a whole number that is positive or negative

Decimal: a positive or negative number that is not whole

Interval: between two points or values

Negative: Any number less than zero; written with a minus sign.

Round: to approximate a number in order to make it easier to calculate with or write as an answer

Place value: The value of a digit depending on its place in a number. In our decimal number system, each place is $10 \times$ bigger than the place to its right

Significant figure: A digit that gives meaning to a number. The most significant digit (figure) in an integer is the number on the left. The most significant digit in a decimal is the first non-zero number after the decimal point.

Power(s) of 10: relates to the place value of a number. Corresponds with the number of 0s a number has e.g. $10^4 = 10000$

$=$ equal to. $\neq$ not equal to. $<$ less than. $>$ greater than. $\leq$ less than or equal to. $\geq$ greater than or equal to

Integer Place Value

Billions			Millions			Thousands			Ones		
H	T	O	H	T	O	H	T	O	H	T	O
		3	1	4	8	0	3	3	0	2	9

Placeholder

Three billion, one hundred and forty eight million, thirty three thousand and twenty nine
 1 billion 1,000,000,000
 1 million 1,000,000

Decimal Place Value

O			Tth			Hth		
1	1	1	0.1	0.1	0.1	0.01	0.01	0.01
			0.1	0.1	0.1			

1 whole, 6 tenths, 3 hundredths

6 tenths, 0.6

3 hundredths, 0.03

Compare integers using $<$, $>$, $=$, $\neq$

$<$ less than

$>$ greater than

$=$ equal to

$\neq$ not equal to

Two and a half million



2 500 000

300 000 000



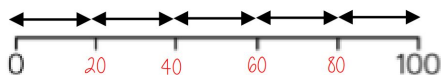
Three billion

Six thousand and eighty



68 000

Intervals on a number line



Divide the difference by the number of intervals (gaps).
 Eg $100 \div 5 = 20$

Rounding to the nearest power of ten

If the number is halfway between we "round up"

5495 to the nearest 1000

5475 to the nearest 100

5475 to the nearest 10

5000



6000

5400

5500

5470



5480

Decimal intervals on a number line

One whole split into 10 parts makes tenths = 0.1
 One tenth split into 10 parts makes hundredths = 0.01



Round to 1 significant figure

370 to 1 significant figure is 400

37 to 1 significant figure is 40

3.7 to 1 significant figure is 4

0.37 to 1 significant figure is 0.4

0.00000037 to 1 significant figure is 0.0000004

Round to the first non zero number

Powers of 10

10^6	10^5	10^4	10^3	10^2	10^1	10^0	10^{-1}	10^{-2}
1,000,000	100,000	10,000	1,000	100	10	1	0.1	0.01

Writing in the form $A \times 10^n$

$$3 \times 10^5 = 3 \times 100,000 = 300,000$$

$$5 \times 10^3 = 5 \times 1000 = 5000$$

$$6 \times 10^1 = 6 \times 10 = 60$$

$$2 \times 10^0 = 2 \times 1 = 2$$

$$3 \times 10^{-1} = 3 \times 0.1 = 0.3$$

$$4 \times 10^{-2} = 4 \times 0.01 = 0.04$$

Retrieval Quiz

1. What is an integer?
2. In the number 3,148,033,029, what is the place value of the digit '4'?
3. Round 5475 to the nearest 100.
4. Write 10,000 as a power of 10.
5. Which is larger: 0.3 or 0.23? Explain how you know.
6. What does the symbol ' $\neq$ ' mean?
7. If a number line goes from 0 to 100 and has 5 intervals, what is the value of each interval?
8. Round 43.37 to 1 significant figure.
9. Write 5000 in the form $A \times 10^n$.
10. What is a decimal?

Answers

1. A whole number (positive or negative)
2. Ten million (10000000)
3. 5500
4. 10^4 ($10 \times 10 \times 10 \times 10 = 10000$)
5. 0.3. Because it has more tenths than 0.23 (which has 2 tenths)
6. Not equal to
7. 20 ($100 \div 5$)
8. 40
9. 5×10^3 ($10^3 = 1000$)
10. A number that is not whole (positive or negative)