Two cars travel the $\boxed{\text{same distance}}$ 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 — d — 10 — t.

C_2 — 11am. — d — $t-1$

$t \geq 6$. $\quad t_{min} = 6$

$S_1 = \frac{d}{t} \quad S_{1\,max} = \frac{d}{6}$

$S_2 = \frac{d}{t-1} \quad S_{2\,max} = \frac{d}{5}$

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

If $a_1, a_2, \ldots\ldots$ are in A.P., then, $\frac{1}{\sqrt{a_1}+\sqrt{a_2}} + \frac{1}{\sqrt{a_2}+\sqrt{a_3}} + \ldots\ldots + \frac{1}{\sqrt{a_n}+\sqrt{a_{n+1}}}$ 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 $\frac{n}{\sqrt{a_1}-\sqrt{a_{n+1}}}$

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

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

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

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

Arithmetic Progression (AP)

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

1, 2, 3, 4, 5, ...

$\underbrace{1,2}_{1}\ \underbrace{2,3}_{1}\ \underbrace{3,4}_{1}\ \underbrace{4,5}_{1}$

1, 4, 7, 10, ...

$d = 3 \quad 3 \quad 3.$

$t_1 = 1 \quad d = 4-1 = 3$

$t_2 = 4$

$t_3 = 1 + 2\times3 = 7.$

$t_4 = 1 + 3\times3 = 10$

$t_1 = a \ , \ cd = d.$

$t_n = a + (n-1)d.$

1 2 3 4 5 6 7 = 28 (Sum)

8. 8 8.

Avg = $\frac{28}{7} = 4.$

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

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

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

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

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

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

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

If $a_1, a_2, \ldots\ldots$ are in A.P., then, $\frac{1}{\sqrt{a_1}+\sqrt{a_2}} + \frac{1}{\sqrt{a_2}+\sqrt{a_3}} + \ldots\ldots + \frac{1}{\sqrt{a_n}+\sqrt{a_{n+1}}}$ 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 $\frac{n}{\sqrt{a_1}-\sqrt{a_{n+1}}}$

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

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

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

$$\vdots$$

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

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

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

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

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

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

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

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

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

$\boxed{\text{Real Nos}}$

$R^2 \geq 0$

RATIONAL

$\frac{p}{q}$, where p & q are integers.

$q \neq 0$ and HCF$(p,q) = 1$

IRRATIONAL.

$\neq \frac{p}{q}$. $\sqrt{2}$.

INTEGERS.

$\frac{p}{q}$, $q = 1$

$-ve$

0

$\boxed{+ve}$

Natural Nos

Whole Nos.

FRACTIONS $\leftrightarrow$ DECIMALS.

$\frac{p}{q}$, $q \neq 1$

FRACTIONS

PROPER.

$\frac{p}{q}$, $p < q$.

$\frac{2}{3}, \frac{3}{5} \ldots$

IMPROPER. $\longleftrightarrow$ MIXED

$\frac{p}{q}$, $p > q$

$\frac{3}{2}, \frac{5}{2} \ldots$

Integer + Proper fraction.

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

DECIMALS

TERMINATING.

RECURRING.

0.1111 . . . .

TERMINATING.

0.2, 0.35

1.923

RECURRING.

0.1111.....

0.333.....

0.16666.....

$\frac{1}{2^1} = 0.5$ $\qquad \frac{1\times5}{2\times5} = \frac{5}{10} = 0.5$

$\frac{1}{4} = 0.25$ $\qquad \frac{1}{4} = \frac{1\times5^2}{2^2\times5^2} = \frac{25}{100} = 0.25$

$\frac{1}{8} = 0.125$ $\qquad \frac{1}{8} = \frac{1\times5^3}{2^3\times5^3} = \frac{125}{1000} = 0.125$

$\frac{1}{20} = \frac{1\times5^1}{2^2\times5^1\times5^1} = \frac{5}{100}$

$= 0.05$

$\frac{1}{40} = \frac{1\times5^2}{2^3\times5\times5^2} = \frac{25}{1000}$

$= 0.025$

$\frac{1}{5} = \frac{1\times2}{5\times2} = \frac{2}{10} = 0.2$

If the denominator consists of power 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.

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

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

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

Next day. Cyclicity of powers.

Remainders.