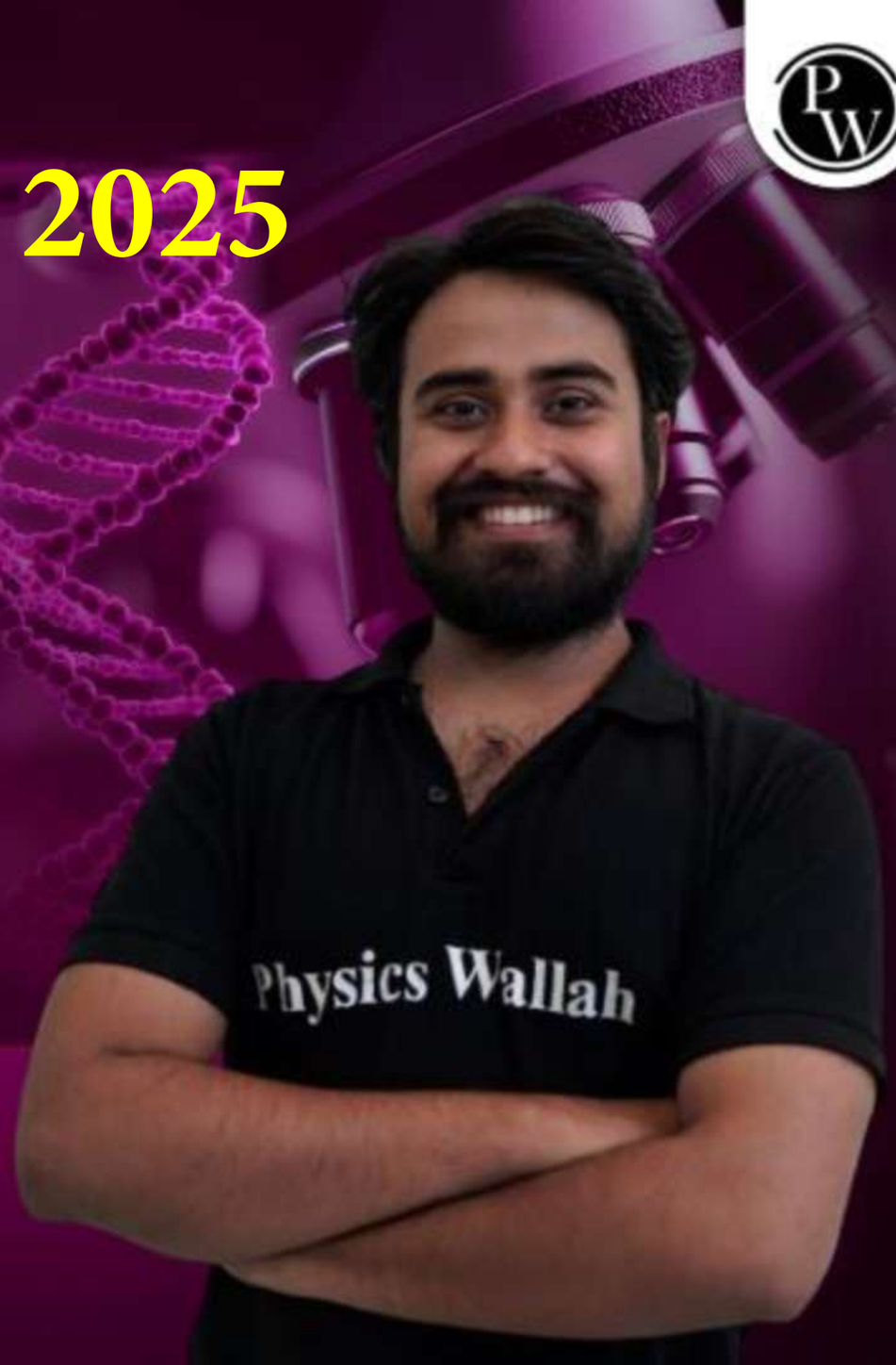
PRACHAND NEET 2025

ONE SHOT

PHYSICS

BASIC MATHS



By – BROFESSOR AAYUDH

Topics *to be covered*

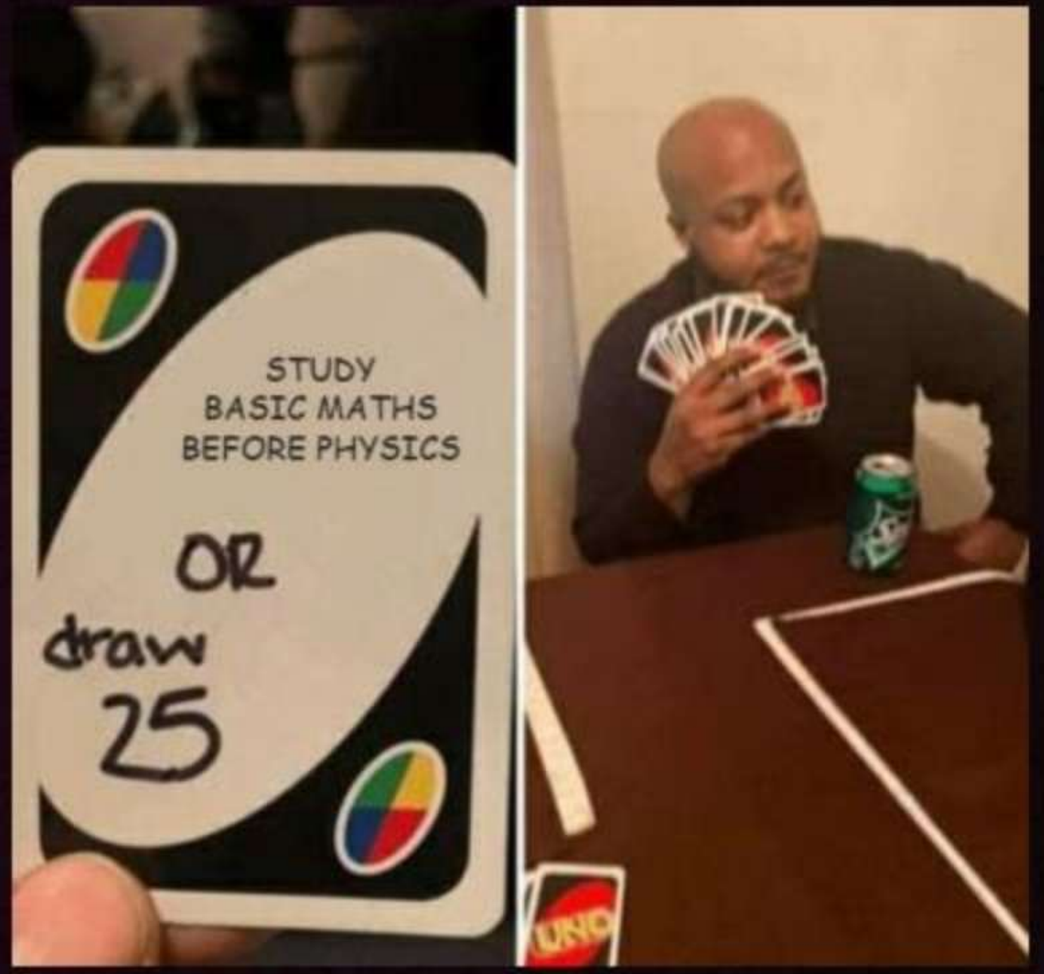
1. Arithmetic
2. Trigo
3. Log
4. Calculus
5. Graph

PRACHAND SERIES

TELEGRAM CHANNEL

KYU PADHU


LEFT
EXIT 12
BASIC MATHS
ANOTHER DROP
I AM SMART MUJHE
DIRECT PHYISCS PADHA DO


STUDY
BASIC MATHS
BEFORE PHYSICS
OR
draw
25
UNO

Tables

1 x 1 = 1	2 x 1 = 2	3 x 1 = 3	4 x 1 = 4	5 x 1 = 5
1 x 2 = 2	2 x 2 = 4	3 x 2 = 6	4 x 2 = 8	5 x 2 = 10
1 x 3 = 3	2 x 3 = 6	3 x 3 = 9	4 x 3 = 12	5 x 3 = 15
1 x 4 = 4	2 x 4 = 8	3 x 4 = 12	4 x 4 = 16	5 x 4 = 20
1 x 5 = 5	2 x 5 = 10	3 x 5 = 15	4 x 5 = 20	5 x 5 = 25
1 x 6 = 6	2 x 6 = 12	3 x 6 = 18	4 x 6 = 24	5 x 6 = 30
1 x 7 = 7	2 x 7 = 14	3 x 7 = 21	4 x 7 = 28	5 x 7 = 35
1 x 8 = 8	2 x 8 = 16	3 x 8 = 24	4 x 8 = 32	5 x 8 = 40
1 x 9 = 9	2 x 9 = 18	3 x 9 = 27	4 x 9 = 36	5 x 9 = 45
1 x 10 = 10	2 x 10 = 20	3 x 10 = 30	4 x 10 = 40	5 x 10 = 50

6 x 1 = 6	7 x 1 = 7	8 x 1 = 8	9 x 1 = 9	10 x 1 = 10
6 x 2 = 12	7 x 2 = 14	8 x 2 = 16	9 x 2 = 18	10 x 2 = 20
6 x 3 = 18	7 x 3 = 21	8 x 3 = 24	9 x 3 = 27	10 x 3 = 30
6 x 4 = 24	7 x 4 = 28	8 x 4 = 32	9 x 4 = 36	10 x 4 = 40
6 x 5 = 30	7 x 5 = 35	8 x 5 = 40	9 x 5 = 45	10 x 5 = 50
6 x 6 = 36	7 x 6 = 42	8 x 6 = 48	9 x 6 = 54	10 x 6 = 60
6 x 7 = 42	7 x 7 = 49	8 x 7 = 56	9 x 7 = 63	10 x 7 = 70
6 x 8 = 48	7 x 8 = 56	8 x 8 = 64	9 x 8 = 72	10 x 8 = 80
6 x 9 = 54	7 x 9 = 63	8 x 9 = 72	9 x 9 = 81	10 x 9 = 90
6 x 10 = 60	7 x 10 = 70	8 x 10 = 80	9 x 10 = 90	10 x 10 = 10

