

## Geometric Sequences - Worksheet

### Skill

#### Group A - Continuing sequences

Write the next 3 terms of each geometric sequence:

1) 2, 4, 8, 16, 32, ...

2) 1, 3, 9, 27, 81, ...

3) 0.2, 1, 5, 25, 125, ...

4) -4, -16, -64, ...

5) 0.12, 0.24, 0.48, ...

6)  $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \dots$

7) -3, 12, -48, 192, ...

8)  $\frac{1}{3}, \frac{5}{6}, \frac{25}{12}, \frac{125}{24}, \frac{625}{48}, \dots$

9) -40, 30, -22.5, ...

#### Group B - Finding missing numbers

Fill in the missing numbers for each geometric sequence:

1) 1, 4, ..., ..., 256

2) 125, 625, ..., ..., 78125

3) 50, 25, ..., ..., 3.125

4) -3, -6, ..., -24, ...

5) ..., 4, 20, 100, ...

6) ..., -1, 1, ..., 1

7) 36, ..., 9, 4.5, ...

8) -1, ..., -0.01, ..., ...

9) ..., 343, ..., ..., -1

#### Group C - Generating sequences

Generate the first 5 terms for each geometric sequence.

1)  $2^n$

2)  $3^n$

3)  $1^n$

4)  $0.5^n$

5)  $2 \times 3^n$

6)  $5 \times 10^n$

7)  $-3 \times 4^n$

8)  $\frac{2^n}{5}$

9)  $0.3 \times (-6)^{n-1}$

## Geometric Sequences - Worksheet

### Applied

- 1) The first 5 terms in a sequence are 7, 21, 63, 189, 567
- (a) What is the common ratio for this sequence?
- (b) Work out the difference between the 6<sup>th</sup> and 7<sup>th</sup> term.
- (c) Explain why the number 413340 is not in the sequence.

- 2) Below are the frequencies of different notes on a piano.

Note	$A_0$	$A_1$	$A_2$	$A_3$	$A_4$	$A_5$
Frequency (Hz)	27.5	55	110	$x$	440	880

- (a) Calculate the value of  $x$ .
- (b) Is the sequence geometric? Explain your answer.
- (c) The highest note on the piano is the top C which has a frequency of 4186Hz. What is the highest A frequency that can be played on the piano? State the name of the note and the frequency it produces.

## Geometric Sequences - Worksheet

- 3) Bacteria divide by binary fission. Under optimum conditions, the bacteria *Escherichia Coli* divides every 20 minutes. Sonia places 10 *E. Coli* bacteria into a petri dish and records the number of bacteria she observes every 20 minutes for 2 hours. Her results are shown below.

Time (mins)	0	20	40	60	80	100	120
No. of Bacteria	10	20	40	80	160	320	640

- (a) How many bacteria would Sonia expect to see after 4 hours?
- (b) *Salmonella Enterica* divides every 30 minutes. Sonia places 10 of these bacteria into another petri dish. How long would it take for her to observe over 1,000,000 *Salmonella* bacteria?
- (c) The formula  $N = ar^{n-1}$  represents the total number of bacteria ( $N$ ) where  $a$  is the first term in the sequence,  $r$  is the common ratio and  $n$  is the term position.

*Salmonella* symptoms start to appear 3 days after 1 bacteria enters the body. By this time, how many bacteria could be produced? Write your answer in standard form correct to 2 d. p. (Assume all bacteria remain alive during this time period).

## Geometric Sequences - Exam Questions

- 1) Which of these is a geometric progression? Circle your answer.

2, 4, 6, 8, 10

2, 3, 5, 7, 11

2, 8, 18, 32, 50

2, 4, 8, 16, 32

**(1 mark)**

- 2) The first four terms of a sequence are 3, 30, 300 and 3000.

- (a) What is the tenth number in the sequence?

.....  
**(1)**

- (b) What is the common ratio in this sequence?

.....  
**(2)**  
**(3 marks)**

- 3) Match each example sequence with the type of sequence.

Triangular
Geometric
Arithmetic
Fibonacci
Quadratic

4, 4, 8, 12, 20, ...
1, 3, 6, 10, 15, ...
2, 8, 18, 32, 50, ...
3, 9, 27, 81, 243, ...
- 4, - 7, - 10, - 13, - 16, ...

**(3 marks)**

## Geometric Sequences - Exam Questions

4) Calculate the next term in the sequence:

0.02, 0.12, 0.72, ...

.....  
**(2 marks)**

5) The common ratio of a sequence is  $\sqrt{5}$ . Complete the table for the first 6 terms of the sequence.

