

Two cars travel the same distance starting at 10:00 am and 11:00 am, respectively, on the same day. They reach their common destination at the same point of time. If the first car travelled for at least 6 hours, then the highest possible value of the percentage by which the speed of the second car could exceed that of the first car is

- A 20
- B 30
- C 25
- D 10

$C_1$   $\frac{d}{t}$   
 $C_2$   $\frac{d}{t-1}$

$t \geq 6$   
 $S_1 = \frac{d}{t}$   
 $S_{1 \text{ max}} = \frac{d}{6}$   
 $S_2 = \frac{d}{t-1}$   
 $S_{2 \text{ max}} = \frac{d}{5}$

$\frac{\frac{d}{5} - \frac{d}{6}}{\frac{d}{6}} \times 100 = 20\%$   
 $\frac{6d - 5d}{30} \times 100 = 20\%$   
 $\frac{\frac{d}{5} - \frac{d}{6}}{\frac{d}{6}} = \frac{100}{5} = 20\%$

If  $a_1, a_2, \dots$  are in A.P., then,  $\frac{1}{\sqrt{a_1} + \sqrt{a_2}} + \frac{1}{\sqrt{a_2} + \sqrt{a_3}} + \dots + \frac{1}{\sqrt{a_n} + \sqrt{a_{n+1}}}$  is equal to

- A  $\frac{n}{\sqrt{a_1} + \sqrt{a_{n+1}}}$
- B  $\frac{n-1}{\sqrt{a_1} + \sqrt{a_{n+1}}}$
- C  $\frac{n-1}{\sqrt{a_1} + \sqrt{a_n}}$
- D  $\frac{n}{\sqrt{a_1} - \sqrt{a_{n+1}}}$

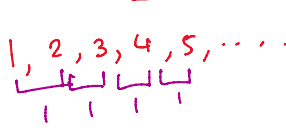
$d = a_2 - a_1 = a_3 - a_2 = \dots = a_{n+1} - a_n$

$\frac{1}{\sqrt{a_1} + \sqrt{a_2}} + \frac{1}{\sqrt{a_2} + \sqrt{a_3}} + \dots + \frac{1}{\sqrt{a_n} + \sqrt{a_{n+1}}}$

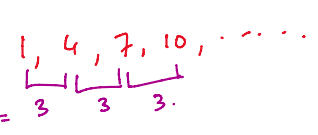
$\frac{1}{\sqrt{a_2} + \sqrt{a_3}} = \frac{\sqrt{a_3} - \sqrt{a_2}}{d}$

$\frac{1}{(\sqrt{a_1} + \sqrt{a_2}) \cdot (\sqrt{a_1} - \sqrt{a_2})} \times \frac{\sqrt{a_1} - \sqrt{a_2}}{\sqrt{a_1} - \sqrt{a_2}}$   
 $= \frac{\sqrt{a_1} - \sqrt{a_2}}{a_1 - a_2} = \frac{\sqrt{a_2} - \sqrt{a_1}}{a_2 - a_1}$   
 $= \frac{\sqrt{a_2} - \sqrt{a_1}}{d}$

Arithmetic Progression (AP)



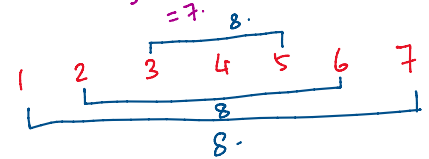
sequence where difference between 2 consecutive terms is constant = common difference = d.



$t_4 = 1 + 3 \times 3 = 10$

$t_1 = 1$   
 $t_2 = 4$   
 $d = 4 - 1 = 3$

$t_1 = a, \quad cd = d$   
 $t_n = a + (n-1)d$



$= 28$  (Sum)  
 $\text{Avg} = \frac{28}{7} = 4$

Avg of the series = Avg of the first and the last terms.

$\frac{\text{Sum of the series}}{n} = \frac{t_1 + t_n}{2}$

$S_n = \text{Sum of the series} = \frac{n}{2} (t_1 + t_n) = \frac{n}{2} [a + a + (n-1)d]$

$S_n = \frac{n}{2} [2a + (n-1)d]$

$1 + 2 + 3 + \dots + n \rightarrow$  Sum of the first n Natural Nos =  $\frac{n(n+1)}{2}$

$1^2 + 2^2 + 3^2 + \dots + n^2$  Sum of the squares of the first n Natural nos =  $\frac{n(n+1)(2n+1)}{6}$

$1^3 + 2^3 + 3^3 + \dots + n^3$  Sum of the cubes " " " " " " =  $\left[ \frac{n(n+1)}{2} \right]^2$

If  $a_1, a_2, \dots$  are in A.P., then,  $\sqrt{a_1} + \sqrt{a_2} + \sqrt{a_3} + \dots + \sqrt{a_n} + \sqrt{a_{n+1}}$  is equal to

