BECA / Huson / Algebra 2: Exponentials Jan 2023 Regents   Name:
4 April 2024

Regents problems: Sequences and series

1. A tree farm initially has 150 trees. Each year, 20% of the trees are cut down and 80 seedlings are planted. Which recursive formula models the number of trees, a_n, after n years?

    (a) $a_1 = 150$
    $a_n = a_{n-1}(0.2) + 80$

    (b) $a_1 = 150$
    $a_n = a_{n-1}(0.8) + 80$

    (c) $a_n = 150(0.2)^n + 80$

    (d) $a_n = 150(0.8)^n + 80$

2. The sum of the first 20 terms of the series $2 - 6 + 18 - 54 + \ldots$ is

    (a) -610

    (b) -59

    (c) 1,743,392,200

    (d) 2,324,522,934

3. A sequence is defined recursively by $a_1 = 2$ and $a_{n+1} = 3a_n + 1$ for $n \geq 1$. Find the first four terms of the sequence.

4. Given the arithmetic sequence where $a_1 = 5$ and the common difference $d = 3$, write an explicit formula for the nth term of the sequence. What is the 10th term?

5. A geometric sequence has a first term of $a_1 = 4$ and a common ratio of $r = \frac{1}{2}$. Write the recursive formula for the sequence. Calculate the 6th term.

6. Savannah just got contact lenses. Her doctor said she can wear them 2 hours the first day, and can then increase the length of time by 30 minutes each day. If this pattern continues, which formula would not be appropriate to determine the length of time, in either minutes or hours, she could wear her contact lenses on the nth day?

    (a) $t_n = 120 + 30(n - 1)$

    (b) $t_n = 2 + 0.5(n - 1)$

    (c) $t_n = 2 + 30n$

    (d) $t_n = 120 + 0.5(n - 1)$

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8. A sequence is defined recursively by $a_1 = 3$ and $a_{n+1} = 2a_n - 1$ for $n \geq 1$. What is the explicit formula for the nth term of the sequence?

   (a) $a_n = 2^n - 1$

   (b) $a_n = 2^n + 1$

   (c) $a_n = 3 \cdot 2^{n-1}$

   (d) $a_n = 3 \cdot 2^n - 1$

9. The nth term of a sequence is given by $a_n = 5n - 3$. What is the 10th term of the sequence?

   (a) 47

   (b) 45

   (c) 43

   (d) 41

10. Which sequence is defined recursively?

   (a) $a_n = 3n + 1$

   (b) $a_1 = 2$ and $a_{n+1} = a_n + 3$

   (c) $a_n = 4n - 5$

   (d) $a_n = 2^n$

11. The first term of a sequence is $a_1 = 7$ and each subsequent term is found by adding 5 to the previous term. Which formula represents the nth term of the sequence?

   (a) $a_n = 5n + 2$

   (b) $a_n = 5n + 7$

(c) $a_n = 5n - 3$

(d) $a_n = 7n + 5$

12. A 7-year lease for office space states that the annual rent is \$85,000 for the first year and will increase by 6% each additional year of the lease. What will the total rent expense be for the entire 7-year lease?

(a) \$42,809.63

(b) \$90,425.53

(c) \$595,000.00

(d) \$713,476.20

13. Which situation could be modeled using a geometric sequence?

(a) A cell phone company charges \$30.00 per month for 2 gigabytes of data and \$12.50 for each additional gigabyte of data.

(b) The temperature in your car is 79°. You lower the temperature of your air conditioning by 2° every 3 minutes in order to find a comfortable temperature.

(c) David's parents have set a limit of 50 minutes per week that he may play online games during the school year. However, they will increase his time by 5% per week for the next ten weeks.

(d) Sarah has \$100.00 in her piggy bank and saves an additional \$15.00 each week.

14. Given the geometric series $300 + 360 + 432 + 518.4 \ldots$, write a geometric series formula, S_n, for the sum of the first n terms. Use the formula to find the sum of the first 10 terms, to the *nearest tenth*.

15. A recursive formula for the sequence $40, 30, 22.5, \ldots$ is

(a) $g_n = 40 \left(\frac{3}{4}\right)^n$

(b) $g_1 = 40$
    $g_n = g_{n-1} - 10$

(c) $g_n = 40 \left(\frac{3}{4}\right)^{n-1}$

(d) $g_1 = 40$
    $g_n = \frac{3}{4} g_{n-1}$