

Geometric Series

An geometric series is a sequence of numbers in which each term after the first is found by multiplying a constant amount to the previous term.

The constant amount is called the common ratio, symbolised, r .

$$r = \frac{T_2}{a}$$

$$= \frac{T_3}{T_2}$$

$$r = \frac{T_n}{T_{n-1}}$$

$$T_1 = a$$

$$T_2 = ar$$

$$T_3 = ar^2$$

$$T_n = ar^{n-1}$$

e.g.(i) Find r and the general term of 2, 8, 32, ...

$$T_n = ar^{n-1}$$

$$= 2(4)^{n-1}$$

$$= 2(2^2)^{n-1}$$

$$= 2(2)^{2n-2}$$

$$a = 2, r = 4$$

$$\therefore T_n = 2^{2n-1}$$

(ii) If $T_2 = 7$ and $T_4 = 49$, find r (iii) find the first term of $1, 4, 16, \dots$ to be greater than 500.

$$\begin{aligned} ar &= 7 \\ ar^3 &= 49 \end{aligned}$$

$$r^2 = 7$$

$$r = \pm\sqrt{7}$$

$$a = 1, r = 4$$

$$T_n = 1(4)^{n-1}$$

$$T_n > 500$$

$$4^{n-1} > 500$$

$$\log 4^{n-1} > \log 500$$

$$(n-1)\log 4 > \log 500$$

$$n-1 > 4.48$$

$$n > 5.48$$

$$\underline{T_6 = 1024, \text{ is the first term } > 500}$$

**Exercise 6E; 1be, 2cf, 3ad, 5ac, 6c, 8bd, 9ac, 10ac, 15, 17,
18ab, 20a**