- A  $\frac{n}{\sqrt{a_1} + \sqrt{a_{n+1}}}$
- B  $\frac{n-1}{\sqrt{a_1} + \sqrt{a_{n-1}}}$
- C  $\frac{n-1}{\sqrt{a_1} + \sqrt{a_n}}$
- D  $\frac{n}{\sqrt{a_1} + \sqrt{a_{n+1}}}$

$$S = \frac{\sqrt{a_{n+1}} - \sqrt{a_1}}{d}$$

$$= \frac{\sqrt{a_{n+1}} - \sqrt{a_1}}{\frac{(a_{n+1} - a_1)}{n}}$$

$$= \frac{n(\sqrt{a_{n+1}} - \sqrt{a_1})}{a_{n+1} - a_1} = \frac{n(\sqrt{a_{n+1}} - \sqrt{a_1})}{(\sqrt{a_{n+1}})^2 - (\sqrt{a_1})^2}$$

$$= \frac{n(\cancel{\sqrt{a_{n+1}}} - \sqrt{a_1})}{(\cancel{\sqrt{a_{n+1}}} - \sqrt{a_1})(\sqrt{a_{n+1}} + \sqrt{a_1})} = \frac{n}{\sqrt{a_{n+1}} + \sqrt{a_1}}$$

$$\frac{1}{\sqrt{a_1} + \sqrt{a_2}} = \frac{\sqrt{a_2} - \sqrt{a_1}}{d}$$

$$+ \frac{1}{\sqrt{a_2} + \sqrt{a_3}} = \frac{\sqrt{a_3} - \sqrt{a_2}}{d}$$

$$+ \frac{1}{\sqrt{a_3} + \sqrt{a_4}} = \frac{\sqrt{a_4} - \sqrt{a_3}}{d}$$

$$\vdots$$

$$+ \frac{1}{\sqrt{a_n} + \sqrt{a_{n+1}}} = \frac{\sqrt{a_{n+1}} - \sqrt{a_n}}{d}$$

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

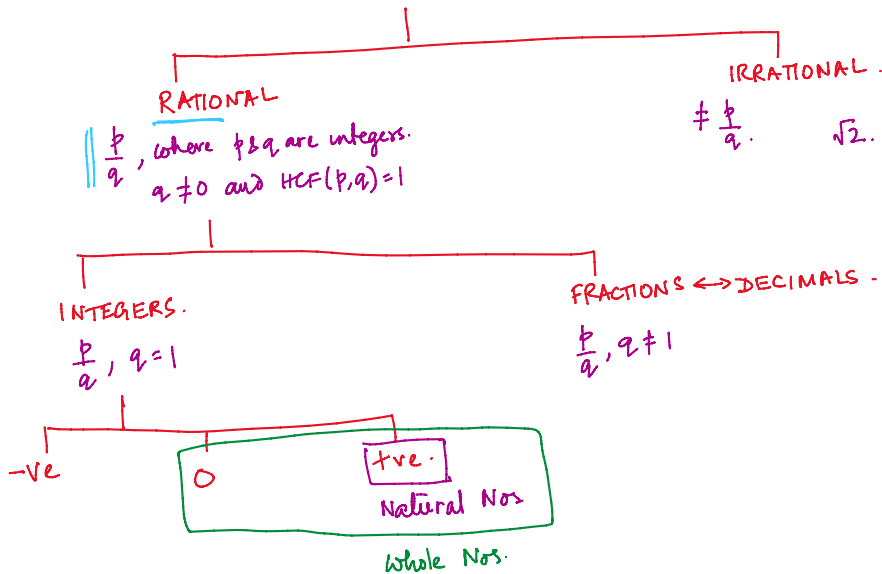
$$a_{n+1} = a_1 + nd$$

$$nd = a_{n+1} - a_1$$

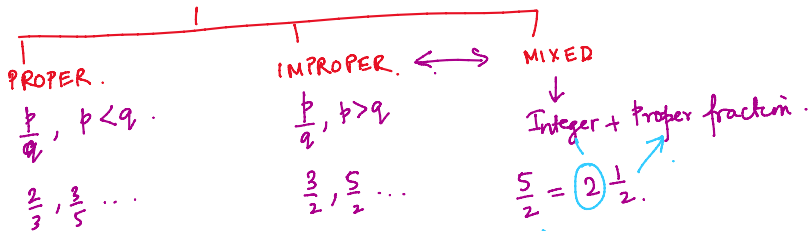
$$d = \frac{a_{n+1} - a_1}{n}$$

### Real Nos

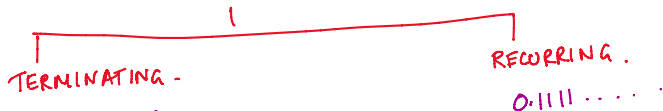
$$R^2 \geq 0$$



### FRACTIONS



### DECIMALS



TERMINATING -

0.2, 0.35  
1.923

RECURRING.

0.1111...  
0.333...  
0.1666...

$$\frac{1}{2} = 0.5$$

$$\frac{1 \times 5}{2 \times 5} = \frac{5}{10} = 0.5$$

$$\frac{1}{4} = 0.25$$

$$\frac{1}{4} = \frac{1 \times 5^2}{2 \times 5^2} = \frac{25}{100} = 0.25$$

$$\frac{1}{8} = 0.125$$

$$\frac{1}{8} = \frac{1 \times 5^3}{2 \times 5^3} = \frac{125}{1000} = 0.125$$

$$\frac{1}{5} = \frac{1 \times 2}{5 \times 2} = \frac{2}{10} = 0.2$$

$$\frac{1}{20} = \frac{1 \times 5^1}{2 \times 5^1 \times 5^1} = \frac{5}{100}$$

$$= 0.05$$

$$\frac{1}{40} = \frac{1 \times 5^2}{2 \times 5 \times 5^2} = \frac{25}{1000}$$
  
$$= 0.025$$

If the denominator consists of powers of 2 or 5 only then it will give a terminating decimal.

The number of digits after the decimal = highest power of 2 or 5 in the denominator.

$$\frac{1}{3} = 0.333... = 0.\dot{3}$$

$$\frac{1}{7} = 0.\overline{142857}$$

$$\frac{1}{6} = 0.1666... = 0.1\dot{6}$$

Next day. Cyclicly of powers.  
Remainders.