Tables

11 x 1 = 11	12 x 1 = 12	13 x 1 = 13	14 x 1 = 14	15 x 1 = 15
11 x 2 = 22	12 x 2 = 24	13 x 2 = 26	14 x 2 = 28	15 x 2 = 30
11 x 3 = 33	12 x 3 = 36	13 x 3 = 39	14 x 3 = 42	15 x 3 = 45
11 x 4 = 44	12 x 4 = 48	13 x 4 = 52	14 x 4 = 56	15 x 4 = 60
11 x 5 = 55	12 x 5 = 60	13 x 5 = 65	14 x 5 = 70	15 x 5 = 75
11 x 6 = 66	12 x 6 = 72	13 x 6 = 78	14 x 6 = 84	15 x 6 = 90
11 x 7 = 77	12 x 7 = 84	13 x 7 = 91	14 x 7 = 98	15 x 7 = 105
11 x 8 = 88	12 x 8 = 96	13 x 8 = 104	14 x 8 = 112	15 x 8 = 120
11 x 9 = 99	12 x 9 = 108	13 x 9 = 117	14 x 9 = 126	15 x 9 = 135
11 x 10 = 110	12 x 10 = 120	13 x 10 = 130	14 x 10 = 140	15 x 10 = 150

16 x 1 = 16	17 x 1 = 17	18 x 1 = 18	19 x 1 = 19	20 x 1 = 20
16 x 2 = 32	17 x 2 = 34	18 x 2 = 36	19 x 2 = 38	20 x 2 = 40
16 x 3 = 48	17 x 3 = 51	18 x 3 = 54	19 x 3 = 57	20 x 3 = 60
16 x 4 = 64	17 x 4 = 68	18 x 4 = 72	19 x 4 = 76	20 x 4 = 80
16 x 5 = 80	17 x 5 = 85	18 x 5 = 90	19 x 5 = 95	20 x 5 = 100
16 x 6 = 96	17 x 6 = 102	18 x 6 = 108	19 x 6 = 114	20 x 6 = 120
16 x 7 = 112	17 x 7 = 119	18 x 7 = 126	19 x 7 = 133	20 x 7 = 140
16 x 8 = 128	17 x 8 = 136	18 x 8 = 144	19 x 8 = 152	20 x 8 = 160
16 x 9 = 144	17 x 9 = 153	18 x 9 = 162	19 x 9 = 171	20 x 9 = 180
16 x 10 = 160	17 x 10 = 170	18 x 10 = 180	19 x 10 = 190	20 x 10 = 200

Common Kidnapping

$30 \times 2 + 30 = 30(2+1) = 30 \times 3 = 90$

$188 \times 9 + 66 \times 3 = 9(188 + 22) = 9 \times 210 = 1890$

$(10^2 + 70^2) = 10^2(1+7^2) = 100 \times (1+49) = 100 \times 50 = 5000$

+ − x ÷ of negative numbers

$2 + 8 = 10$

$-2 - 8 = -(2+8) = -10$

$8 - 2 = 6$

$2 - 8 = -(-2+8) = -6$

$-2 + 8 = 6$

$-8 + 2 = -6$

(Chota − Bada
= − (Bada − Chota))

+ − x ÷ of negative numbers

$2 \times 8 = 16$

$-2 \times -8 = +16$

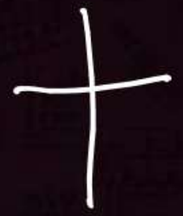
$8 \times -2 = -16$

$2 \times -8 = -16$

$-2 \times 8 = -16$

$-8 \times 2 = -16$

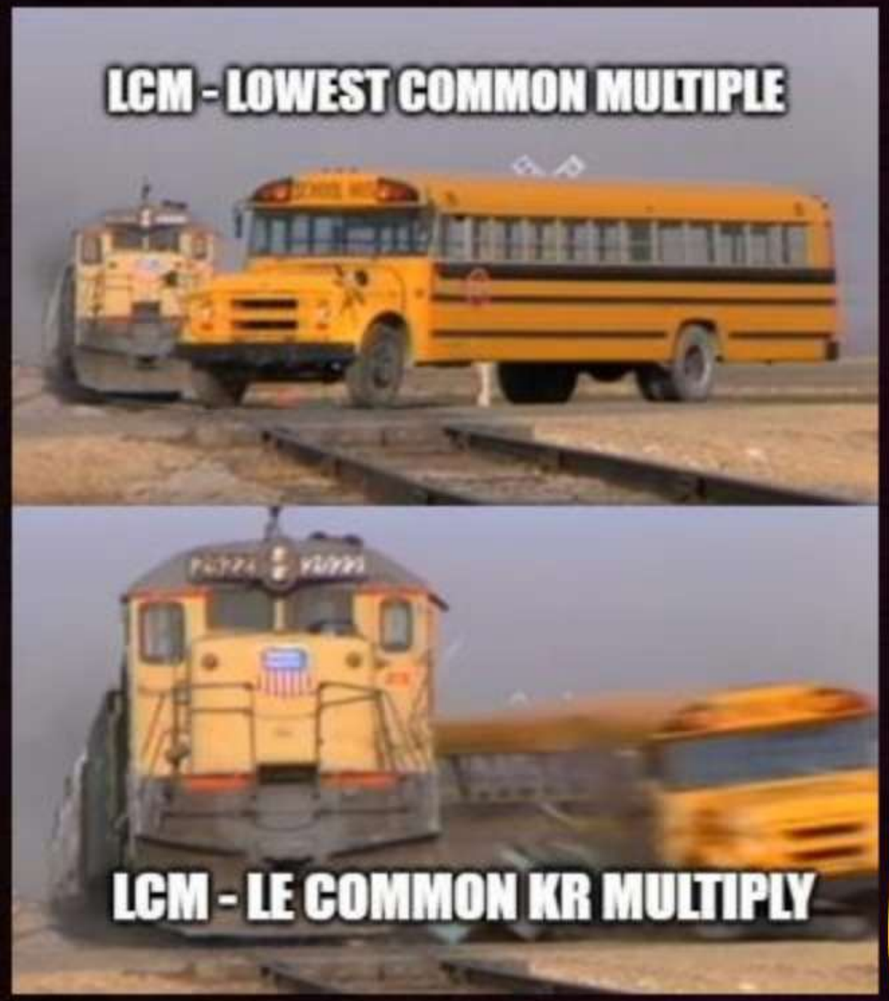
$(-)(-) = +$



Q $-2 \times -1 \times -7$

(a) 14 (b) −14 (Ryu)

LCM



$(60,40) = 20(3,2) = 120$ ✓✓

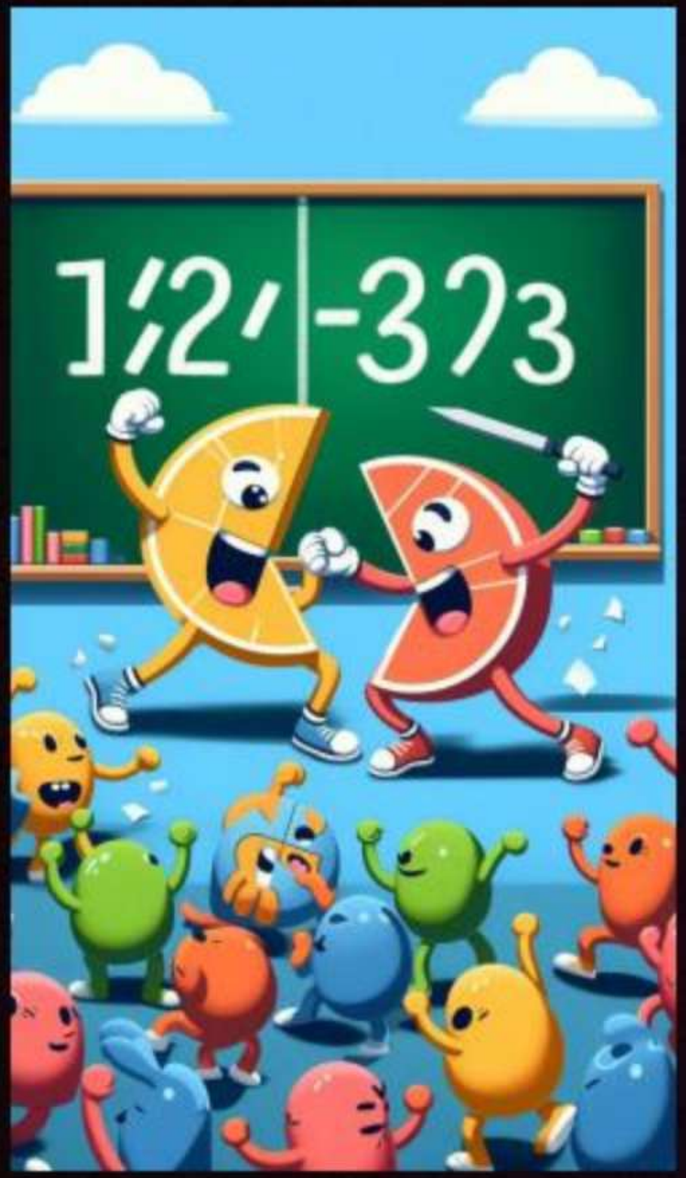
$(144, 60) = 12(12,5) = 144 \times 5 = \frac{2}{5}\overset{2}{0}0 = 720$

$(13, 39) = 13(1,3) = 39$ ✓✓

$(4, 6, 12) =$ → Jab koi ek dusre ki table me ata hai tabh direct chote wale ko kattou

12

Fractions to Decimals



$\frac{1}{2} = 0.5$ $\frac{1}{3} = 0.33$ $\frac{2}{3} = 0.66 = 0.67$

$\frac{1}{4} = 0.25$ $\frac{3}{4} = 0.75$

$\frac{1}{5} = 0.2$ $\frac{2}{5} = 0.4$ $\frac{3}{5} = 0.6$ $\frac{4}{5} = 0.8$

$\frac{1}{6} = 0.166$ $\frac{5}{6} = 0.833$

$\frac{1}{7} = 0.142857$ $\frac{2}{7} = 0.285714$ $\frac{3}{7} = 0.428571$ $\left(\frac{4}{7} = 0.571428\right.$

