9.1 SERIES NOTATION

$u_n = 3n \quad u_1 = 3 \cdot 1 = 3 \quad u_2 = 3 \cdot 2 = 6 \ldots\ldots$

$\sum_{n=1}^{\infty} u_n = 3+6+9+12+15+18+\cdots$ LIKE Q.R. 1, 2

GEOMETRIC SERIES (COMMON MULTIPLIER) $2, 6, 18, 54, 162 \ldots\ldots$ (×3 ×3 ×3 ×3)

$a = 2$ FIRST TERM $\quad r = 3$ MULTIPLIER

SUM $= \boxed{S = \sum_{n=1}^{\infty} a \cdot r^{n-1}} = \sum_{n=1}^{\infty} 2 \cdot 3^{n-1} = 2+6+\cdots\ldots$

LIKE QR 3, 4

$\frac{1}{2} + \frac{1}{3} + \frac{1}{4.5} + \frac{1}{6.75} + \cdots\ldots$ MAKE A FORMULA.

$\sum_{n=1}^{\infty} \frac{1}{ar^{n-1}} = \sum_{n=1}^{\infty} \frac{1}{2(1.5)^{n-1}}$ LIKE EX, 1, 2

HOMEWORK p. 466 QR. 1-4 AND EX. 1-5

THE SUM OF A GEOMETRIC SERIES IS $\boxed{S = \frac{a}{1-r}}$

AS LONG AS $-1 < r < 1$

$4+2+1+\frac{1}{2}+\frac{1}{4}+\cdots\ldots = \frac{4}{1-\frac{1}{2}} = 8$

$4+8+16+32+64+\cdots\ldots = \infty$

IF A SERIES HAS A FINITE SUM
IT IS SAID TO CONVERGE.

$4+2+1+\frac{1}{2}+\frac{1}{4}+\cdots = 8$ CONVERGES

IF A SERIES HAS NO FINITE SUM
IT IS SAID TO DIVERGE.

$4+8+16+32+64+\cdots = \infty$ DIVERGES

$-4-8-16-32-64-\cdots = -\infty$ DIVERGES

$-4+4-4+4-4+\cdots = ?$ DIVERGES

IF $\lim_{n\to\infty} a_n \neq 0$ THE SERIES DIVERGES.

IF $\lim_{n\to\infty} a_n = 0$ THE SERIES MIGHT CONVERGE

EXAMPLE $\sum_{n=1}^{\infty} \frac{4^n}{5^{n-1}}$ CONVERGE OR DIVERGE?

$= \frac{4}{1} + \frac{16}{5} + \frac{64}{25} + \frac{256}{125} + \cdots$ $a=4$ $r=\frac{4}{5}$

$\times\frac{4}{5}$ $\times\frac{4}{5}$ $\times\frac{4}{5}$ $S = \frac{a}{1-r} = \frac{4}{1-\frac{4}{5}} = 20$

CONVERGE

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p.467 #28 $.\overline{21} = .212121\ldots$

$= .21 + .0021 + .000021 + \ldots$

$= .21 + .21(.01)^1 + .21(.01)^2 + \ldots$

GEOMETRIC SERIES $a = .21$ $r = .01$

$S = \frac{a}{1-r} =$ $a = \frac{21}{100}$ $r = \frac{1}{100}$

$$\frac{\frac{21}{100}}{1-\frac{1}{100}} = \frac{\frac{21}{100}}{\frac{99}{100}} = \frac{21}{99}$$

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p.468 #42 $\frac{1}{1+3x}$ WRITE A SERIES

$$S = \sum_{n=1}^{\infty} a \cdot r^{n-1} = \frac{a}{1-r} \qquad a=1 \quad r=-3x \qquad |r|<1 \quad |-3x|<1$$

$$S = \sum_{n=1}^{\infty} 1 \cdot (-3x)^{n-1} = 1 - 3x + 9x^2 - 27x^3 + \ldots$$

$-\frac{1}{3} < x < \frac{1}{3}$

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