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**Sequences & Series Test**

**SOLUTIONS**

**A. Solve for following**

1) Arithmetic: 1st term: 7 common difference: 4  
 $a_n = 32$   
 $7 + (n-1) \cdot 4 = 32$   
 $4n - 4 = 25$   
 $4n = 29$   
 $n = \frac{29}{4}$   
 Arithmetic

2) Geometric: 1st term: 3 common ratio: 2  
 $a_n = 75$   
 $3 \cdot 2^{n-1} = 75$   
 $2^{n-1} = 25$   
 $2^{n-1} = 5^2$   
 $2^{n-1} = 2^{\log_2 5^2}$   
 $n-1 = 2 \log_2 5$   
 $n = 2 \log_2 5 + 1$   
 Geometric

**B. Answer the following (using formula)**

1) Find the 10th partial sum of the geometric series with 1st term 100 and common ratio 0.7  
 $S_{10} = 100 \frac{1-0.7^{10}}{1-0.7} = \frac{100(1-0.7^{10})}{0.3} \approx 280.4$

2) Find the 6th partial sum of the following  
 $S_6 = 32 + 32 + 48 + \dots$   
 First term: 32  
 Common difference: 16  
 $S_6 = \frac{6}{2}(2 \cdot 32 + (6-1) \cdot 16) = 3(64 + 80) = 3(144) = 432$

**IV. Summation and Sigma Notation**

A) Solve

1)  $\sum_{k=1}^5 k^2 = 55$   
 $1^2 + 2^2 + 3^2 + 4^2 + 5^2 = 1 + 4 + 9 + 16 + 25 = 55$

2)  $\sum_{k=1}^5 (2k + 5) = 55$   
 $2(1+2+3+4+5) + 5(5) = 2(15) + 25 = 30 + 25 = 55$

3)  $\sum_{k=1}^5 (4k - 3) = 35$   
 $4(1+2+3+4+5) - 3(5) = 4(15) - 15 = 60 - 15 = 45$

B) Describe the following series using sigma notation

1)  $4 + 8 + 12 + 16 + \dots$   
 $\sum_{k=1}^{\infty} 4k$

2)  $2 + 4 + 8 + 16 + 32 + \dots$   
 $\sum_{k=1}^{\infty} 2^k$

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**Arithmetic Sequences**

Determine if the sequence is arithmetic. If it is, find the common difference.

1)  $31, 32, 33, 34, \dots$   
 Yes, common difference: 1

2)  $-5, -25, -45, -65, \dots$   
 Yes, common difference: -20

3)  $-34, -64, -94, -124, \dots$   
 Yes, common difference: -30

4)  $-7, -9, -11, -13, \dots$   
 Yes, common difference: -2

5)  $8, 16, 24, 32, \dots$   
 Yes, common difference: 8

Given the explicit formula for an arithmetic sequence find the first five terms and the term named in the problem.

7)  $a_n = -11 + 7n$   
 Find  $a_6$   
 $a_6 = -11 + 7(6) = -11 + 42 = 31$   
 -11, 6, 13, 20, 27

8)  $a_n = 15 - 10n$   
 Find  $a_4$   
 $a_4 = 15 - 10(4) = 15 - 40 = -25$

9)  $a_n = -2.1 + \frac{1}{3}n$   
 Find  $a_6$   
 $a_6 = -2.1 + \frac{1}{3}(6) = -2.1 + 2 = -0.1$

Given the first term and the common difference of an arithmetic sequence find the first five terms and the explicit formula.

11)  $a_1 = 28, d = 10$   
 $28, 38, 48, 58, 68$   
 $a_n = 28 + (n-1)10 = 10n + 18$

12)  $a_1 = -38, d = -100$   
 $-38, -138, -238, -338, -438$   
 $a_n = -38 + (n-1)(-100) = -100n + 62$

13)  $a_1 = -34, d = -10$   
 $-34, -44, -54, -64, -74$   
 $a_n = -34 + (n-1)(-10) = -10n - 24$

**RP**

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

**GEOMETRIC SEQUENCE AND SERIES WORKSHEET**

The common ratio of a sequence is the common multiplier.  
 The general term of a geometric sequence is given by  $a_n = a_1 r^{n-1}$   
 where  $a_1$  is the first term and  $r$  is the common ratio.  
 The sum of the first  $n$  terms of a geometric series is given by  $S_n = \frac{a_1(1-r^n)}{1-r}$

Determine whether each sequence is a geometric sequence. If so, identify the common ratio,  $r$ , and give the next three terms.

