

# Geometric Series

Geometric Series – the sum of the terms of a geometric sequence

**examples** 1)  $1+2+4+8+16+\dots$

2)  $2+10+50+250+\dots$

3)  $-3+6-12+24 \dots$

**$S_n$  formula for each of the geometric series examples**

**find  $t_7$  and  $S_6$  for each of the geometric series examples**

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Ex.1 Find the sum of the following series

(a)  $-2 - 6 - 18 - 54 - \dots - 4374$

(b)  $\frac{1}{4} + \frac{1}{2} + 1 + 2 + 4 + \dots + 512$

## Key Concepts

- The sum of the first  $n$  terms of a geometric series can be found using the formula  $S_n = \frac{a(r^n - 1)}{r - 1}$ .
- Given at least the first two terms and the last term of a geometric series, the number of terms can be found by substituting known values in  $t_n = ar^{n-1}$  and solving for  $n$ .

## Communicate Your Understanding

1. Describe the similarities and the differences between a geometric series and an arithmetic series.
2. Describe how you would find  $S_{15}$  for the series  $4 + 8 + 16 + \dots$
3. Describe how you would find the sum of the series  $5 + 15 + 45 + \dots + 10\,935$ .

## Practise

### A

1. Find the indicated sum for each geometric series.
  - a)  $S_{12}$  for  $1 + 2 + 4 + \dots$
  - b)  $S_7$  for  $1 + 4 + 16 + \dots$
  - c)  $S_6$  for  $3 + 15 + 75 + \dots$
  - d)  $S_8$  for  $2 - 6 + 18 - \dots$
  - e)  $S_9$  for  $3 - 6 + 12 - \dots$
  - f)  $S_6$  for  $256 + 128 + 64 + \dots$
  - g)  $S_7$  for  $972 + 324 + 108 + \dots$
  - h)  $S_6$  for  $1 - \frac{1}{2} + \frac{1}{4} - \dots$
2. Find  $S_n$  for each geometric series.
  - a)  $a = 5, r = 3, n = 8$
  - b)  $a = 4, r = -3, n = 10$
  - c)  $a = 625, r = 0.6, n = 5$
  - d)  $f(1) = 4, r = 0.5, n = 7$
  - e)  $a = 100\,000, r = -0.1, n = 5$
  - f)  $f(1) = \frac{1}{2}, r = -5, n = 6$
3. Find the sum of each geometric series.
  - a)  $1 + 2 + 4 + \dots + 256$
  - b)  $1 + 3 + 9 + \dots + 2187$
  - c)  $2 - 4 + 8 - \dots + 512$
  - d)  $5 - 15 + 45 - \dots + 3645$
  - e)  $729 + 243 + 81 + \dots + 1$
  - f)  $1200 + 120 + 12 + \dots + 0.0012$
4. If  $f(1) = 0.8$  and  $f(2) = 1.6$  for a geometric series, find  $S_{10}$ .
5. If  $f(1) = 2$  and  $f(2) = -8$  for a geometric series, find  $S_{15}$ .