

# Algebra II

11-5

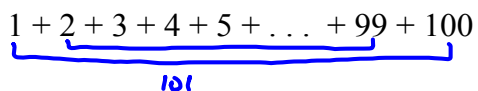
## Sums of Arithmetic and Geometric Series

Sum of a Finite Arithmetic Series :

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

Find the sum of each arithmetic series.

$$1 + 2 + 3 + 4 + 5 + \dots + 99 + 100$$



$a_1$   
 $n=1$

$a_{100}$

$$S_{100} = \frac{100(1+100)}{2} = \frac{100(101)}{2} = 5050$$

### Sum of a Finite Geometric Series :

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

Find the sum of each geometric series.

$$2 + 4 + 8 + 16 + \dots + 1024$$

$$a_1, a_2 \qquad a_n$$

geometric:  $r = 2$

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

$$1024 = 2(2)^{n-1}$$

$$512 = 2^{n-1}$$

$$2^9 = 2^{n-1}$$

$$n = 10$$

$$S_{10} = \frac{2(1 - 2^{10})}{1 - 2}$$

$$= \frac{2(1 - 1024)}{-1}$$

$$= \frac{2(-1023)}{-1}$$

$$= 2046$$

Find the sum of each arithmetic series.

1)  $n = 20$  ;  $a_1 = 5$  ;  $a_{20} = 62$

$$S_{20} = \frac{n(a_1 + a_n)}{2}$$

$$= \frac{20(5 + 62)}{2}$$

$$= 10(67) = 670$$

Find the sum of each arithmetic series.

$$\begin{aligned} 7) \quad \sum_{j=1}^{50} 3j+2 &= 5+8+11+\dots+152 \\ S_{50} &= \frac{50(5+152)}{2} \\ &= 25(157) \\ &= \boxed{3925} \end{aligned}$$

Find the sum of each geometric series.

$$\begin{aligned} 17) \quad \sum_{k=1}^{12} 2^{-k} &= 2^{-1}+2^{-2}+\dots+2^{-12} \\ &= \frac{1}{2}+\frac{1}{4}+\dots+\frac{1}{2^{12}} \\ S_n &= \frac{a_1(1-r^n)}{1-r} \\ &= \frac{\frac{1}{2}(1-(\frac{1}{2})^{12})}{1-\frac{1}{2}} = \frac{\frac{1}{2}(1-\frac{1}{4096})}{\frac{1}{2}} \\ &= \boxed{\frac{4095}{4096}} \end{aligned}$$

Find the sum of the following.

21) The first 20 positive integers ending in 3

$$3 + 13 + 23 + \dots$$
$$S_{20} = \frac{20(3 + 193)}{2}$$
$$= 10(196)$$
$$= \underline{1960}$$
$$a_{20} = a_1 + d(n-1)$$
$$a_{20} = 3 + 10(20-1)$$
$$= 3 + 10(19)$$
$$= 193$$

Pg 527

2-28 even

Pg 533

2-12 even