1. 3, 6, 12, 24, ...  
 Yes,  $r=2$ , next terms: 48, 96, 192

2. 2, 6, 18, 54, ...  
 Yes,  $r=3$ , next terms: 162, 486, 1458

3. 9, 3, 1,  $\frac{1}{3}, \dots$   
 Yes,  $r=\frac{1}{3}$ , next terms:  $\frac{1}{9}, \frac{1}{27}, \frac{1}{81}$

4. 2, 4, 6, 8, ...  
 No, arithmetic sequence

5. 1, 4, 16, 64, ...  
 Yes,  $r=4$ , next terms: 256, 1024, 4096

6. 2, 3, 4.5, 6.75, ...  
 Yes,  $r=1.5$ , next terms: 10.125, 15.1875, 22.78125

7.  $10, 2, \frac{2}{5}, \frac{2}{25}, \dots$   
 Yes,  $r=\frac{1}{5}$ , next terms:  $\frac{2}{125}, \frac{2}{625}, \frac{2}{3125}$

8. 6, 42, 294, ...  
 Yes,  $r=7$ , next terms: 2058, 14406, 100842

9. 16, 20, 25, 31, 25, ...  
 No, not a geometric sequence

10. Graph the sequence in #6 on the graph provided.  
 How are the graphs of geometric sequences different from arithmetic sequences?  
 Geometric sequences form a curve, while arithmetic sequences form a straight line.

Solve, giving your answers correct to 3 decimal places, (a)  $3^{x+1} = 15$ , (b)  $(0.8)^{2x} = 0.45$ .

(a)  $3^{x+1} = 15$   
 $\log 3^{x+1} = \log 15$   
 $(x+1) \log 3 = \log 15$   
 $x+1 = \frac{\log 15}{\log 3}$   
 $x = \frac{\log 15}{\log 3} - 1$   
 or  $x = 1.465$

(b)  $(0.8)^{2x} = 0.45$   
 $\log(0.8)^{2x} = \log 0.45$   
 $2x \log(0.8) = \log 0.45$   
 $2x = \frac{\log 0.45}{\log 0.8}$   
 $x = \frac{\log 0.45}{2 \log 0.8}$   
 $x = 1.789$

**Example 10**

Solve for  $x$  the equations (a)  $5^{2x+1} + 4 = 21 \times 5^x$ , (b)  $\log_3 x + \log_3 9 = 3$ .

(a)  $5^{2x+1} + 4 = 21 \times 5^x$   
 or  $5 \times 5^{2x} - 21 \times 5^x + 4 = 0$   
 letting  $y = 5^x$ ,  
 $5y^2 - 21y + 4 = 0$   
 $(5y - 4)(y - 1) = 0$   
 $y = \frac{4}{5}$  or  $y = 1$   
 $\therefore 5^x = \frac{4}{5}$  or  $5^x = 1$   
 $= 5^{-1}$   $x \log 5 = \log 4$   
 i.e.  $x = -1$  or  $x = \frac{\log 4}{\log 5} = 0.86$

(b)  $\log_3 x + \log_3 9 = 3$   
 $\log_3 x + \frac{\log_3 9}{\log_3 x} = 3$   
 $(\log_3 x)^2 + 2 = 3 \log_3 x$   
 letting  $y = \log_3 x$ ,  
 $y^2 - 3y + 2 = 0$   
 $(y - 1)(y - 2) = 0$   
 $y = 1$  or  $y = 2$   
 $\therefore \log_3 x = 1$  or  $\log_3 x = 2$   
 i.e.  $x = 3$  or  $x = 9$

**Answers to Sequences & Series Test**

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