$n$	1	2	3	4	5	6
Term Value				25		

.....  
**(3 marks)**

6) A chessboard has 64 squares labelled  $A1 - H8$ .

See the diagram below.



(a) A grain of rice is placed on each square, such that one grain is placed on  $A1$ , two on  $A2$ , four on the  $A3$ , and so on (doubling the number of grains on each subsequent square). How many grains of rice would be on the final square,  $H8$ ? Express your answer as a power of 2.

.....  
**(1)**

## Geometric Sequences - Exam Questions

(b) What kind of sequence is this?

.....  
(1)  
(2 marks)

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7) Josh says 6, 12, 15, 30, 35, 70 is a geometric progression.  
Sofia says 4, 12, 36, 108, 324, 972 is a geometric progression.

Who is correct? Give a reason.

- Josh  
 Sofia  
 They are both correct.  
 They are both incorrect.

.....  
(2 marks)

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8) Calculate the sum of the first 5 terms of the sequence :

$$n^{\text{th}} \text{ term} = \left(\frac{1}{2}\right)^{n-1}$$

.....  
(4 marks)

## Geometric Sequences - Answers

	Question	Answer
	Skill Questions	
Group A	Write the next 3 terms of each geometric sequence: <b>1)</b> 2, 4, 8, 16, 32, ... <b>2)</b> 1, 3, 9, 27, 81, ... <b>3)</b> 0.2, 1, 5, 25, 125, ... <b>4)</b> - 4, - 16, - 64, ... <b>5)</b> 0.12, 0.24, 0.48, ... <b>6)</b> $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \dots$ <b>7)</b> - 3, 12, - 48, 192, ... <b>8)</b> $\frac{1}{3}, \frac{5}{6}, \frac{25}{12}, \frac{125}{24}, \frac{625}{48}, \dots$ <b>9)</b> - 40, 30, - 22.5, ...	<b>1)</b> 64, 128, 256 <b>2)</b> 243, 729, 2187 <b>3)</b> 625, 3125, 15625 <b>4)</b> - 256, - 1024, - 4096 <b>5)</b> 0.96, 1.92, 3.84 <b>6)</b> $\frac{1}{32}, \frac{1}{64}, \frac{1}{128}$ <b>7)</b> - 768, 3072, - 12288 <b>8)</b> $\frac{3125}{96}, \frac{15625}{192}, \frac{78125}{384}$ <b>9)</b> 16.875, - 12.65625, 9.4921875
Group B	Fill in the missing numbers for each geometric sequence: <b>1)</b> 1, 4, ..., ..., 256 <b>2)</b> 125, 625, ..., ..., 78125 <b>3)</b> 50, 25, ..., ..., 3.125 <b>4)</b> - 3, - 6, ..., - 24, ... <b>5)</b> ..., 4, 20, 100, ... <b>6)</b> ..., - 1, 1, ..., 1 <b>7)</b> 36, ..., 9, 4.5, ... <b>8)</b> - 1, ..., - 0.01, ..., ... <b>9)</b> ..., 343, ..., ..., - 1	<b>1)</b> 16, 64 <b>2)</b> 3125, 15625 <b>3)</b> 12.5, 6.25 <b>4)</b> - 12, - 48 <b>5)</b> 0.8, 500 <b>6)</b> 1, - 1 <b>7)</b> 18, 2.25 <b>8)</b> - 0.1, - 0.001, - 0.0001 <b>9)</b> - 2401, - 49, 7

## Geometric Sequences - Answers

<b>Group C</b>	Generate the first 5 terms for each geometric sequence:	
<b>1)</b> $2^n$		<b>1)</b> 2, 4, 8, 16, 32
<b>2)</b> $3^n$		<b>2)</b> 3, 9, 27, 81, 243
<b>3)</b> $1^n$		<b>3)</b> 1, 1, 1, 1, 1
<b>4)</b> $0.5^n$		<b>4)</b> $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{32}$
<b>5)</b> $2 \times 3^n$		<b>5)</b> 6, 18, 54, 162, 486
<b>6)</b> $5 \times 10^n$		<b>6)</b> 50, 500, 5 000, 50 000, 500 000
<b>7)</b> $-3 \times 4^n$		<b>7)</b> - 12, - 48, - 192, - 768, - 3072
<b>8)</b> $\frac{2^n}{5}$		<b>8)</b> $\frac{2}{5}, \frac{4}{5}, \frac{8}{5}, \frac{16}{5}, \frac{32}{5}$
<b>9)</b> $0.3 \times (-6)^{n-1}$		<b>9)</b> 0.3, - 1.8, 10.8, - 64.8, 388.8



