What you'll Learn About

- Geometric Series

Common Ratio

r

Determine if the following series is Geometric. If it is give the common ratio.

2) 3, 12, 48, 192, . . .

$\frac{12}{3}=4$

$\frac{48}{12}=4$

$\frac{192}{48}=4$

Yes geometric

$r=4$

4) 1, -2, 4, - 8, ...

$\frac{-2}{1}=-2$

$\frac{4}{-2}=-2$

$\frac{-8}{4}=-2$

Yes Geometric

$r=-2$

$.2=\frac{1}{5}$

$.04=\frac{1}{25}$

6) 5, 1, .2, .04, . . .

$\frac{1}{5}=\frac{1}{5}$

$\frac{.2}{1}=\frac{\frac{1}{5}}{1}=\frac{1}{5}$

$\frac{.04}{.2}=\frac{\frac{1}{25}}{\frac{1}{5}}=\frac{1}{25}\cdot\frac{5}{1}=\frac{1}{5}$

Yes Geometric

$r=\frac{1}{5}$

10) $\frac{1}{5}, \frac{2}{7}, \frac{3}{9}, \frac{4}{11}, \ldots$

$\frac{\frac{2}{7}}{\frac{1}{5}}=\frac{2}{7}\cdot\frac{5}{1}=\frac{10}{7}$

$\frac{\frac{3}{9}}{\frac{2}{7}}=\frac{3}{9}\cdot\frac{7}{2}=\frac{21}{9}$

Not Geometric

Write the first 5 terms of the geometric sequence

12) $a_1 = 4 \quad r = 2$

$a_1=4$
$a_2=8$
$a_3=16$
$a_4=32$
$a_5=64$

16) $a_1 = 6 \quad r = -1/4$

$a_1=6$

$a_2=6\left(-\frac{1}{4}\right)=-\frac{6}{4}=-\frac{3}{2}$

$a_3=\left(-\frac{3}{2}\right)\left(-\frac{1}{4}\right)=\frac{3}{8}$

$a_4=\left(\frac{3}{8}\right)\left(-\frac{1}{4}\right)=\frac{-3}{32}$

$a_5=\left(-\frac{3}{32}\right)\left(-\frac{1}{4}\right)=\frac{3}{128}$

18) $a_1 = 4 \quad r = \sqrt{3}$

$a_1=4$

$a_2=4\sqrt{3}$

$a_3=4\sqrt{3}\cdot\sqrt{3}=12$

$a_4=12\sqrt{3}$

$a_5=12\sqrt{3}\cdot\sqrt{3}$
$=36$

Explicit

$A_n = a_1r^{n-1}$ when n =1 or $A_n = a_1r^n$ when n =0	Use the recursive rule to write the first five terms of the sequence. Then, write the sequence as a function of n. 20) $a_1 = 81$ $a_{k+1} = \frac{1}{3}a_k$ $a_1 = 81$ $a_2 = 81(\frac{1}{3}) = 27$ $a_3 = 27(\frac{1}{3}) = 9$ $a_4 = 9(\frac{1}{3}) = 3$ $a_5 = 3(\frac{1}{3}) = 1$ $a_n = 81(\frac{1}{3})^{n-1}$ 24) $a_1 = 30$ $a_{k+1} = \frac{-2}{3}a_k$ $a_1 = 30$ $a_2 = 30(\frac{-2}{3}) = -20$ $a_3 = -20(\frac{-2}{3}) = \frac{40}{3}$ $a_4 = \frac{40}{3}(\frac{-2}{3}) = \frac{-80}{9}$ $a_5 = -\frac{80}{9}(\frac{-2}{3}) = \frac{160}{27}$ $a_n = 30(\frac{-2}{3})^{n-1}$

