Chapter - 01 (Real Numbers)

Important Questions

1. Use Euclid's Division Algorithm to find the H.C.F of 135 and 225.

Solution:-

Here we have 135 and 225.

Always check which number is less than other
In this question $135 < 225$.

Formula:

$$\text{Dividend} = \text{Divisor} \times \text{Quotient} + \text{Rem.}$$

$$a = bq + r$$

$$225 = 135 \times 1 + 90$$

Again, $135 = 90 \times 1 + 45$

& $90 = 45 \times 2 + 0$

$r = 0$ at this step.

So the H.C.F of $(135, 225) = 45$.

Final Answer = 45.

$$\begin{array}{r|l} 135 & 225 \,(1 \\ & \underline{135} \\ & 90 \end{array}$$

$$\begin{array}{r|l} 90 & 135 \,(1 \\ & \underline{90} \\ & 45 \end{array}$$

$$\begin{array}{r|l} 45 & 90 \,(2 \\ & \underline{90} \\ & \times \end{array}$$

Formula used: Euclid's division Algorithm.

$$\boxed{a = bq + r}$$

where, a = dividend, b = Divisor, r = Remainder.
q = quotient.

2. Prove that $\sqrt{5}$ is irrational.

Solution:-

We will prove this by the method of Contradiction.

Let $\sqrt{5}$ is a rational number
so $\sqrt{5}$ can be written as p/q where $q \neq 0$

i.e, $$\sqrt{5} = \frac{p}{q}$$

$\Rightarrow$ squaring on both side.

$$(\sqrt{5})^2 = \left(\frac{p}{q}\right)^2$$

$$5 = p^2/q^2$$

$$5q^2 = p^2$$

or, $$q^2 = \frac{p^2}{5} \quad \text{------} \text{ (1)}$$

This means p^2 is divisible by 5
so p also must be divisible by 5.

Again, let $p = 5K$ {K is any integer

putt in (1) ie, $q^2 = \frac{(5K)^2}{5}$

$$q^2 = \frac{\cancel{25}^{\,5} k^2}{\cancel{5}}$$

$$q^2 = 5k^2$$

$$k^2 = \frac{q^2}{5} \qquad \text{——— (2)}$$

This means q^2 is also divisible by 5 and q must be divisible by 5.

This is contradiction of our Assumption. From equation (1) & (2) it is clear that $\sqrt{5}$ is not a rational number. because p & q have common factors.

Hence proved that $\sqrt{5}$ is irrational.

Formula used:- Contradiction method.

3. Find the H.C.F and L.C.M of 306 and 657 using the Euclid's Division Algorithm.
Very that

H.C.F x L.C.M = Product of the two Numbers.

Solution:-

we have numbers 306 and 657.

Here smaller number is 306

Then we start using E.D.A to find the H.C.F

So, start divide from smaller number. 306

Rule:-

$a = bq + r$

$657 = 306 \times 2 + 45$

$306 = 45 \times 6 + 36$

$45 = 36 \times 1 + 9$

$36 = 9 \times 4 + 0$

$$
\begin{array}{r|l}
306 & 657 \; (2 \\
 & 612 \\ \hline
 & 45
\end{array}
\qquad
\begin{array}{r|l}
45 & 306 \; (6 \\
 & 270 \\ \hline
 & 36
\end{array}
\qquad
\begin{array}{r|l}
36 & 45 \; (1 \\
 & 36 \\ \hline
 & 9
\end{array}
\qquad
\begin{array}{r|l}
9 & 36 \; (4 \\
 & 36 \\ \hline
 & \times
\end{array}
$$

Hence, the H.C.F = 9

using formula:-

$$L.C.M = \frac{\text{Product of Numbers}}{H.C.F}$$

$$L.C.M = \frac{306 \times 657}{9}$$

$$L.C.M = \frac{\cancel{306}^{34} \times 657}{\cancel{9}}$$

$$L.C.M = 34 \times 657$$

$$L.C.M = 22338 \quad \text{Ans.}$$

Verification :-

L.C.M × H.C.F = Product of Numbers.

$$22338 \times 9 = 306 \times 657$$

$$201042 = 201042 \quad \text{verified.}$$

Formula used :-

(i) Product of two numbers = H.C.F × L.C.M

(ii) $a = bq + r$ Euclid's Division algorithm.

where, a = dividend

b = Divisor

q = quotient

r = remainder

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4. Prove that $3+2\sqrt{5}$ is irrational

Solution:-

similary as question 1. Assume that $3+2\sqrt{5}$ is a rational number.