$\frac{1}{8} = 0.125$ $\left(\frac{3}{8} =$ hw $\frac{5}{8} =$ $\frac{7}{8} =\right)$ hw comment

$\frac{1}{9} = 0.111111$ $\frac{2}{9} = 0.2222$ $\frac{4}{9} = 0.4444\ldots$ $\frac{5}{9} = 0.555555$

$7\overline{)20}\,(2$
14

Puppy Pattern - ①

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

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

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

$\frac{1}{16} = 0.0625$

$\frac{1}{5} = 0.2$

$\frac{1}{25} = 0.04$

$\frac{1}{125} = 0.008$

$\frac{1}{625} = 0.0016$

Q No of e in 1 Coulomb charge

↳ Yaad

$\frac{1}{16} = 0.0625$

Fractions Addition, Subtraction Rules

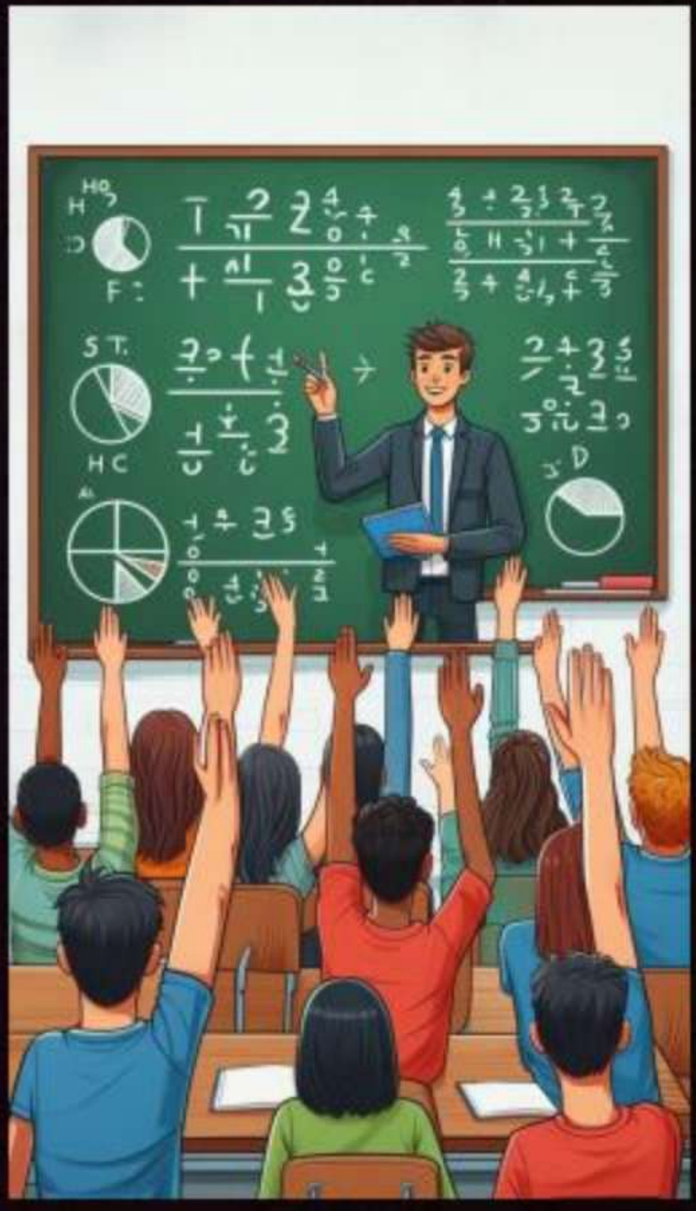
★ Only be added (same denominator)

$$\frac{2}{5} + \frac{3}{5} = \frac{5}{5} \checkmark$$

$$\frac{2}{5} + \frac{3}{7} = \frac{5}{6} \times \times \times$$

$$\frac{a}{b} + \frac{c}{d} = \frac{ad + bc}{bd}$$

$$\frac{2}{5} + \frac{3}{7} = \frac{14 + 15}{35} = \frac{29}{35} \checkmark\checkmark$$



$$\frac{1}{8} \times \frac{1}{4} = \frac{4+8}{32} = \frac{12}{32} = \frac{6}{16} = \frac{3}{8} \times$$

$$\frac{1}{4}\left(\frac{10}{2} \times \frac{1}{1}\right) = \frac{1}{4}\left(\frac{1+2}{2}\right) = \frac{3}{8}$$

$$\frac{7}{10} \times \frac{3}{50} = \frac{7\times 50 + 10\times 3}{10\times 50} = \frac{350+30}{500} = \frac{380}{500} = \frac{19}{25}$$

$$\frac{1}{10}\left(\frac{7}{1} \times \frac{3}{5}\right) = \frac{35+3}{50} = \frac{38}{50} = \frac{19}{25}$$

Fractions Addition - DORA

$\frac{1}{2} + \frac{1}{8} = \frac{8+2}{16} = \frac{10}{16}$

$\frac{3}{7} - \frac{1}{9} =$

$\frac{1}{2} + \frac{1}{4} =$

HW

$\left(\frac{7}{11} - \frac{2}{121}\right) = \frac{121 \times 7 - 11 \times 2}{121 \times 11}$ — 1 min

$\frac{2}{3} + \frac{1}{4} =$ HW

Trick

$\frac{7}{11} - \frac{2}{121}$

$= \frac{1}{11}\left(\frac{7}{1} - \frac{2}{11}\right) = \frac{77-2}{121} = \frac{75}{121}$ — 15 sec

Fractions Addition - PUPPY

$1 + \frac{1}{8} = \frac{9}{8}$

$1 - \frac{1}{9} = \frac{8}{9}$

$1 + \frac{1}{4} = \frac{5}{4}$

$1 - \frac{2}{121} = \frac{119}{121}$

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

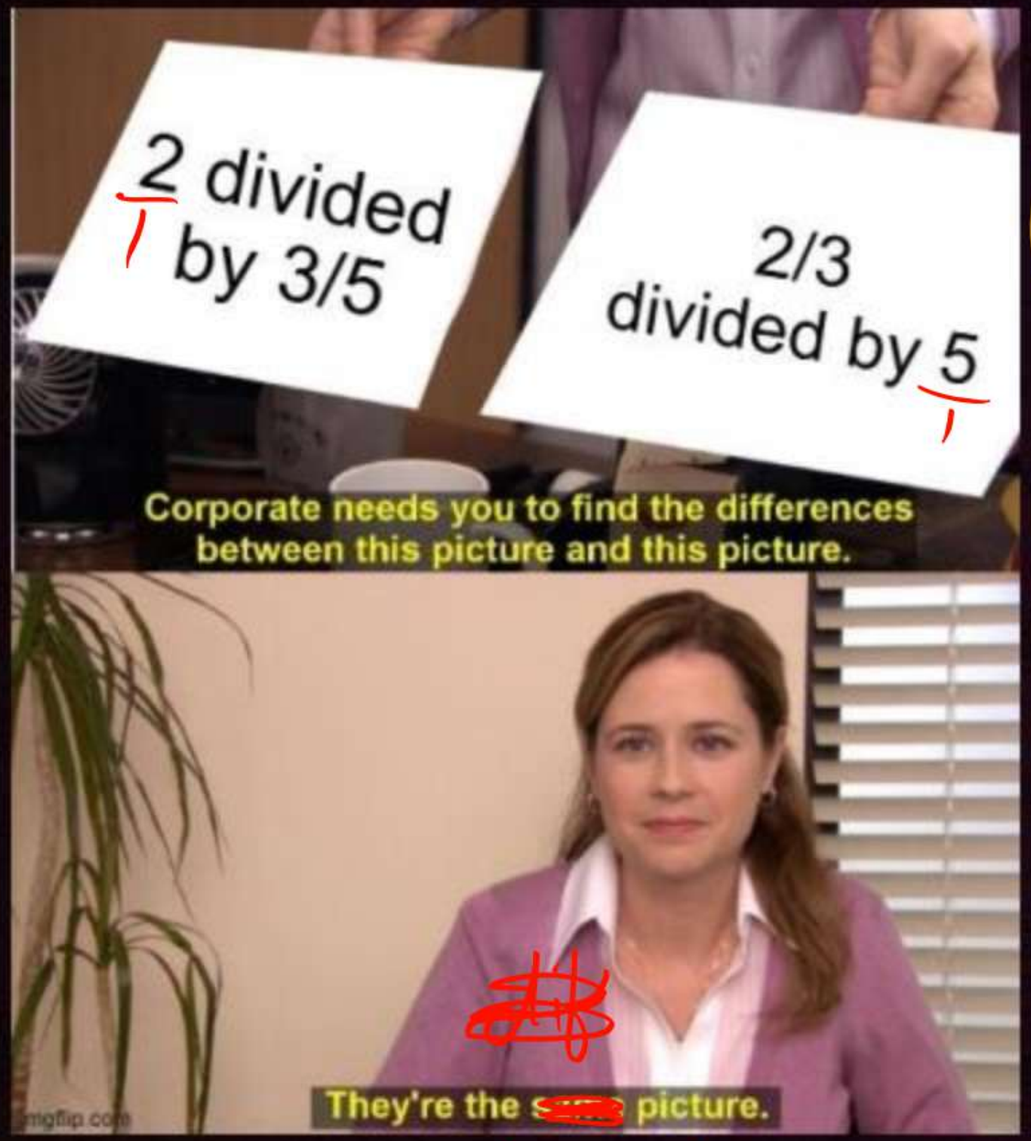
A $\frac{1}{4}$

B $\frac{2}{4}$

C $\frac{3}{4}$

D $\frac{5}{4}$

Fractions Division, Multiplication Rules



different

$$\frac{\frac{2}{1}}{\frac{3}{5}} = \frac{10}{3}$$

$$\frac{\frac{2}{3}}{\frac{5}{1}} = \frac{2}{15}$$

QUESTION

Value of x in 3x/5 = 2 and 5x = 2/3 is....

