

## 2.9 INFINITE GEOMETRIC SERIES

- Given the series  $8+4+2+1+\dots$ . DETERMINE THE SUM OF THE 1<sup>st</sup> A) 5 TERMS B) 10 TERMS C) 20 TERMS  
D) 30 TERMS E) 40 TERMS F)  $\infty$  TERMS

Solve A) 5 TERMS = 15.5

$$\begin{aligned} \text{B) } S_n &= a \frac{(r^n - 1)}{r - 1} = \frac{8 \left( \left( \frac{1}{2} \right)^n - 1 \right)}{\frac{1}{2} - 1} = 15.984375 \end{aligned}$$

$$\begin{aligned} \text{C) } S_n &= a \frac{(r^n - 1)}{r - 1} = \frac{8 \left( \left( \frac{1}{2} \right)^{20} - 1 \right)}{\frac{1}{2} - 1} = 15.99998474 \end{aligned}$$

$$b) S_n = \frac{8 \left( \left( \frac{1}{2} \right)^{30} - 1 \right)}{\frac{1}{2} - 1} = 15.99999999$$

$$E) S_n = \frac{8 \left( \left( \frac{1}{2} \right)^{40} - 1 \right)}{\frac{1}{2} - 1} = 16$$

$$F) S_n = \frac{8 \left( \left( \frac{1}{2} \right)^{\infty} - 1 \right)}{\frac{1}{2} - 1} = 16$$

- AS  $n$  GETS REALLY LARGE  $r^n$  GETS REALLY SMALL,  
ESSENTIALLY WE ARE ADDING 0.

- THIS IS ONLY TRUE WHEN  $r$  IS BETWEEN  $-1$  AND  $1$   
(WE CAN WRITE THIS AS  $r < |1|$ )

IF WHICH OF THESE HAVE A FINITE SUM

1)  $2 + 3 + 4 + 5 + \dots$   $\leftarrow$  NOT A FINITE SUM

2)  $5 - \frac{15}{4} + \frac{45}{16} - \frac{135}{64} + \dots$   $r = -\frac{3}{4}$   $\therefore$  FINITE SUM

3)  $6 - 18 + 54 - \dots$   $r = -3$  NO SUM

4)  $8 + 7.2 + 6.48 + \dots$   $r = \frac{9}{10}$   $\therefore$  FINITE SUM

FINITE SUM  $\Rightarrow S_{\infty} = \frac{a}{1-r}$

THE FINDS THE  $\infty$  SUM OF  $32 - 16 + 8 - 4 + \dots$   $\leftarrow$

$$\int_{\infty} = \frac{32}{1 - \left(\frac{1}{2}\right)} = \frac{32}{1.5} = 21\frac{1}{3}$$

DE Find the  $\infty$  sum of

$$\frac{5}{3} + \frac{16}{9} + \frac{20}{27} + \dots$$

$$S = \frac{\frac{5}{3}}{1 - \frac{2}{3}} = \frac{\frac{5}{3}}{\frac{1}{3}} = \frac{5}{3} \times \frac{3}{1} = 5$$

~~DE~~ IF THE FIRST TERM OF THE INFINITE  
GEOMETRIC IS 12 AND THE SUM IS 20, FIND  $r$

Solve

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

$$20 = \frac{12}{1-r}$$

$$20(1-r) = 12$$

$$20 - 20r = 12$$

$$\frac{-20r}{-20} = \frac{-8}{-20} \quad r = \frac{2}{5}$$

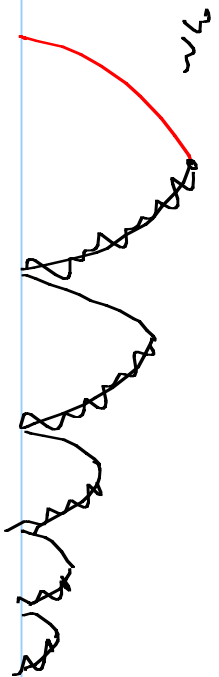
- A BALL IS DROPPED FROM A HEIGHT OF 3m, IT REBOUNDS TO A MAXIMUM OF 80% OF ITS PREVIOUS HEIGHT. DETERMINE

A) TOTAL VERTICAL DISTANCE TRAVELED BY THE BALL IN THE FIRST 5 BOUNCES

B) TOTAL VERTICAL DISTANCE TRAVELED

Solve A)  $S_n = a(r^n - 1)$

$$S_n = \frac{3((.8)^6 - 1)}{.8 - 1} = 11.06$$



$$11.06 \times 2 = 22.12 - 3 = 19.12$$

$$B) \quad S = \frac{a}{1-r}$$

$$S = \frac{3}{1-.8} = \frac{3}{.2} = 15$$

$$15 \times 2 - 3 = 27$$

H/W Pk 130

# 2-6

