Warm Up

1. Find the formula for a_n for the arithmetic sequence if $a_5 = 190,\ a_{10} = 115$

$\frac{115-190}{10-5} = -15$

$190 = -60 + a_1$

$250 = a_1$

$a_n = -15(n-1)+250$

$\boxed{a_n = -15n + 265}$

$a_5 = -15(5-1) + a_1$

$190 = -15(4) + a_1$

2. Find the partial sum for $\sum_{n=4}^{20}(2n-5)$

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

$n = 17$

$a_1 = 3$

$a_n = 35$

$\frac{17}{2}(3+35)$

$\frac{17}{2}(38)$

$17(19)$

$$\begin{array}{r} {}^{6}17 \\ 19 \\ \hline 153 \\ 170 \\ \hline 323 \end{array}$$

GO COUGARS!

Homework Questions

In Exercises 1–8, determine whether or not the sequence is arithmetic. If it is, find the common difference.

1. $10, 8, 6, 4, 2, \ldots$
2. $4, 9, 14, 19, 24, \ldots$
3. $3, \frac{5}{2}, 2, \frac{3}{2}, 1, \ldots$
4. $\frac{1}{3}, \frac{2}{3}, \frac{4}{3}, \frac{8}{3}, \frac{16}{3}, \ldots$
5. $-24, -16, -8, 0, 8, \ldots$
6. $\ln 1, \ln 2, \ln 3, \ln 4, \ln 5, \ldots$
7. $3.7, 4.3, 4.9, 5.5, 6.1, \ldots$
8. $1^2, 2^2, 3^2, 4^2, 5^2, \ldots$

$\ln 2 - \ln 1$ $\quad$ $\ln 3 - \ln 2$

In Exercises 9–16, write the first five terms of the sequence. Determine whether or not the sequence is arithmetic. If it is, find the common difference. (Assume n begins with 1.)

9. $a_n = 8 + 13n$
10. $a_n = 2^n + n$
11. $a_n = \frac{1}{n+1}$
12. $a_n = 1 + (n-1)4$
13. $a_n = 150 - 7n$
14. $a_n = 2^{n-1}$
15. $a_n = 3 + 2(-1)^n$
16. $a_n = 3 - 4(n+6)$

$$\frac{16 - -4}{5-1} = 5$$

$$a_n = 5(n-1) + a_1$$

In Exercises 17–26, find a formula for a_n for the arithmetic sequence.

17. $a_1 = 1, d = 3$
18. $a_1 = 15, d = 4$
19. $a_1 = 100, d = -8$
20. $a_1 = 0, d = -\frac{2}{3}$
21. $4, \frac{3}{2}, -1, -\frac{7}{2}, \ldots$
22. $10, 5, 0, -5, -10, \ldots$
23. $a_1 = 5, a_4 = 15$
24. $a_1 = -4, a_5 = 16$
25. $a_3 = 94, a_6 = 85$
26. $a_5 = 190, a_{10} = 115$

GO COUGARS!

Homework Questions

In Exercises 27–34, write the first five terms of the arithmetic sequence. Use the *table* feature of a graphing utility to verify your results.

27. $a_1 = 5, d = 6$

28. $a_1 = 5, d = -\frac{3}{4}$

29. $a_1 = -10, d = -12$

30. $a_4 = 16, a_{10} = 46$

31. $a_8 = 26, a_{12} = 42$

32. $a_6 = -38, a_{11} = -73$

33. $a_3 = 19, a_{15} = -1.7$

34. $a_5 = 16, a_{14} = 38.5$

In Exercises 35–38, write the first five terms of the arithmetic sequence. Find the common difference and write the *n*th term of the sequence as a function of *n*.

35. $a_1 = 15, \quad a_{k+1} = a_k + 4$

36. $a_1 = 200, \quad a_{k+1} = a_k - 10$

37. $a_1 = \frac{3}{5}, \quad a_{k+1} = -\frac{1}{10} + a_k$

38. $a_1 = 1.5, \quad a_{k+1} = a_k - 2.5$

$a_{k+1} = a_k - 10$

$a_6 = a_5 - 10$

$a_{11} = a_{10} - 10$

In Exercises 39–42, the first two terms of the arithmetic sequence are given. Find the missing term. Use the *table* feature of a graphing utility to verify your results.

39. $a_1 = 5, \quad a_2 = 11, \quad a_{10} =$

40. $a_1 = 3, \quad a_2 = 13, \quad a_9 =$

41. $a_1 = 4.2, \quad a_2 = 6.6, \quad a_7 =$

42. $a_1 = -0.7, \quad a_2 = -13.8, \quad a_8 =$

In Exercises 53–60, find the sum of the finite arithmetic sequence.

53. $2 + 4 + 6 + 8 + 10 + 12 + 14 + 16 + 18 + 20$

54. $1 + 4 + 7 + 10 + 13 + 16 + 19$

55. $-1 + (-3) + (-5) + (-7) + (-9)$

GO COUGARS!