A 10/3 , 10/3

B 2/15 , 2/15

C 10/3 , 2/15

D 2/15 , 10/3

$\frac{3}{5}x = \frac{2}{1}$ $\quad \frac{5}{1}x = \frac{2}{3}$

$\left(x = \frac{10}{3}, \quad x = \frac{2}{15}\right)$

FOR NOTES & DPP CHECK DESCRIPTION

Decimals Addition, Subtraction Rules (Point se Point mila)

$0.2 + 0.3 =$

$$\begin{array}{r} 0.2 \\ +\ 0.3 \\ \hline 0.5 \end{array}$$

$0.2 - 0.03 =$

$$\begin{array}{r} 0.20 \\ -\ 0.03 \\ \hline 0.17 \end{array}$$

$22.3 + 0.23 =$

$$\begin{array}{r} 22.30 \\ 0.23 \\ \hline 22.53 \end{array}$$

$8.27 - 1.99 =$

$$\begin{array}{r} {}^{7}{}^{1}{}^{11} \\ 8.\cancel{2}\cancel{7} \\ 1.99 \\ \hline 6.28 \end{array}$$

(A) 6.1 (B) 6.2 (C) 6.28 (D) None

Decimals Multiply, Division Rules

$0.x = \frac{x}{10}$

$0.2 \times 0.3 = \frac{2}{10} \times \frac{3}{10} = \frac{6}{100} = 0.06$

$0.2 \times 0.03 = \frac{2}{10} \times \frac{3}{100} = \frac{6}{1000} = 0.006$

$0.2 / 0.3 = \frac{0.2}{0.3} = \frac{2}{3} = 0.67$

$0.2 / 0.03 =$

(A) 3.33 (B) 6.66 (C) 10 (D) None

$\frac{0.2}{0.03} = \frac{2 \times 100}{3 \times 1} = \frac{20}{3} = 6.66$

Squares and Cubes – Meaning

8 ka square = 8×8

Cube of 8 = $8 \times 8 \times 8$

Squares and Cubes — Important

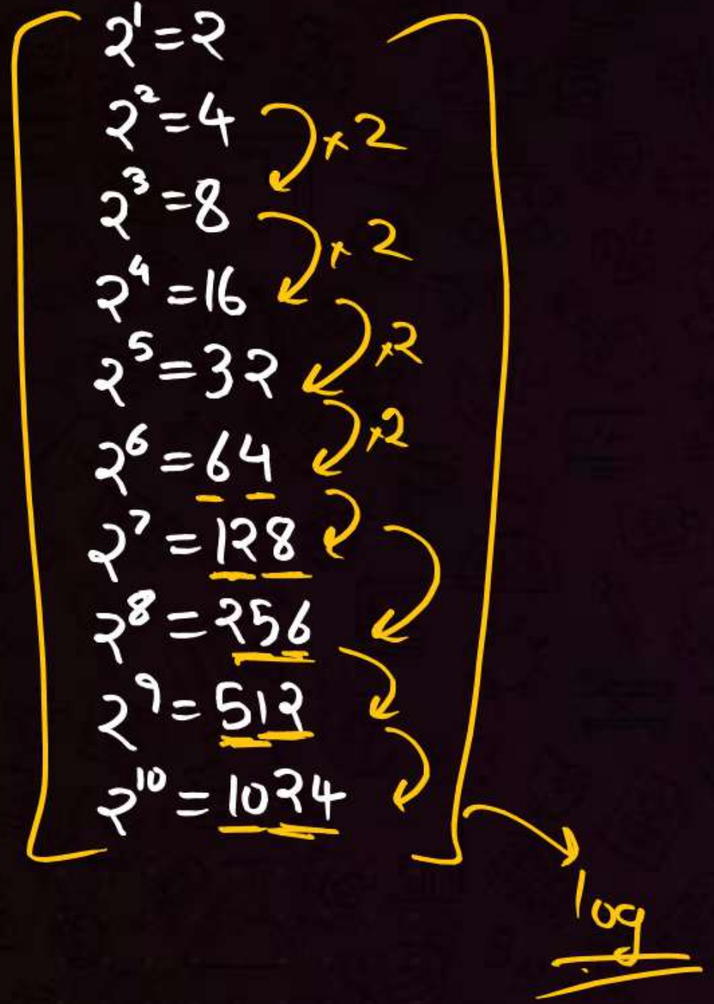
$1^2 = 1$
$2^2 = 4$
$3^2 = 9$
$4^2 = 16$
$5^2 = 25$
$6^2 = 36$
$7^2 = 49$
$8^2 = 64$
$9^2 = 81$
$10^2 = 100$

$1^3 = 1$
$2^3 = 8$
$3^3 = 27$
$4^3 = 64$
$5^3 = 125$
$6^3 = 216$
$7^3 = 343$
$8^3 = 512$
$9^3 = 729$
$10^3 = 1000$

$1^4 = 1$
$2^4 = 16$
$3^4 = 81$
$4^4 = 256$
$5^4 = 625$

→ Radiation Stephan's Law

Powers of 2


$2^1 = 2$
$2^2 = 4$
$2^3 = 8$
$2^4 = 16$
$2^5 = 32$
$2^6 = 64$
$2^7 = 128$
$2^8 = 256$
$2^9 = 512$
$2^{10} = 1024$
×2
×2
×2
×2
log

Square Root

★ There are 2 ways to write sq. root

Square root of $x \Rightarrow \sqrt{x}$ or $(x)^{1/2}$

★ There are 2 ways to solve sq. root

(I) 2-2 ka pair banaker ghar choddo

$\sqrt{13 \times 13 \times 2} = 13\sqrt{2}$

$\sqrt{4 \times 4 \times 2 \times 3 \times 3} = 4 \times 3\sqrt{2} = 12\sqrt{2}$

(II) Ab tum square ban gaye ho.

$\sqrt{4 \times 9} = 2 \times 3 = 6$

$\sqrt{4 \times 4 \times 4} = 4\sqrt{4} = 4 \times 2 = 8$

{ Kepler's law III rd $T^2 \propto 13x$ }

$1^2 = 1$

$2^2 = 4$

$3^2 = 9$

$4^2 = 16$

$5^2 = 25$

$6^2 = 36$

$7^2 = 49$

$8^2 = 64$

$9^2 = 81$

$10^2 = 100$

Square Root

Q Value of $\sqrt{8}$ is (a) $\sqrt{2}$ (b) 2 (c) 4 (d) $2\sqrt{2}$

★ Some value of roots must be learned

$\sqrt{2}=1.414$ $\sqrt{3}=1.732$ $\sqrt{5}=2.23$ $\sqrt{10}=3.16$

★ Any number be written as a product of its root 2 times.

$x=\sqrt{x}\sqrt{x}$ $2=\sqrt{2}\sqrt{2}$ $10=\sqrt{10}\sqrt{10}$

Q Solve value of $\sin 45^\circ =$ (Hint: $\sin 45^\circ = \frac{1}{\sqrt{2}}$)

(a) $\frac{1}{2}$ ✗ (b) $\frac{\sqrt{2}}{2}$ (c) $\frac{2}{\sqrt{2}}$ ✗ (d) $\sqrt{2}$ ✗

$\frac{1}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2}}{2}$

$\frac{1\sqrt{2}}{\sqrt{2}\sqrt{2}}$

$\sqrt{10} = $ (A) $\frac{10}{\sqrt{10}}$ (B) $\left(\frac{\sqrt{10}}{10}\right)$

$\frac{\sqrt{10}\sqrt{10}}{\sqrt{10}}$ | $\frac{1\sqrt{10}}{\sqrt{10}\sqrt{10}}$

Cube Root

★ There are 2 ways to write cube root

Square root of $x \Rightarrow \sqrt[3]{x}$ or $(x)^{1/3}$

★ There are 2 ways to solve cube root

(I) 3-3 ka pair banaker ghar choddo

$\sqrt[3]{13\times 13\times 13\times 2} = 13\sqrt[3]{2}$

$\sqrt[3]{4\times 4\times 3\times 3\times 4\times 2\times 2\times 3} = 4\times 3\sqrt[3]{4}$

$= 12\sqrt[3]{4}$

(II) Ab tum Cube ban gaye ho.

$\sqrt[3]{125\times 8} = 5\times 2$

$= 10$ //

$\sqrt[3]{729\times 343\times 2}$

$= (9\times 7)\sqrt[3]{2} = 63\sqrt[3]{2}$

$1^3 = 1$
$2^3 = 8$
$3^3 = 27$
$4^3 = 64$
$5^3 = 125$
$6^3 = 216$
$7^3 = 343$
$8^3 = 512$
$9^3 = 729$
$10^3 = 1000$

Square Root Approximation - Pande

✯ Any number can be written as $\sqrt{p^2 \pm e}$, p is perfect square and e is small

$\sqrt{6} = \sqrt{4+2} = \sqrt{2^2+2}$ $p=2$ $e=2$

$\sqrt{7} = \sqrt{4+3} = \sqrt{9-2} = \sqrt{3^2-2}$ $p=3$ $e=2$

$\sqrt{8} = \sqrt{9-1} = \sqrt{3^2-1}$ $p=3$ $e=1$

$\sqrt{10} = \sqrt{9+1}$ $p=3$ $e=1$

$\sqrt{24} = \sqrt{25-1}$ $p=5$ $e=1$

$\sqrt{80} = \sqrt{81-1} = \sqrt{9^2-1}$ $p=9$ $e=1$

$\sqrt{50} = \sqrt{49+1} = \sqrt{7^2+1}$ $p=7$ $e=1$

$1^2 = 1$
$2^2 = 4$
$3^2 = 9$
$4^2 = 16$
$5^2 = 25$
$6^2 = 36$
$7^2 = 49$
$8^2 = 64$
$9^2 = 87$
$10^2 = 100$

Square Root Approximation - Pandey

☆ Any number can be written as $\sqrt{p^2 \pm e}$, p is perfect square and e is small

☆ $\sqrt{p^2 \pm e} = p \pm \frac{e}{2p}$

$\sqrt{6} = \sqrt{4+2} = \sqrt{2^2+2}$ $(p=2\ e=2)$ $= 2 + \frac{2}{2\times2} = 2 + \frac{1}{2} = 2.5$ ✓✓

$\sqrt{7} = \sqrt{9-2} = \sqrt{3^2-2}$ $(p=3\ e=2)$ $= 3 - \frac{2}{2\times3} = 3 - \frac{1}{3} = \frac{8}{3} = 2.16$