Let $$3+2\sqrt{5} = r$$

where r is any rational number.

So, $$2\sqrt{5} = r-3$$

since r and 3 are rational numbers.

ie., $2\sqrt{5}$ is also ~~a~~ rational number.

So $2\sqrt{5}$ must be rational.

Now divide both side by 2:

$$\frac{\cancel{2}\sqrt{5}}{\cancel{2}} = \frac{r-3}{2}$$

$$\sqrt{5} = \frac{r-3}{2}$$

$\left\{ \because \right.$ Rational ÷ Rational = rational

$\because$ R.H.S of above equation is rational so. $\sqrt{5}$ is rational.

But we know. $\sqrt{5}$ is irrational. ie, This contradiction occurs, our assumption is wrong. Hence.

$\boxed{3+2\sqrt{5} = \text{irrational.}}$ Proved.

5. Show the number 0.666...... in the form of $\frac{p}{q}$.

(2020 MB)

Solution:-

Let $x = 0.666.......$ —— (1)

Here only single digit is repeated. So we multiply by 10 in equation (1).

$10x = 10 \times 0.666.........$

$10x = 6.666.............$ —— (2)

Equation (2) − Equation (1)

$10x - x = (6.666......) - (0.666......)$

$9x = 6$

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$x = \frac{\cancel{6}^{2}}{\cancel{9}_{3}}$

$x = \frac{2}{3}$

i.e., $\boxed{x = \frac{2}{3} = 0.666.....}$ Ans.

6. Prove that $\sqrt{3}$ is an irrational. (2019, 20, 22, 23, 24)

Solution:-

Assume $\sqrt{3}$ is a rational.

ie, $\sqrt{3} = \frac{p}{q}$.

on squaring both side.

$$(\sqrt{3})^2 = \frac{p^2}{q^2}$$

$$3 = p^2/q^2$$

$$3q^2 = p^2 \quad \text{—— (1)}$$

Since, p^2 is divisible by 3

So p must be divisibble by 3.

let an other rational number say 'c'

$$p = 3c$$

putting (1)

$$3q^2 = (3c)^2$$

$$3q^2 = 9c^2$$

$$q^2 = \frac{\cancel{9}^{3}}{\cancel{3}} c^2$$

$$q^2 = 3c^2 \quad \text{—— (2)}$$

again, q^2 also divisible by 3.

So q must be divisible by 3

By equation ① and ② $\sqrt{3}$ have common factors.

This is contradiction of our assumption.

From equation ① & ② Hence proved that $\sqrt{3}$ is an irrational number.

Note:- Similarly you can proved that $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$, $\sqrt{7}$, ... etc. are irrational.

7. Show the following numbers as a prime factorisation.

(i) 140

(ii) 156 [2022 AW, 23 DW, 25 BV, BY]

(iii) 3825

(iv) 5005

Solution:-

(i) $140 = 2 \times 2 \times 5 \times 7 \Rightarrow 2^2 \times 5 \times 7$. Ans.

(ii) $156 = 2 \times 2 \times 3 \times 13 \Rightarrow 2^2 \times 3 \times 13$. Ans.

(iii) $3825 = 3 \times 3 \times 5 \times 5 \times 17 \Rightarrow 3^2 \times 5^2 \times 17$. Ans.

(iv) $5005 = 5 \times 7 \times 11 \times 13 \Rightarrow 5 \times 7 \times 11 \times 13$. Ans.

If you don't know how factorise these you can comment below. Thanks for love and support mathangles.com.

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