Homework Questions

56. $-5 + (-3) + (-1) + 1 + 3 + 5$
57. Sum of the first 50 positive even integers
58. Sum of the first 100 positive odd integers
59. Sum of the integers from -100 to 30
60. Sum of the integers from -10 to 50

In Exercises 61–66, find the indicated *n*th partial sum of the arithmetic sequence.

61. 8, 20, 32, 44, . . . , $n = 10$
62. $-6, -2, 2, 6, \ldots, \quad n = 50$
63. 0.5, 1.3, 2.1, 2.9, . . . , $n = 10$
64. 4.2, 3.7, 3.2, 2.7, . . . , $n = 12$
65. $a_1 = 100, \quad a_{25} = 220, \quad n = 25$
66. $a_1 = 15, \quad a_{100} = 307, \quad n = 100$

In Exercises 67–74, find the partial sum without using a graphing utility.

67. $\sum_{n=1}^{50} n$
68. $\sum_{n=1}^{100} 2n$

$n = 100$
$a_1 = 2$
$a_n = 200$

$50(202)$

69. $\sum_{n=1}^{100} 5n$
70. $\sum_{n=51}^{100} 7n$
71. $\sum_{n=11}^{30} n - \sum_{n=1}^{10} n$
72. $\sum_{n=51}^{100} n - \sum_{n=1}^{50} n$
73. $\sum_{n=1}^{500} (n + 8)$
74. $\sum_{n=1}^{250} (1000 - n)$

8.3 Geometric Sequences & Series

- Common Ratio
- Finding the geometric formula
- Sums of Geometric Sequences
  - Finite Sums
  - Infinite Sums

A sequence is geometric if the ratios of the consecutive terms are the same

for $a_1, a_2, a_{3,} ....a_n$

$\frac{a_2}{a_1} = \frac{a_3}{a_2} = \frac{a_4}{a_3} ..... = r$ r is the common ratio

$2, 4, 8, 16 \dots 2^n$ r = 2

$\frac{-1}{3}, \frac{1}{9}, \frac{-1}{27}, \frac{1}{81} \dots\dots \left(\frac{-1}{3}\right)^n$ r = $-\frac{1}{3}$

$\frac{1}{9} \div -\frac{1}{3}$ $\frac{1}{81} \div -\frac{1}{27}$

$$\boxed{a_n = a_1 r^{n-1}} \longrightarrow a_1, a_1 \cdot r, a_1 \cdot r^2, a_1 \cdot r^3 ......a_1 r^{n-1}$$

start common ratio

[redacted]

$\overset{1}{5}, \overset{2}{10}, \overset{3}{20}, 40, 80$

$a_n = 5(2)^{n-1}$

Find the 12^{th} term of a geometric sequence whose first term is 6 and common ratio is 2.3

$$a_n = 6(2.3)^{n-1}$$

$$a_{12} = 6(2.3)^{11}$$

$$= 57{,}168$$

Find the rule or formula for

5, 10, 20, 40 ...

Find a_{20}

$a_{20} = 5(2)^{19}$

2,621,440

Find the indicated term for the geometric sequence

$a_3 = \frac{16}{3} \cdot \frac{3}{2}$ $\quad a_5 = \frac{64}{27}$ $\quad n = 7$

$a_2 = 8$ $\quad a_6$ $\quad a_7$

a_1 $\quad \frac{64}{27} \div \frac{16}{3}$ $\quad \frac{64}{27} \cdot \frac{4}{9} = \frac{256}{243}$

$\frac{\cancel{64}^{4}}{\cancel{27}_{9}} \cdot \frac{\cancel{3}^{1}}{\cancel{16}_{1}} = \sqrt[2]{\frac{4}{9}}$ $\quad \frac{2}{3} = r$

Sum of a finite geometric sequence

$$S = \cancel{\sum_{i=1}^{n}} ar^{i-1} = \boxed{a_1\left(\frac{1-r^n}{1-r}\right)}$$

Find the finite geometric sum

$$\sum_{n=1}^{6} 3(1.5)^n$$

$a_1 = 4.5$

$r = 1.5$

$n = 6$

$$4.5\left(\frac{1-1.5^6}{1-1.5}\right)$$

Sum of an infinite geometric sequence

$$S = \cancel{\sum_{i=1}^{\infty} ar^i} = \boxed{a_1\left(\frac{1}{1-r}\right)}$$

Find the infinite sum of the geometric sequence

$$\sum_{n=1}^{\infty} 4(.2)^{n-1}$$

$a_1 = 4$

$r = .2$

$4\left(\frac{1}{1-.2}\right)$

$4\left(\frac{1}{.8}\right)$

$4\left(\frac{1}{4/5}\right)$

$4\left(1 \cdot \frac{5}{4}\right)$

$4\left(\frac{5}{4}\right) = 5$

$a_1 \quad a_2 \quad a_3 \ \ldots \quad a_{100}$

$4 \quad .8 \quad .16 \ \ldots$

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HOMEWORK

p 607

1-35 odd (omit #19-23)

#47-51, 59-63

odd