# More Arithmetic and Geometric Series Questions

## **DO IT NOW!**

In an arithmetic sequence,  $t_3 = 25$  and  $t_9 = 43$ . Determine the formula for the general term of this

Determine the formula for the general term of this sequence.

$$t_{\eta} = a + (n-1)d$$
 $25 = a + (3-1)d$ 
 $25 = a + 2d$ 

1 solve using elimination

3 43 = a + 8d

3 43 = a + 8d

1 35 = a + 2d

18 = 6d

3 = d

The great formula for the general term of this sequence.

 $t_{\eta} = a + (n-1)d$ 
 $243 = a + (9-1)d$ 
 $243 = a + 8d$ 
 $243 = a + 8d$ 
 $36 = a + 2d$ 
 $36 = a + 2d$ 

# **Arithmetic**

## **Sequence:**

$$t_n = a + (n-1)d$$

#### **Series:**

$$S_n = \frac{n}{2}[2a + (n-1)d]$$

$$S_n = \frac{n}{2}(a + t_n)$$

# **Geometric**

## **Sequence:**

$$t_n = a \cdot r^{n-1}$$

## **Series:**

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

**Example 1:** In an amphitheatre, seats are arranged in 50 semicircular rows facing a domed stage. The first row contains 23 seats, and each row contains 4 more seats than the previous row. How many seats are in the amphitheatre?

$$S_{50} = \frac{n}{2} [2\alpha + (n-1)d]$$

$$= \frac{59}{2} [2(23) + (50-1)(4)]$$

$$= 25 (242)$$

$$= 6050$$

Note: use formula for arithmetic series because difference between consecutive rows is a constant.

The amphitheatre has 6050 seats.

Example 2: Determine the sum of -31 -35 -39-....-403

start by determining what term #

the last term is.

$$t_n = a + (n-1)d$$
 $-403 = -3l + (n-1)(-4)$ 
 $-37a = (n-1)(-4)$ 
 $93 = n-1$ 
 $94 = n$ 

Next, And  $594$ :  $5n = \frac{1}{2}(a + t_n)$ 

$$594 = \frac{94}{3}(-3l - 403)$$

$$= 47(-434)$$

$$= -20 398$$

**Example 3:** Determine the sum of the first 20 terms of the arithmetic series in which the 15th term is 107 and the terms decrease by 3.

Start by finding the value of (a) using 
$$t_{18} = 107$$

$$t_{n} = a + (n-1)d$$

$$107 = a + (15-1)(-3)$$

$$107 = a - 42$$

$$149 = a$$
Now find Sao:  $S_{n} = \frac{1}{2} \left[ 2a + (n-1)d \right]$ 

$$= \frac{20}{3} \left[ 2(149) + (30-1)(-3) \right]$$

$$= 10(241)$$

$$= 2410$$

**Example 4:** The 10th term of an arithmetic series is 34, and the sum of the first 20 terms is 710. Determine the 25th term.

the 34 See = 710 
$$t_{25}$$
 = ?

 $t_{10}$ 
 $t_{10}$ 
 $t_{10}$ 
 $t_{10}$ 
 $t_{10}$ 
 $t_{10}$ 
 $t_{10}$ 
 $t_{10}$ 
 $t_{20}$ 
 $t_{$ 

**Example 5:** Determine the sum of the first seven terms of the geometric series in which  $t_5 = 5$  and  $t_8 = -40$ .

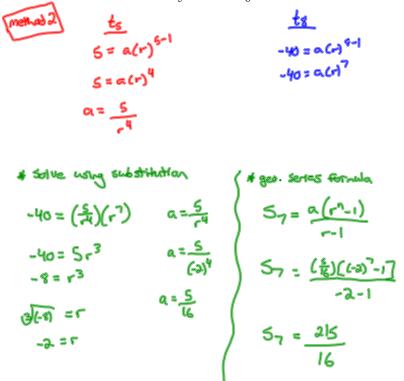
$$\frac{5}{16}, \frac{-5}{16}, \frac{5}{16}, \frac{5}{16}, \frac{-5}{16}, \frac{5}{16}, \frac{-5}{16}, \frac{30}{10}, \frac{-40}{20}$$

$$\frac{5}{16}, \frac{-5}{16}, \frac{5}{16}, \frac{5}{16}, \frac{5}{16}, \frac{5}{16}, \frac{-10}{20}, \frac{30}{20}, \frac{-40}{20}$$

$$\frac{5}{16}, \frac{3}{16}, \frac{5}{16}, \frac{20}{16}, \frac{-40}{20}$$

$$\frac{5}{16}, \frac{5}{16}, \frac{5}{1$$

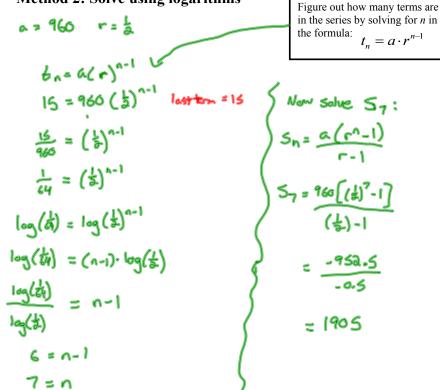
**Example 5:** Determine the sum of the first seven terms of the geometric series in which  $t_5 = 5$  and  $t_8 = -40$ .



**Example 6:** Calculate the sum of the geometric series,  $960 + 480 + 240 + \dots + 15$ 

Method 1: write out full series

#### Method 2: Solve using logarithms



## Method 3: Solve using powers with the same base

a=960 r= 1

$$\frac{1}{15} = 960 \left(\frac{1}{3}\right)^{n-1} \quad | \text{ lest ton} = 15$$

$$\frac{15}{960} = \left(\frac{1}{3}\right)^{n-1}$$

$$\frac{1}{14} = \left(\frac{1}{3}\right)^{n-1}$$

$$\frac{$$

**Example 7:** A tennis tournament has 128 entrants. A player is dropped from the competition after losing one match. Winning players go on to another match. What is the total number of matches that will be played in this tournament?

a= 64 r= & last term is 1.

**Note:** The first term is 128/2 = 64 because 2 players participate in one match. The last term is 1 but we don't know what term number it is.

Start by determining the 4 of terms in the series

$$t_n = \alpha(r)^{n-1}$$

$$1 = 64(\frac{1}{2})^{n-1}$$

$$\frac{1}{64} = (\frac{1}{2})^{n-1}$$

$$\frac{1}{64$$

& 127 matricles will be played in the tournament.