

# Geometric Series



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## Formula for a Geometric Series

$$S_n = \frac{a_1(1 - r^n)}{1 - r} \quad r = \frac{a_n}{a_{n-1}}$$

$S_n$ : sum of the first  $n$  terms

$a_1$ : first term

$n$ : # of terms

$r$ : common ratio



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Find the sum of :  $\frac{2}{5} + \frac{1}{10} + \frac{1}{40} + \frac{1}{160} + \frac{1}{640}$



$$S_n = \frac{a_1(1-r^n)}{1-r}$$

$$S_5 = \frac{2}{5} \left( 1 - \left( \frac{1}{4} \right)^5 \right)$$

$$a_1 = \frac{2}{5}$$

$$n = 5$$

$$r = \frac{\frac{1}{40}}{\frac{1}{10}} = \frac{1}{40} \cdot \frac{10}{1} = \frac{1}{4}$$

$$= \frac{341}{640}$$

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Find  $S_5$  of the series:  $1 + 4 + 16 \dots$



$$a_1 = 1$$

$$n = 5$$

$$r = \frac{16}{4} = 4$$

$$S_5 = 341$$

Ans / (1-4)

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Find  $S_8$  of the series:  $7 + 21 + 63 + \dots$



$$S_8 = 22,960$$

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Find  $S_6$  of the series:

$$\frac{1}{9} + \frac{-1}{3} + 1 + \dots$$

$$-3 \quad \frac{365}{18} \quad -180\frac{2}{9}$$

$$20.2778$$

$$\frac{365}{18}$$

$$18 \quad -20.2$$

$$\frac{-182}{9}$$

$$a_1 = \frac{1}{9}$$

$$n = 6$$

$$r = -3$$

$$S_6 = \frac{\frac{1}{9} (1 - (-3)^6)}{1 + 3}$$

$$1 + 3^6 = 1 + 729 = 730$$

$$1 - (-3)^6 = 1 - 729 = -728$$

$$\frac{-182}{9}$$

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Round to the nearest hundredth, if necessary...

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

$$a_1 = 4(2^{1-1}) = 4$$

$$n = 4$$

$$r = 2$$

$$a_n = a_1 r^{n-1}$$

$$S_4 = \frac{4(1-2^4)}{1-2} = 60$$

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Round to the nearest hundredth, if necessary...

$$\sum_{n=1}^{12} (3.1^{n-1})$$

$$a_1 = 1$$

$$n = 12$$

$$r = 3.1$$

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Round to the nearest hundredth, if necessary...

$$\sum_{n=1}^{17} \frac{2}{3} (3^{n-1})$$



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## Formulas

Arithmetic

$$\text{Seq: } a_n = a_1 + (n-1)d$$

$$d = a_n - a_{n-1}$$

$$\text{Series: } S_n = \frac{n}{2}(a_1 + a_n)$$

Geometric

$$\text{Seq: } a_n = a_1 r^{n-1}$$

$$r = \frac{a_n}{a_{n-1}}$$

$$\text{Series: } S_n = \frac{a_1(1-r^n)}{1-r}$$

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# Homework



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