Assignment

Subject Code: MAT-111

Course Title: Basic Mathematics

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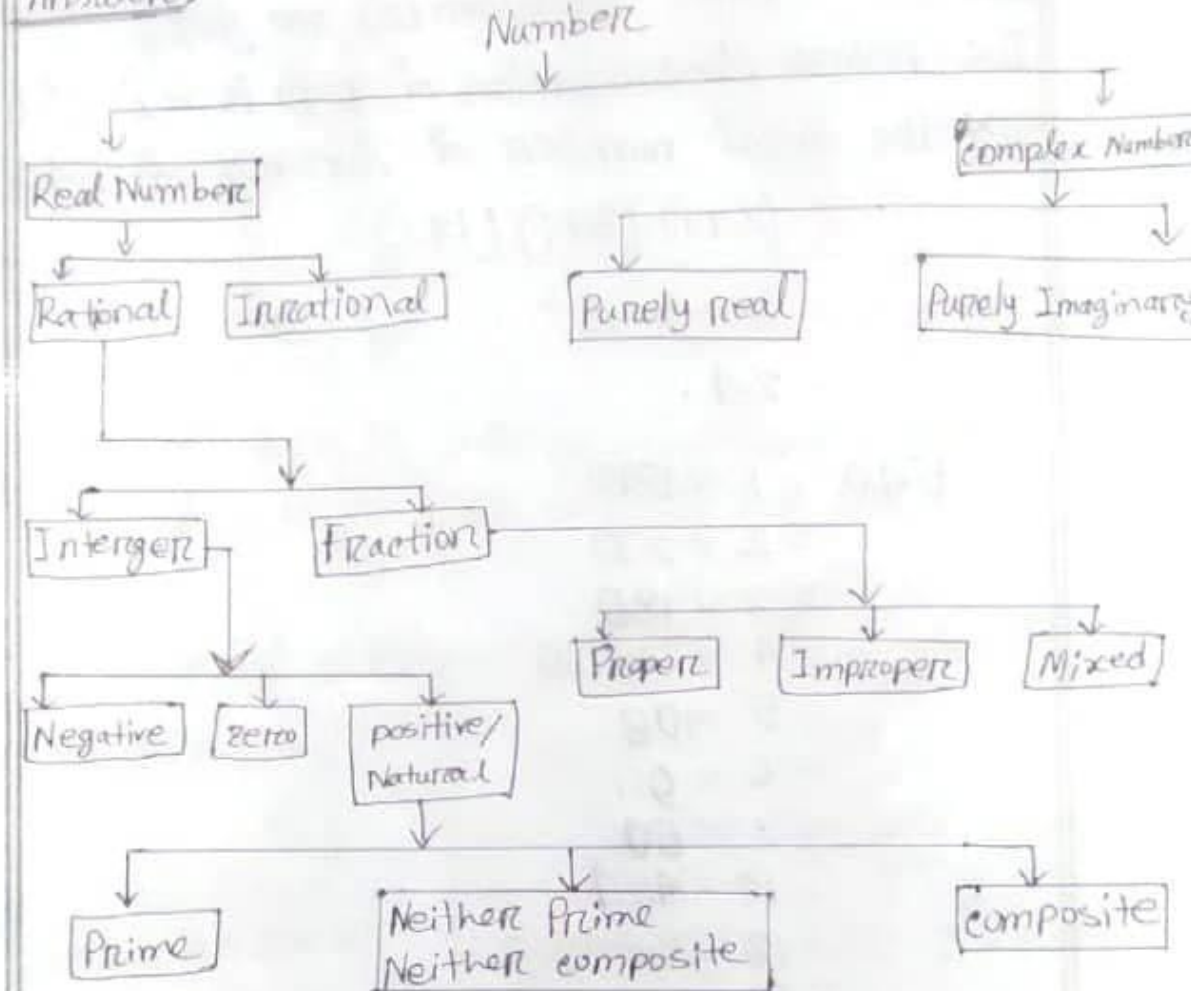
Sub :

1 Write down the classification of number system.

Answer:



