

11-4 Geometric Series

Objective: Find sums of geometric series.
Find specific terms of geometric series.

Geometric sequence

1, 2, 4, 8, 16

vs.

Geometric series

1+2+4+8+16

Sum of a geometric series

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

Sum of n terms

term # looking for

r does not equal 1.

r = common ratio

EX 1. $a_1=2, r=2, n=15$ Find the sum of the first 15 terms.

$a_1(r)^{n-1}$

$$S_{15} = \frac{2(1-2^{15})}{1-2} = \frac{2(1-2^{15})}{-1}$$

$$= \boxed{65,534}$$

EX 2. Evaluate

6
 $\sum_{n=1} 5(2)^{n-1}$

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

$$S_6 = \frac{5(1-2^6)}{1-2} = \boxed{315}$$

EX 3. Evaluate $\sum_{n=1}^{12} 3(2)^{n-1}$

$$a(r)^{n-1}$$

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

$$S_{12} = \frac{3(1-2^{12})}{1-2} = \boxed{12,285}$$

EX 4. Find the sum of a geometric series of $a_1=15,625$, $a_n=-5$, $r=(-1/5)$.

$$S_n = \frac{15,625 - (-5)(-1/5)}{1 - (-1/5)}$$

$$= \frac{15,625 - 1}{1 + 1/5} = \frac{15,624}{1.2} = \boxed{13,020}$$

We don't know "n".
* Use this formula:

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

EX 5. Find a_1 in a geometric series for which $S_8=39,360$, $r=3$.

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

$$n=8$$

$$(2) \quad 39,360 = \frac{a_1(1-3^8)}{1-3} \quad (-2)$$

$$-78,720 = a_1(1-3^8)$$

$$-78,720 = a_1(-6,560)$$

$$\frac{-78,720}{-6,560} = \frac{a_1(-6,560)}{-6,560}$$

$$\boxed{12 = a_1}$$