$\sqrt{8} = \sqrt{9-1} = \sqrt{3^2-1}$ $(p=3\ e=1)$ $= 3 - \frac{1}{2\times3} = 3 - \frac{1}{6} = 3 - 0.166 = 2.84$

$\sqrt{10} = \sqrt{9+1} = \sqrt{3^2+1}$ $(p=3\ e=1)$

$\sqrt{24} = \sqrt{25-1} = \sqrt{5^2-1}$ $(p=5\ e=1)$

$\sqrt{80} = \sqrt{81-1} = \sqrt{9^2-1}$ $(p=9\ e=1)$

$\sqrt{50} = \sqrt{49+1} = \sqrt{7^2+1}$ $(p=7\ e=1)$

$\sqrt{1}$ to $\sqrt{100}$

Hw

$1^2 = 1$
$2^2 = 4$
$3^2 = 9$
$4^2 = 16$
$5^2 = 25$
$6^2 = 36$
$7^2 = 49$
$8^2 = 64$
$9^2 = 81$
$10^2 = 100$

Square Root Approximation – Pande

☆ Any number can be written as $\sqrt{p^2 \pm e}$, p is perfect square and e is small

☆ $\sqrt{p^2 \pm e} = p \pm \frac{e}{2}$

Q Find pande for $\sqrt{35} = \sqrt{36-1} = \sqrt{6^2-1}$

$p = 6 \quad e = 1$

$\sqrt{p^2-e} = p - \frac{e}{2p}$

Q Solve $\sqrt{35}$

(a) 5.92 (b) 5 (c) 6 (d) 5.323

$\left(6 - \frac{1}{12}\right) = 5.8 \text{ to } 5.9$

$1^2 = 1$
$2^2 = 4$
$3^2 = 9$
$4^2 = 16$
$5^2 = 25$
$6^2 = 36$
$7^2 = 49$
$8^2 = 64$
$9^2 = 87$
$10^2 = 100$

Algebraic Identities

$(ab)^2 = a^2b^2$ ✓

$(a+b)^2 = a^2+b^2+2ab$

$(a-b)^2 = a^2+b^2-2ab$

$(a/b)^2 = a^2/b^2$ ✓

$(ab)^3 = a^3b^3$

$(a/b)^3 = a^3/b^3$

$(a+b)^3 = a^3+b^3+3ab(a+b)$ ✗

$(a-b)^3 = a^3-b^3-3ab(a-b)$ ✗

$(a^2-b^2) = (a+b)(a-b)$

$(a+b)(a-b) = a^2-b^2$

Q] Value of $x = \frac{1}{\sqrt{2}-1} =$

(a) $\sqrt{2}-1$ (b) $\sqrt{2}+1$ (c) $\sqrt{2}$ (d) None.

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

Algebraic Identities

If $\frac{a}{b}=\frac{c}{d}$ then $\left(\frac{a}{b}=\frac{c}{d}=\frac{a+c}{b+d}=\frac{a-c}{b-d}\right)$

Use: Find Null Point in many chapters...

Q] $\frac{x}{2}=\frac{y}{3}$, $x+y=20$ Find x and y

(I) Old Method

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

$x+y=20$

$\frac{2y}{3}+y=20$

$\frac{5y}{3}=20$

$y=\frac{20\times 3}{5}$

$y=12$

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

$x=\frac{2\times 12}{3}$

$x=8$

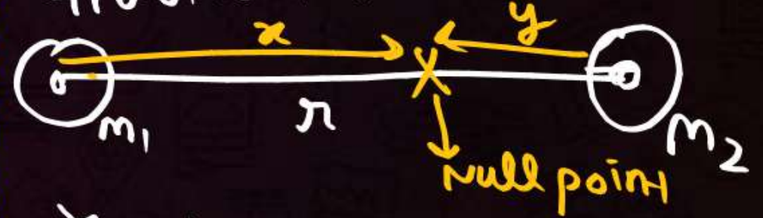
(II) PUPPY Method

$\frac{x}{2}=\frac{y}{3}=\frac{x+y}{2+3}=\frac{20}{5}$

$\frac{x}{2}=4$ $\frac{y}{3}=4$

$x=8$, $y=12$

Gravitation



$\frac{x}{\sqrt{m_1}}=\frac{y}{\sqrt{m_2}}$

$x+y=r$

Algebraic Identities

Componendo - Dividendo → (1 baar kaam)

If $\frac{a}{b}=\frac{c}{d}$ then $\frac{a+b}{a-b}=\frac{c+d}{c-d}$

Use : Wave optics · $\frac{I_{max}}{I_{min}}=\left(\frac{\sqrt{I_1}+\sqrt{I_2}}{\sqrt{I_1}-\sqrt{I_2}}\right)^2$

Q $\frac{a}{b}=10$, Find value of $\frac{a+b}{a-b}$ =

(a) 9/11 (b) 10/1 (c) 11/10 (d) 11/9

Q $\frac{I_1}{I_2}=\frac{9}{4}$, Find value of $\frac{I_{max}}{I_{min}}$ =

I_1+I_2

I_1-I_2

$\frac{a}{b}=\frac{10}{1}$

$\frac{a+b}{a-b}=\frac{10+1}{10-1}=\frac{11}{9}$ ✓

$\frac{I_1}{I_2}=\frac{9}{4}$ | $\frac{\sqrt{I_1}}{\sqrt{I_2}}=\frac{3}{2}$

$\frac{\sqrt{I_1}+\sqrt{I_2}}{\sqrt{I_1}-\sqrt{I_2}}=\frac{3+2}{3-2}=\frac{5}{1}$

$\frac{I_{max}}{I_{min}}=\left(\frac{5}{1}\right)^2=\frac{25}{1}$

Quadratic Equation

$ax+b \rightarrow$ linear equation ✓

✓ $ax^2+bx+c \rightarrow$ quadratic equation ✓

$ax^3+bx^2+cx+d \rightarrow$ cubic equation

$ax^4+bx^3+cx^2+dx+e \rightarrow$ bi-quadratic equation

Q Find a, b, c in the following equations

① $2x^2+3x-4$ $\quad a=2 \quad b=3 \quad c=-4$

② x^2-2 $\quad a=1 \quad b=0 \quad c=-2$

③ $-3x^2-2x+2$ $\quad a=-3 \quad b=-2 \quad c=2$

④ x^2-2x $\quad a=1 \quad b=-2 \quad c=0$

Quadratic Equation

There are 4 method of solving quadratic equations.

1. Compliting the square — useless ✗
2. Quadratic Formula — 100% valid, lengthy ✓ (1 min) ✓✓
3. Splitting the middle term → 90% valid, moderate (40 sec)
4. Puppy method → Use only when you know answer will be positive
   (Like value of time, n^{th} orbital in atom)
   90% valid, (2-3 second)

Quadratic Equation

Quadratic Formula — 100% valid, lengthy.

$ax^2+bx+c=0$

$$\left(x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}\right)$$ — Yaad

Q Solve $n^2-n-90=0$

$a=1 \quad b=-1 \quad c=-90$

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}=\frac{1\pm\sqrt{1+4\times1\times90}}{2\times1}=\frac{1\pm\sqrt{1+360}}{2}=\frac{1+\sqrt{361}}{2}$$

$$=\frac{1+19}{2}=\frac{20}{2}$$

$$=10$$

Quadratic Equation

PUPPY method – Tables.

+ve

Q $n^2 - n - 90 = 0$

$n^2 - n = 90$

$n(n-1) = 90$

$10 \times 9 = 90$

$n = 10$

Q When an electron revolving in n^{th} orbit comes to ground state it releases 10 spectral lines in a sample of H-gas atoms. Find n

(a) 5 (b) 4 (c) 3 (d) 6

Hint

No. of lines $= \frac{n(n-1)}{2}$

$10 = \frac{n(n-1)}{2}$

$20 = n(n-1)$

$n^2 - n = 20$

$n^2 - n - 20 = 0$

$n = \frac{+1 + \sqrt{1 - 4 \times 1 \times -20}}{2 \times 1} = \frac{1 + \sqrt{1+80}}{2} = \frac{1+\sqrt{81}}{2} = \frac{1+9}{2} = \frac{10}{2} = 5$

$20 = \frac{n(n-1)}{5 \times 4}$

$n = 5$

Quadratic Equation

PUPPY method – Tables. (Self-Learn)

$4 \times 5 = 20$

$x(x+1) = 20$ ✓

$x(x-1) = 20$ ✓✓

$5 \times 6 = 30$

$x(x+1) = 30$ ✓

$x(x-1) = 30$ ✓✓

$2 \times 12 = 24$

$x(x+10) = 24$ ✓

$x(x-10) = 24$

$x = 12$

$10 \times 13 =$

(A) $x \cdot 3x = 130$

(B) $x(x+1) = 130$

(C) $x(x+2) = 130$

(D) $x(x+3) = 130$

1 × 20
2 × 10

Q) $x(x+8) = 20$

$x =$ (A) 1 (B) 2 (C) 3 (D) 4

Maxima & Minima for Quadratic

$ax^2+bx+c=0$

$a>0$

Parabola

$a<0$

$$x=\frac{-b}{2a} \qquad y_{max/min}=\frac{4ac-b^2}{4a}$$

Yaad

$y=4x^2-2x-8$

minima

$y=-2x^2+3x+1000$

maxima

Binomial Approximation

$(1+x)^n = 1+nx$ But $x \ll 1$ (Useless – some derivations)

Eg → $(1.01)^3 =$

$(1+8)^{10}$ ✗

$(1+0.01)^3 = 1+3\times0.01 = 1+0.03 = 1.03$ ✓

Binomial Approximation

$(1+x)^n = 1+nx$ But $x \ll 1$ (Useless – some derivations)

Gravitation

$$g = \frac{g_0}{\left(1+\frac{h}{R}\right)^2} = g_0\left(1+\frac{h}{R}\right)^{-2} = g_0\left(1-\frac{2h}{R}\right) \checkmark$$

$$U = \frac{x}{\left(1+\frac{h}{R}\right)} = x\left(1+\frac{h}{R}\right)^{-1} = x\left(1-\frac{h}{R}\right) \checkmark$$

Electrostats

$$E = \frac{E_0}{\left(1+\frac{h}{R}\right)^2} = E_0\left(1+\frac{h}{R}\right)^{-2} = E_0\left(1-\frac{2h}{R}\right)$$

Entire Syllabus

Arithmetic Progression AP (Chances of coming - very less).