a_1 a_2 a_3 a_4 a_5 a_6 a_7 a_8 $a_1 = \frac{16}{3(\frac{2}{3})^2}$ $= \frac{16}{\frac{12}{9}}$ $= \frac{16}{1} \cdot \frac{9}{12}$ $= \frac{144}{12} = 12$	Find the missing term of the geometric sequence 26. $a_1 = 5$ $r = \frac{3}{2}$ $n = 8$ $a_n = 5\left(\frac{3}{2}\right)^{n-1}$ $a_8 = 5\left(\frac{3}{2}\right)^{8-1}$ $5\left(\frac{3}{2}\right)^7$ $5\left(\frac{2187}{128}\right)$ $\frac{10,935}{128}$ A) $a_4 = 81$ $a_7 = 2187$ $n = 10$ $\cancel{\frac{2187-81}{7-4}}$ $a_4 = a_1 r^3$ $a_7 = a_1 r^6$ $81 = a_1 r^3$ $2187 = a_1 r^6$ $a_1 = \frac{81}{r^3}$ $2187 = \frac{81}{r^3} \cdot r^6$ $\frac{2187}{81} = \frac{81 r^3}{81}$ $\sqrt[3]{27} = \sqrt[3]{r^3}$ $r = 3$ $a_1 = \frac{81}{3^3}$ $a_n = 3(3)^{n-1}$ $a_{10} = 3(3)^{10-1} = 59,049$ 32) $a_3 = \frac{16}{3}$ $a_5 = \frac{64}{27}$ $n = 7$ $a_3 = a_1 r^2$ $a_5 = a_1 r^4$ $\frac{16}{3} = a_1 r^2$ $\frac{64}{27} = a_1 r^4$ $\frac{16}{3r^2} = a_1$ $\frac{64}{27} = \frac{16}{3r^2} \cdot r^4$ $\frac{3}{16} \cdot \frac{64}{27} = \frac{\frac{16}{3} \cdot r^2}{\frac{16}{3}}$ $r^2 = \frac{4}{9}$ $r = \frac{2}{3}$ 34) 3, 36, 437,. . . n = 7 $a_1 = 3$ $r = 12$ $a_n = 3(12)^{n-1}$

$a_n = 12\left(\frac{2}{3}\right)^{n-1}$

$\frac{12}{8}=\frac{3}{2}$ $\frac{18}{12}=\frac{3}{2}$	Find the sum of the first 5 terms. Then find r. 42) 8, 12, 18, 27, 81/2 $8+12+18+27+\frac{81}{2}=\frac{211}{2}$ $r=\frac{3}{2}$ Find the sum of the first 10 terms. Then find r. 41) $8,-4,2,-1,\frac{1}{2},\frac{-1}{4},\frac{1}{8},\frac{-1}{16},\frac{1}{32},\frac{-1}{64}$ $\frac{512}{64}-\frac{256}{64}+\frac{128}{64}-\frac{64}{64}+\frac{32}{64}-\frac{16}{64}+\frac{8}{64}-\frac{4}{64}+\frac{2}{64}-\frac{1}{64}$ $\frac{341}{64}$ $r=-\frac{1}{2}$ 41A) $8,4,2,1,\frac{1}{2},\frac{1}{4},\frac{1}{8},\frac{1}{16},\frac{1}{32},\frac{1}{64}$ $\frac{1023}{64}$ $r=\frac{1}{2}$

$S=\frac{a_1}{1-r}$ $\lvert r\rvert < 1$	Find the sum of the infinite series using the formula $S=\frac{a_1}{1-r}$. 41) $8,-4,2,-1,\frac{1}{2},\frac{-1}{4},\frac{1}{8},\frac{-1}{16},\frac{1}{32},\frac{-1}{64},\ldots$ 41A) $8,4,2,1,\frac{1}{2},\frac{1}{4},\frac{1}{8},\frac{1}{16},\frac{1}{32},\frac{1}{64}$ $S=\frac{8}{1-(-\frac{1}{2})}$ $=\frac{8}{1+\frac{1}{2}}=\frac{8}{\frac{3}{2}}=\frac{16}{3}$ $S=\frac{8}{1-\frac{1}{2}}$ $=\frac{8}{\frac{1}{2}}=16$ 62. $\sum_{n=0}^{\infty}2\left(\frac{-2}{3}\right)^n$ 64. $\sum_{n=1}^{\infty}\frac{1}{2}(4^n)$ $a_0=2$ $S=\frac{2}{1-(-\frac{2}{3})}$ $\frac{2}{1+\frac{2}{3}}=\frac{2}{\frac{5}{3}}=\frac{6}{5}$ $\frac{2}{-3}$ 64*B*. $\sum_{n=1}^{\infty}\frac{1}{2}(-4)^n$ 64*C*. $\sum_{n=1}^{\infty}\frac{-1}{2}(4)^n$ $-\frac{2}{5}$ $\frac{2}{3}$ 70) $9+6+4+8/3+\ldots$ $S=\frac{9}{1-\frac{2}{3}}=\frac{9}{\frac{1}{3}}=27$