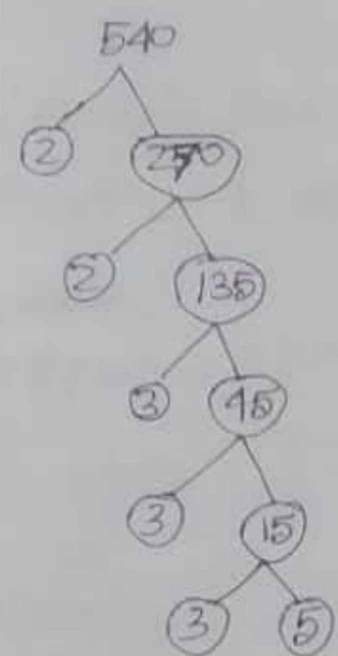
Sub :

Day:

Time: Date: / /

2 Find the prime factorization of 540 using tree.

Answer:



The prime factorization of 540 is $= 2^2 \cdot 3^3 \cdot 5^1$

Sub:

Day

Time: Date: / /

3 Find out the all factors of 540.

Answer: From problem (2) we get.

The prime factorization of 540 is $= 2^2 \cdot 3^3 \cdot 5^1$

So, the total number of factors of 540 are $=$

$$(2+1)(3+1)(1+1)$$

$$= 3 \cdot 4 \cdot 2$$

$$= 24.$$

$$
\begin{aligned}
540 &= 1 \times 540 \\
&= 2 \times 270 \\
&= 3 \times 180 \\
&= 4 \times \cancel{108}\,135 \\
&= 5 \times 108 \\
&= 6 \times 90 \\
&= 9 \times 60 \\
&= 10 \times 54 \\
&= 12 \times \cancel{36}\,45 \\
&= 15 \times \cancel{30}\,36 \\
&= 18 \times 30 \\
&= 20 \times 27
\end{aligned}
$$

The all factors of 540 are 1, 2, 3, 4, 5, 6, 9, 10, 12, 15, 18, 20, 27, 30, 36, 45, 54, 60, 90, 108, 135, 180, 270, 540.

Sub :

Day

Time Date / /

4 — What is the GCD & LCM of 240 & 540?

Answer:

$$\begin{array}{r|l} 2 & 240 \\ 2 & 120 \\ 2 & 60 \\ 2 & 30 \\ 3 & 15 \\ & 5 \end{array} \qquad \begin{array}{r|l} 2 & 540 \\ 2 & 270 \\ 3 & 135 \\ 3 & 45 \\ 3 & 15 \\ & 5 \end{array}$$

$\therefore 240 = 2^4 . 3 . 5$ $\therefore 540 = 2^2 . 3^3 . 5$

LCM of 240 & 540 $= 2^4 . 3^3 . 5 = 2160$

GCD of 240 & 540 $= 2^2 . 3 . 5 = 60$.

5 — Find the HCF & LCM of 42, 63 & 140.

Answer:

$$\begin{array}{r|l} 2 & 42 \\ 3 & 21 \\ & 7 \end{array} \qquad \begin{array}{r|l} 3 & 63 \\ 3 & 21 \\ & 7 \end{array} \qquad \begin{array}{r|l} 2 & 140 \\ 2 & 70 \\ 5 & 35 \\ & 7 \end{array}$$

$\therefore 42 = 2 \times 3 \times 7$ $\therefore 63 = 3^2 \times 7$ $\therefore 140 = 2^2 \times 5 \times 7$

LCM of $(42, 63 \,\&\, 140) = 2^2 . 3^2 . 5 . 7 = 1260$

HCF of $(42, 63 \,\&\, 140) = 7$.

Sub :

6 Find the HCF & LCM of $\frac{3}{2}, \frac{8}{9}, \frac{16}{81}$ & $\frac{10}{27}$

Answer:

Calculation of Numerator

$2 = 2^1$

$8 = 2^3$

$16 = 2^4$

$10 = 2 \cdot 5$

LCM of Numerator

$= 2^4 \cdot 5 = 80$

HCF of Numerator

$= 2$

Calculation of Denumerator

$3 = 3^1$

$9 = 3^2$

$81 = 3^4$

$27 = 3^3$

LCM of Denumerator

$= 3^4 = 81$

HCF of Denumerator

$= 3$

$\therefore$ LCM of $\left(\frac{2}{3}, \frac{8}{9}, \frac{16}{81} \text{ \& } \frac{10}{27}\right) = \frac{80}{3}$

$\therefore$ HCF of $\left(\frac{2}{3}, \frac{8}{9}, \frac{16}{81} \text{ \& } \frac{10}{27}\right) = \frac{2}{81}$

Sub :

Day

Time Date / /

7 — Find the modulus and argument of $z = \frac{1+\sqrt{3}i}{1-\sqrt{3}i}$ and also its polar, exponent form.