1st term

$a, a+d, a+2d, a+3d$ ......

$2, 5, 8, 11, \ldots\ldots$, n terms

+3 +3 +3

d (common difference)

$$l = a + (n-1)d$$

$$S = \frac{n}{2}(2a + (n-1)d) = \frac{n}{2}(a + l)$$

Yaad

Geometric Progression GP

(only Sum upto ∞ is important
Rest is pretty useless)

first term

$a, ar, ar^2, ar^3, \ldots$ n terms

$10, 20, 40, 80, 160, 320, \ldots$

$\frac{20}{10}$ $\frac{40}{20}$ $\frac{80}{40}$

2 2 2

r Common ratio

$l = ar^{n-1}$

$S = a\left(\frac{r^n - 1}{r - 1}\right)$

Yaad

Useless

$1+\frac{1}{2}+\frac{1}{4}+\frac{1}{8}- - - - - +\infty =$ $a=1$ $r=\frac{1}{2}$

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

$$S_\infty = \frac{a}{1-r} = \frac{1}{1-\frac{1}{2}} = \frac{1}{\frac{1}{2}} = 2$$

$1+\frac{1}{3}+\frac{1}{9}+\frac{1}{27}+ - - - - - - \infty =$ $a=1$ $r=1/3$

(A) 2 (B) $\frac{3}{2}$ (C) $\frac{4}{3}$ (D) None

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

$1-\frac{1}{2}+\frac{1}{4}-\frac{1}{8}+\frac{1}{16}- - - \infty$ $a=1$ $b=-\frac{1}{2}$

$$\frac{1}{1+\frac{1}{2}} = \frac{1}{\frac{3}{2}} = \frac{2}{3}$$

Puppy Pattern

$$1+\frac{1}{x}+\frac{1}{x^2}+\frac{1}{x^3}+\cdots\cdots+\infty=\frac{x}{x-1}$$

$$1+\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\cdots\cdots\infty=\frac{2}{2-1}=2$$

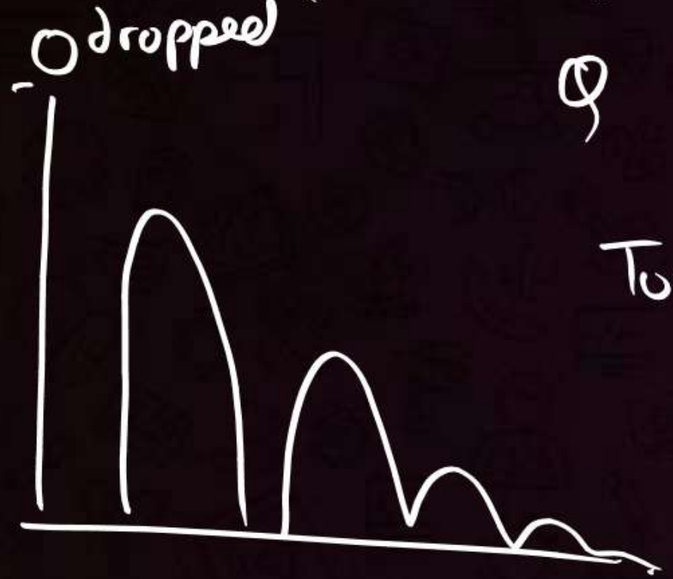
$$1+\frac{1}{3}+\frac{1}{9}+\frac{1}{27}+\cdots\cdots\infty=\frac{3}{3-1}=\frac{3}{2}$$

$$1+\frac{1}{4}+\frac{1}{16}+\frac{1}{64}+\cdots\cdots\infty=\left(\frac{4}{4-1}=\frac{4}{3}\right)$$

A $3/2$ B 2

C $5/4$ ~~D $4/3$~~

Geometric Progression GP (only Sum upto ∞ is important Rest is pretty useless)



Q

Total distance is given by $h+2e^2h+2e^4h+2e^6h+\cdots\infty =$

(a) $h\left(\frac{1+e}{1-e}\right)$ (b) $h\left(\frac{1-e}{1+e}\right)$ (c) $h\left(\frac{1+e^2}{1-e^2}\right)$ (d) $h\left(\frac{1-e^2}{1+e^2}\right)$

hw//

Geometric Progression GP (only Sum upto ∞ is important Rest is pretty useless)

Q A mass of 3kg is kept at origin and multiple masses of 1kg are kept at $x = 1, 2, 4, 8 \ldots\ldots$. Fnet on 3kg is

(a) G (b) 2G (c) 3G (d) 4G

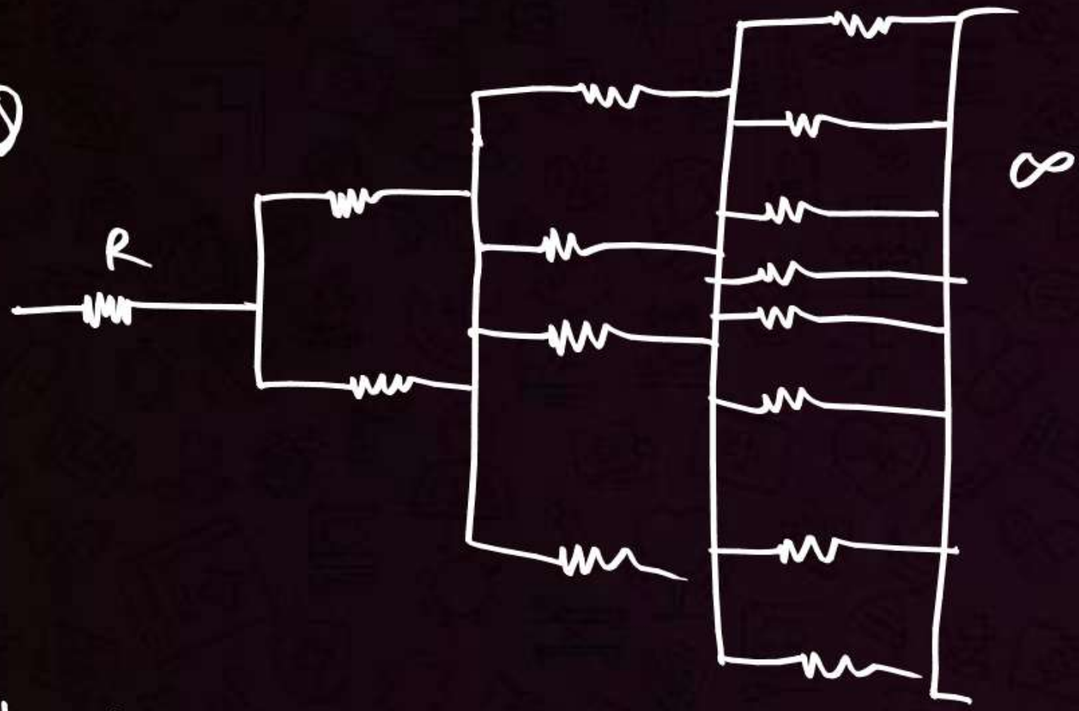
PYQ

$$3G\left(1+\frac{1}{4}+\frac{1}{16}+\frac{1}{64}+\ldots\ldots\infty\right)=$$

$3G \times \frac{4}{3}$

Geometric Progression GP (only Sum upto ∞ is important Rest is pretty useless)

Q

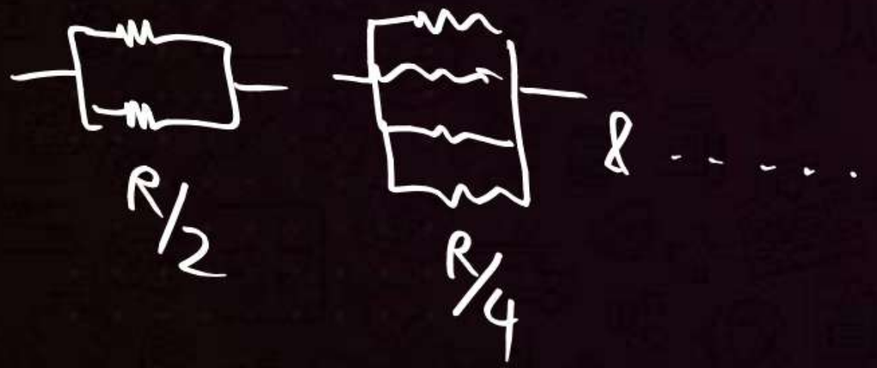


R_{∞} = (A) R (B) 2R (C) 3R (D) 4R

$= R\left(1+\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\cdots\cdots\infty\right)$

$= R\left(\frac{2}{2-1}\right) = \underline{R2}$

Hint



Maxima Multiplication of parts - BATWARA

$x + y = 10$

x	y
1	9
2	8
3	7
4	6
5	5

$1 \times 9 = 9$
$2 \times 8 = 16$
$3 \times 7 = 21$
$4 \times 6 = 24$
$5 \times 5 = 25$

Use: many chapters, Gravitation, Electrostats, Fluid, ...

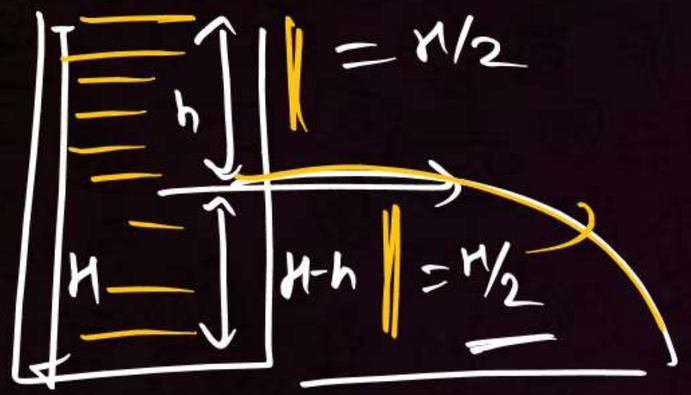
Q $F = G\frac{m_1 m_2}{r^2}$, A mass of 10kg is divided in 2 parts and kept at a distance r such that Force is maximum. Ratio of one part to full mass is.