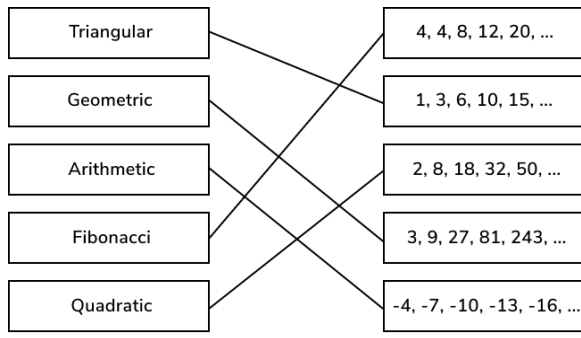
## Geometric Sequences - Answers

	Question	Answer														
	Applied Questions															
<b>1)</b>	<p>The first 5 terms in a sequence are 7, 21, 63, 189, 567</p> <p><b>(a)</b> What is the common ratio for this sequence?</p> <p><b>(b)</b> Work out the difference between the 6<sup>th</sup> and 7<sup>th</sup> term.</p> <p><b>(c)</b> Explain why the number 413340 is not in the sequence.</p>	<p><b>(a)</b> 3</p> <p><b>(b)</b> <math>5103 - 1701 = 3402</math></p> <p><b>(c)</b> Any of the following:</p> <ul style="list-style-type: none"> <li>• All terms are odd.</li> <li>• End in</li> <li>• 1, 3, 7 or 9</li> <li>• 413340 is not divisible by 7</li> </ul>														
<b>2)</b>	<p>Below are the frequencies of different notes of on the piano.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Note</th> <th><math>A_0</math></th> <th><math>A_1</math></th> <th><math>A_2</math></th> <th><math>A_3</math></th> <th><math>A_4</math></th> <th><math>A_5</math></th> </tr> </thead> <tbody> <tr> <td>Frequency (Hz)</td> <td>27.5</td> <td>55</td> <td>110</td> <td><math>x</math></td> <td>440</td> <td>880</td> </tr> </tbody> </table> <p><b>(a)</b> Calculate the value of <math>x</math>.</p> <p><b>(b)</b> Is the sequence geometric? Explain your answer.</p> <p><b>(c)</b> The highest note on the piano is the top C which has a frequency of 4186Hz. What is the highest A frequency that can be played on the piano? State the name of the note and the frequency it produces.</p>	Note	$A_0$	$A_1$	$A_2$	$A_3$	$A_4$	$A_5$	Frequency (Hz)	27.5	55	110	$x$	440	880	<p><b>(a)</b> 220</p> <p><b>(b)</b> Yes, all terms have a common ratio of 2.</p> <p><b>(c)</b> <math>A_7 = 3520\text{Hz}</math></p>
Note	$A_0$	$A_1$	$A_2$	$A_3$	$A_4$	$A_5$										
Frequency (Hz)	27.5	55	110	$x$	440	880										


## Geometric Sequences - Answers

<b>3)</b>	<p>Bacteria divide by binary fission. Under optimum conditions, the bacteria <i>Escherichia Coli</i> divides every 20 minutes. Sonia places 10 <i>E. Coli</i> bacteria petri dish and records the number of bacteria she observes every 20 minutes for 2 hours. Her results are shown below.</p> <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <tr> <td style="padding: 5px;">Time (mins)</td> <td style="padding: 5px;">0</td> <td style="padding: 5px;">20</td> <td style="padding: 5px;">40</td> <td style="padding: 5px;">60</td> <td style="padding: 5px;">80</td> <td style="padding: 5px;">100</td> <td style="padding: 5px;">120</td> </tr> <tr> <td style="padding: 5px;">No. of Bacteria</td> <td style="padding: 5px;">10</td> <td style="padding: 5px;">20</td> <td style="padding: 5px;">40</td> <td style="padding: 5px;">80</td> <td style="padding: 5px;">160</td> <td style="padding: 5px;">320</td> <td style="padding: 5px;">640</td> </tr> </table> <p><b>(a)</b> How many bacteria would Sonia expect to see after 4 hours?</p> <p><b>(b)</b> <i>Salmonella Enterica</i> divides every 30 minutes. Sonia places 10 of these bacteria into another petri dish. How long would it take for her to observe over 1,000,000 <i>Salmonella</i> bacteria?</p> <p><b>(c)</b> The formula <math>N = ar^{n-1}</math> represents the total number of bacteria (<math>N</math>) where <math>a</math> is the first term in the sequence, <math>r</math> is the common ratio and <math>n</math> is the term position.</p> <p>Salmonella symptoms start to appear 3 days after 1 bacteria enters the body. By this time, how many bacteria could be produced? Write your answer in standard form correct to 2 d.p. (Assume all bacteria remain alive during this time period).</p>	Time (mins)	0	20	40	60	80	100	120	No. of Bacteria	10	20	40	80	160	320	640	<p><b>(a)</b> 40 960</p> <p><b>(b)</b> 8 – 8.5 hours</p> <p><b>(c)</b> 3 days = 72 hours This will be 144 time periods.  <math>a = 1</math>  <math>r = 2</math>  <math>n = 144</math>  <math>S = 1 \times 2^{143}</math>  <math>= 1.11 \times 10^{43}</math></p>
Time (mins)	0	20	40	60	80	100	120											
No. of Bacteria	10	20	40	80	160	320	640											