Answer: We have,

$$z = \frac{1+\sqrt{3}i}{1-\sqrt{3}i}$$

$$= \frac{(1+\sqrt{3}i)^2}{(1-\sqrt{3}i)(1+\sqrt{3}i)}$$

$$= \frac{1+2\sqrt{3}i+(\sqrt{3})^2 \cdot i^2}{1-(\sqrt{3})^2 \cdot i^2}$$

$$= \frac{1+2\sqrt{3}i-3}{1+3}$$

$$= \frac{2\sqrt{3}i-2}{4}$$

$$= \frac{2\sqrt{3}i}{4} - \frac{2}{4}$$

$$= \frac{\sqrt{3}i}{2} - \frac{1}{2}$$

So, polar form $= -\frac{1}{2} + \frac{\sqrt{3}i}{2}$

Now, $z = -\frac{1}{2} + \frac{\sqrt{3}i}{2}$

$$\therefore |z| = \sqrt{\left(-\frac{1}{2}\right)^2 + \left(\frac{\sqrt{3}}{2}\right)^2}$$

$$= \sqrt{\frac{1}{4} + \frac{3}{4}}$$

$$= \sqrt{\frac{1+3}{4}} = \sqrt{\frac{4}{4}} = 1.$$

Sub : Day Time : Date : / /

So. modulus of $Z = 1$

And Argument of $z = \theta = \pi - \tan^{-1}\left(\frac{\frac{\sqrt{3}}{2}}{-\frac{1}{2}}\right)$

$$= \pi - \tan^{-1}\left(\frac{\sqrt{3}}{2} \times \frac{2}{1}\right)$$

$$= \pi - \tan^{-1}\sqrt{3}$$

$$= \pi - \tan^{-1}\tan\frac{\pi}{3}$$

$$= \pi - \frac{\pi}{3}$$

$$= \frac{3\pi - \pi}{3}$$

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

Exponential form of $z = r.e^{i\theta}$

$$= 1 \cdot e^{\frac{2\pi}{3}i}$$

$$= e^{\frac{2\pi}{3}i}$$

8 Evaluate $\sqrt{-16} \times \sqrt{-4}$ & $\frac{\sqrt{-16}}{\sqrt{-4}}$

Answer:

$\sqrt{-16} \times \sqrt{-4}$	$\frac{\sqrt{-16}}{\sqrt{-4}}$
$= 4i \times 2i$	$= \frac{4i}{2i}$
$= 8i^2$	$= 2$
$= -8$	

Sub :

9 — Evaluate Modulus & Argument of $8z-z^2$ by replacing $z=2+i$

Answer: Here given that,

$z = 2+i$

$\therefore 8z-z^2 = 8(2+i)-(2+i)^2$

$= 16+8i-(4 \cdot 2 \cdot 2 \cdot i+i^2)$

$= 16+8i-4-4i-i^2$

$= 16+8i-4-4i+1$

$= 13+4i$

Modulus, $r = \sqrt{x^2+y^2}$

$= \sqrt{(13)^2+(4)^2}$

$= \sqrt{169+16}$

$= \sqrt{185}$

Argument, $\theta = \tan^{-1}\left(\frac{y}{x}\right)$

$= \tan^{-1}\frac{4}{13}$

$= 17.10^{\circ}$

Sub:

10. Express $1+\sqrt{3}i$ in the form of $r(\cos\theta + i\sin\theta)$

Answer: Here,

$$z = 1+\sqrt{3}i$$

$\therefore$ Modulus, $r = \sqrt{1^2+(\sqrt{3})^2}$

$$= \sqrt{1+3}$$
$$= \sqrt{4}$$
$$= 2$$

$\therefore$ Argument, $\theta = \tan^{-1}\frac{\sqrt{3}}{1}$

$$= \tan^{-1}\left(\tan\frac{\pi}{3}\right)$$
$$= \frac{\pi}{3}$$

Therefore, $r(\cos\theta + i\sin\theta)$ form is

$$= 2\left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right).$$