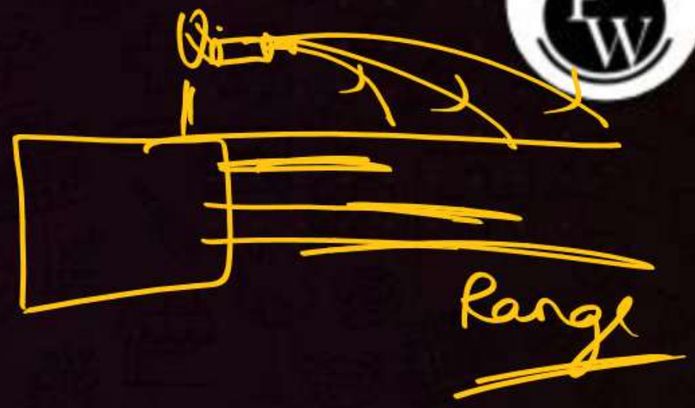
(a) 1 (b) 2 (c) $\frac{1}{2}$ (d) $\frac{2}{5}$

$10 \rightarrow (5, 5)$

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

Maxima Multiplication of parts - BATWARA





Range is given by $R = 2\sqrt{h(H-h)}$

Range is maximum when. $h =$

(a) H (b) 0 (c) $H/2$ (d) None

Exponents –

$10^{-x} = \frac{1}{10^x}$

$\frac{1}{10^{-x}} = 10^x$

$x^a y^a = (xy)^a$

$x^a / y^a = (x/y)^a$

$x^a x^b = x^{a+b}$

$x^a / x^b = x^{a-b}$

$(x^a)^b = x^{ab}$

$(((x^a)^b)^c)^d = x^{abcd}$

83.27×10^{-7}

$832.7 \times 10^{-7-1}$

832.7×10^{-8}

8327×10^{-9}

8.327×10^{-7}

$8.327 \times 10^{-7+1}$

8.327×10^{-6}

PUPPY POINTS-1 Arithmetic

LCM = 8812 = 4(2,3) = 4×2×3 = 12

$\frac{5}{8}+\frac{7}{12}=\frac{1}{4}\left(\frac{5}{2}+\frac{7}{3}\right)=\frac{1}{4}\left(\frac{15+14}{6}\right)=\frac{19}{24}$

$\frac{1}{2}=0.5$ $\frac{1}{3}=0.33$ $\frac{2}{3}=0.66$ $\frac{1}{4}=0.25$ $\frac{3}{4}=0.75$ $\frac{1}{5}=0.2$ $\frac{2}{5}=0.4$

$\frac{1}{6}=0.16$ $\frac{5}{6}=0.83$ $\frac{1}{7}=0.142857$ $\frac{1}{8}=0.125$ $\frac{1}{9}=0.111$ $\frac{2}{9}=0.22..$ $\frac{8}{9}=0.88.$

$\frac{1}{2}=0.5$ $\frac{1}{4}=0.25$ $\frac{1}{8}=0.125$ $\frac{1}{16}=0.0625$ $\frac{1}{5}=0.2$ $\frac{1}{25}=0.04$ $\frac{1}{125}=0.008$ $\frac{1}{625}=0.0016$

n^2	n^3	$\sqrt{n}$
$1^2=1$	$1^3=1$	$\sqrt{1}=1$
$2^2=4$	$2^3=8$	$\sqrt{4}=2$
$3^2=9$	$3^3=27$	$\sqrt{9}=3$
$4^2=16$	$4^3=64$	$\sqrt{16}=4$
$5^2=25$	$5^3=125$	$\sqrt{25}=5$
$6^2=36$	$6^3=216$	$\sqrt{36}=6$
$7^2=49$	$7^3=343$	$\sqrt{49}=7$
$8^2=64$	$8^3=512$	$\sqrt{64}=8$
$9^2=81$	$9^3=729$	$\sqrt{81}=9$
$10^2=100$	$10^3=1000$	$\sqrt{100}=10$

$\sqrt{2}=1.414$ $\sqrt{3}=1.732$

$\sqrt{5}=2.23$ $\sqrt{10}=3.16$

$\sqrt{p^2\pm e}=p\pm\frac{e}{2p}$

$(1+x)^n=1+nx \quad (x\ll 1)$

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

GP $a_n=ar^{n-1}$ $S_n=a\left(\frac{r^n-1}{r-1}\right)$ $S_\infty=\frac{a}{1-r}$ $1+\frac{1}{x}+\frac{1}{x^2}+\dots=\frac{x}{x-1}$

$ax^2+bx+c=0$

$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$

Max/Min $=\frac{4ac-b^2}{4a}$ at $x=-b/2a$

$D=b^2-4ac$

$D=0$ 1 root

$D>0$ 2 root

$D<0$ no root

$a>0 \cup$ $a<0 \cap$

$x=a+b$, ab max when $a=b=\frac{x}{2}$

$(a+b)^2=a^2+b^2+2ab$

$(a-b)^2=a^2+b^2-2ab$

$a^2-b^2=(a+b)(a-b)$

$(a+b)^3=a^3+b^3+3ab(a+b)$

$(a-b)^3=a^3-b^3-3ab(a-b)$

$\frac{a}{b}=\frac{c}{d}=\frac{a+c}{b+d}=\frac{a-c}{b-d}$

$\frac{a+b}{a-b}=\frac{c+d}{c-d}$

$\frac{a}{b}\times\frac{c}{d}=\frac{ac}{bd}$

23.2×10^{-5}	
2.32×10^{-4}	
232×10^{-6}	

$(ab)^x=a^x b^x$

$(a/b)^x=a^x/b^x$

$a^x a^y=a^{x+y}$

$a^x/a^y=a^{x-y}$

$(a^x)^y=a^{xy}$

$a^{-x}=\frac{1}{a^x}$ $\frac{1}{a^{-x}}=a^x$

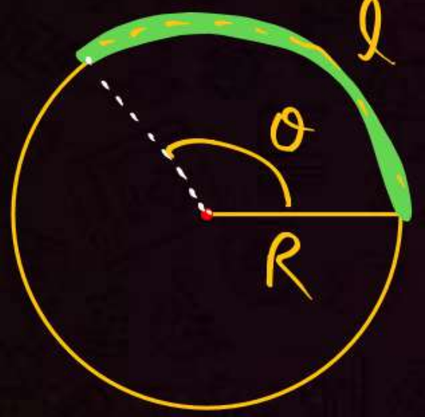
★ Puppy

Angle Radian & Degree

Simple conversion

$1^c = 57^\circ$

$\pi^c = 180^\circ$



$l = R\theta$

θ → radian

sin(θ) → radian/degree

Conversion - Normal

$\pi = 180^\circ$

$\frac{\pi}{2} = \frac{180}{2} = 90^\circ$

$\frac{3\pi}{2} = \frac{3}{2} \times 90 = 270^\circ$

$\frac{2\pi}{3} = 120^\circ$

$\frac{5\pi}{6} = \frac{5}{6} \times 180 = 150^\circ$

$\frac{3\pi}{4} = 135^\circ$

nw

$\pi = 180^\circ$

$\frac{\pi}{2} = 90^\circ$

$\frac{\pi}{4} = 45^\circ$

$\frac{\pi}{3} = 60^\circ$

$\frac{\pi}{6} = 30^\circ$

Good

Angle Radian & Degree

Conversion - PUPPY

$\pi = 180^\circ$

$\pi/2 = 90$

$\pi/4 = 45^\circ$

$\pi/3 = 60$

$\pi/6 = 30^\circ$

$11\frac{\pi}{6} = 11 \times 30^\circ = 330^\circ$

$11\frac{\pi}{3} = 660^\circ$

$\frac{3\pi}{2} = 3 \times 90 = 270^\circ$

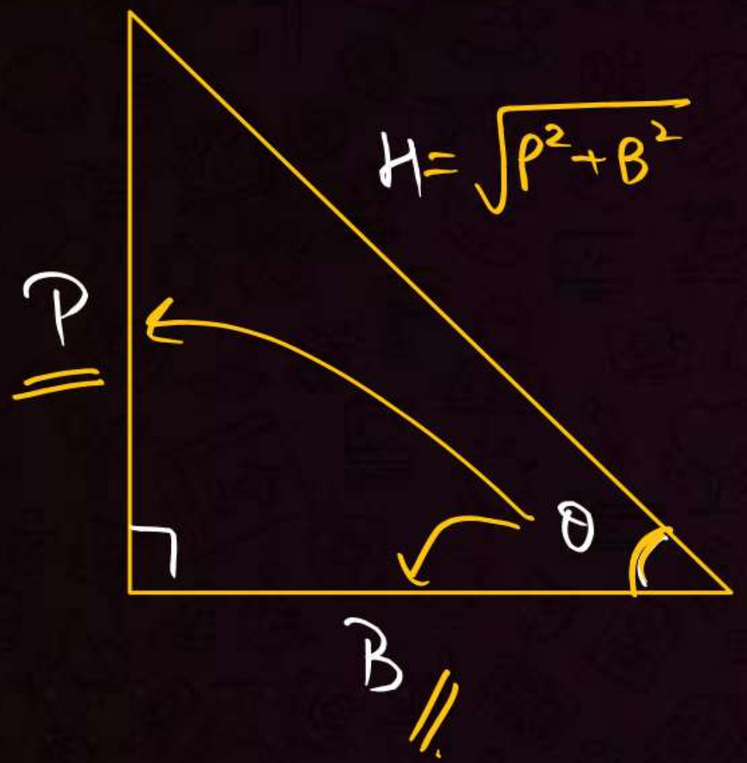
$\frac{2\pi}{3} = 2 \times 60^\circ = 120^\circ$