## Geometric Sequences - Mark Scheme

	Question	Answer	
	Exam Questions		
1)	Which of these is a geometric progression? Circle your answer.  2, 4, 6, 8, 10      2, 3, 5, 7, 11  2, 8, 18, 32, 50    2, 4, 8, 16, 32	2, 4, 8, 16, 32	<b>(1)</b>
2)	The first four terms of a sequence are 3, 30, 300 and 3000.		
	(a) What is the tenth number in the sequence?	(a) 3,000,000,000	<b>(1)</b>
	(b) What is the common ratio in this sequence?	(b) $30 \div 3$ 10	<b>(1)</b> <b>(1)</b>
3)	Match each example sequence with the type of sequence.	 <p>Minimum 2 correct Minimum 3 correct All 5 sequences correct</p>	<b>(1)</b> <b>(1)</b> <b>(1)</b>
4)	Calculate the next term in the sequence: 0.02, 0.12, 0.72, ...	$r = 6$ 4.32	<b>(1)</b> <b>(1)</b>

## Geometric Sequences - Mark Scheme

<b>5)</b>	The common ratio of a sequence is $\sqrt{5}$ . Complete the table for the first 6 terms of the sequence.	<table border="1" style="margin: 0 auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="padding: 5px;"><math>n</math></th> <th style="padding: 5px;">1</th> <th style="padding: 5px;">2</th> <th style="padding: 5px;">3</th> <th style="padding: 5px;">4</th> <th style="padding: 5px;">5</th> <th style="padding: 5px;">6</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">Term Value</td> <td style="padding: 5px;"><math>\sqrt{5}</math></td> <td style="padding: 5px;">5</td> <td style="padding: 5px;"><math>5\sqrt{5}</math></td> <td style="padding: 5px;">25</td> <td style="padding: 5px;"><math>25\sqrt{5}</math></td> <td style="padding: 5px;">125</td> </tr> </tbody> </table> <p style="margin-top: 10px;">Minimum 2 correct Minimum 4 correct All 5 values correct</p>	$n$	1	2	3	4	5	6	Term Value	$\sqrt{5}$	5	$5\sqrt{5}$	25	$25\sqrt{5}$	125	(1) (1) (1)
$n$	1	2	3	4	5	6											
Term Value	$\sqrt{5}$	5	$5\sqrt{5}$	25	$25\sqrt{5}$	125											
<b>6)</b>	A chessboard has 64 squares labelled $A1 - H8$ .  <b>(a)</b> A grain of rice is placed on each square, such that one grain is placed on $A1$ , two on $A2$ , four on the $A3$ , and so on (doubling the number of grains on each subsequent square). How many grains of rice would be on the final square, $H8$ ? Express your answer as a power of 2.	 <p style="margin-top: 10px;"><b>(a)</b> <math>2^{63}</math> or <math>2^{64-1}</math></p>	(1)														
<b>(b)</b>	What kind of sequence is this?	<b>(b)</b> Geometric	(1)														
7)	Josh says 6, 12, 15, 30, 35, 70 is a geometric progression.  Sofia says 4, 12, 36, 108, 324, 972 is a geometric progression.	Sofia is correct.  The common ratio is 3 for each progression between terms for Sofia's sequence.	(1)  (1)														
8)	Calculate the sum of the first 5 terms of the sequence : $n^{th}$ term = $\left(\frac{1}{2}\right)^{n-1}$	<p>Finding the 1<sup>st</sup> term = 1</p> <p>Finding the first 5 terms</p> $= 1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}$ <p>Adding the first 5 terms together</p> $= 1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16}$ $\frac{31}{16} = 1\frac{15}{16}$	(1) (1) (1) (1)														

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