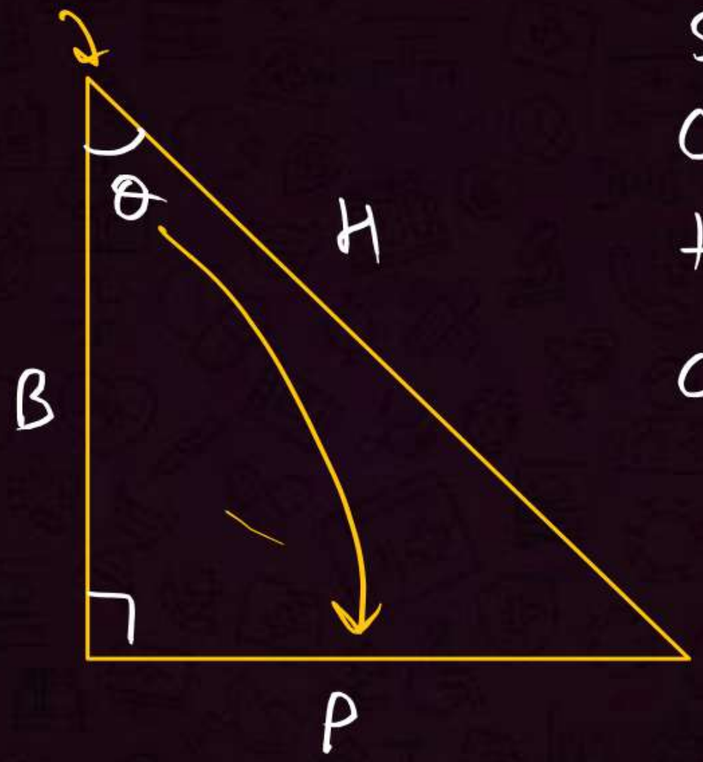
$\frac{5\pi}{6} = 5 \times 30^\circ = 150^\circ$

$\frac{3\pi}{4} = 3 \times 45^\circ = 135^\circ$

Trigonometry Ratio Interconversion

6 ratios





$\sin\theta = P/H$

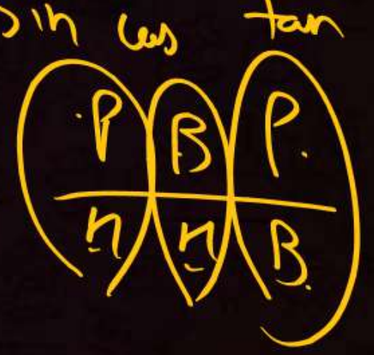
$\cos\theta = B/H$

$\tan\theta = P/B$

$\text{cosec}\,\theta = H/P$

$\sec\theta = H/B$

$\cot\theta = B/P$



Trigonometry Ratio Interconversion

6 ratios

$\sin\theta = P/H$

$\cos\theta = B/H$

$\tan\theta = P/B$

$\operatorname{cosec}\theta = H/P$

$\sec\theta = H/B$

$\cot\theta = B/P$

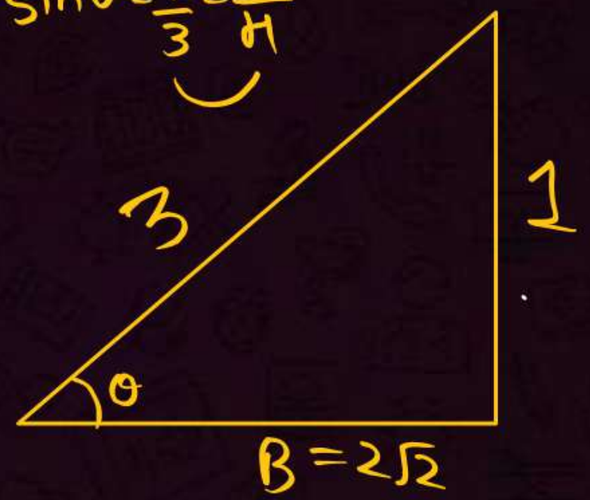
$\operatorname{cosec}\theta = \frac{1}{\sin\theta}$

$\sec\theta = \frac{1}{\cos\theta}$

$\cot\theta = \frac{1}{\tan\theta}$

Q $\sin\theta = 1/3$, Find rest of the ratios

$\sin\theta = \frac{1}{3} = \frac{P}{H}$



$P^2 + B^2 = H^2$

$1^2 + B^2 = 3^2$

$1 + B^2 = 9$

$B^2 = 9 - 1 = 8$

$B = \sqrt{8} = 2\sqrt{2}$

$\sin\theta = 1/3$

$\cos\theta = B/H = \frac{2\sqrt{2}}{3}$

$\tan\theta = P/B = \frac{1}{2\sqrt{2}}$

$\operatorname{cosec}\theta = 3$

$\sec\theta = 3/2\sqrt{2}$

$\cot\theta = 2\sqrt{2}$

Trigonometry Ratio Standard Values

	0°	30°	45°	60°	90°	120°	135°	150	180
sin	0	$\frac{1}{2}$	$\frac{1}{2}\sqrt{2}=\frac{1}{\sqrt{2}}$	$\sqrt{3}/2$	1	$\sqrt{3}/2$	$1/\sqrt{2}$	$\frac{1}{2}$	0
cos	1	$\sqrt{3}/2$	$1/\sqrt{2}$	$\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{1}{\sqrt{2}}$	$-\sqrt{3}/2$	-1
tan	0	$1/\sqrt{3}$	1	$\sqrt{3}$	X	$-\sqrt{3}$	-1	$-\frac{1}{\sqrt{3}}$	-0

37°	53°
3/5	4/5
4/5	3/5
3/4	4/3

$\sin(-\theta) = -\sin\theta$

$\cos(-\theta) = \cos\theta$

$\tan(-\theta) = -\tan\theta$

$\sin(\theta) = \sin(\theta \pm 360°)$

$\cos(\theta) = \cos(\theta \pm 360°)$

$\tan(\theta) = \tan(\theta \pm 360°)$

Q//

$\sin(330°)$

$\sin(330-360)$

$\sin(-30) = -\sin 30 = -\frac{1}{2}$ ✓

Trigonometry Identities

Reciprocal: $\operatorname{cosec}\theta = \frac{1}{\sin\theta}$ $\quad \sec\theta = \frac{1}{\cos\theta}$ $\quad \cot\theta = \frac{1}{\tan\theta}$

Pythagorean: $\sin^2\theta + \cos^2\theta = 1$ $\quad 1 + \tan^2\theta = \sec^2\theta$ $\quad 1 + \cot^2\theta = \operatorname{cosec}^2\theta$

$(A \pm B)$

- $\sin(A+B) = \sin A\cos B + \cos A\sin B$
  $\sin(A-B) = \sin A\cos B - \cos A\sin B$

$\sin 2\theta = 2\sin\theta\cos\theta$ → Projectile

- $\cos(A+B) = \cos A\cos B - \sin A\sin B$
  $\cos(A-B) = \cos A\cos B + \sin A\sin B$

$\cos 2\theta = \cos^2\theta - \sin^2\theta$

$\cos^2\theta = \frac{1+\cos 2\theta}{2}$ $\quad \sin^2\theta = \frac{1-\cos 2\theta}{2}$

(Sum of waves wo)

$\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A\tan B}$

$\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A\tan B}$

$\tan 2\theta = \frac{2\tan\theta}{1-\tan^2\theta}$

Trigonometry Useful Identities

HW → 5times

Trigonometry Increasing Decreasing Functions

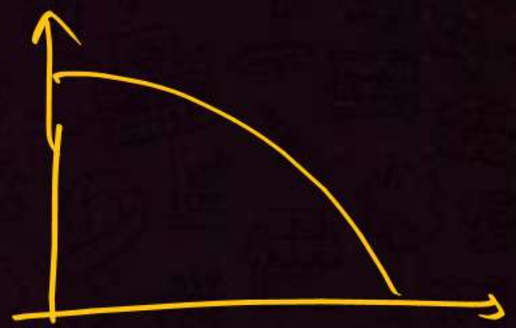
$\tan\theta$, $\sin\theta$ increasing

$\sin 0 \to 0$ $\qquad$ $\sin 90 \to 1$

$\sin 37^\circ = 3/5$ $\qquad$ $\sin 53 = 4/5$

$\theta_1 > \theta_2 > \theta_3$

$\sin\theta_1 > \sin\theta_2 > \sin\theta_3$



$\cos\theta$ decreasing

$\cos 0 = 1$ $\qquad$ $\cos 90 = 0$

$\cos 37^\circ = 4/5$ $\qquad$ $\cos 53^\circ = 3/5$

$\theta_1 > \theta_2 > \theta_3$

$\cos\theta_1 < \cos\theta_2 < \cos\theta_3$

Trigonometry Maxima and Minima

$\sin, \cos\theta \rightarrow [-1, \text{to } 1]$

Q Max $y = 3 + 2\cos^{111}\theta$ $= 3+2\times1 = 3+2=5$ ✓

$\sec, \text{cosec}\,\theta$ $(-\infty \text{ to } -1] \text{ to } [1 \text{ to } \infty)$

$\sin\theta = \cos\theta$	$\sin\theta = \text{cosec}\,\theta$	$\sec\theta = \cos\theta$
$\theta = 45°$ ✓	✓ $\theta = 90°$] $\sin = \text{cosec} = 1$	✓ $0°$ $\sec = \cos\theta = 1$
$\theta = 135°$	$\theta = 270°$] $\sin = \text{cosec} = -1$	$180°$ $\sec = \cos 0 = -1$
	$\sin\theta = 1$ $\theta = 90°$	$\cos\theta = 1$ $\theta = 0°$

$x = \frac{1}{x}$ Solve

$x^2 = 1$

$x = \pm 1$

$a\sin\theta \pm b\cos\theta \longrightarrow \left[-\sqrt{a^2+b^2} \text{ to } \sqrt{a^2+b^2}\right]$

$3\sin\theta \pm 4\cos\theta = \text{Max}$ $\sqrt{a^2+b^2} = \sqrt{3^2+4^2} = \sqrt{9+16}$

$= \sqrt{25}$

$= 5$

Trigonometry Small Angle Approximation

$\theta \rightarrow$ very small $< 10^\circ$

$\sin\theta = \tan\theta = \theta$ → radian

$\cos\theta = 1$

$\pi^c = 180^\circ$

$1^\circ = \frac{\pi}{180}{}^c$

$3^\circ = \frac{3\pi}{180}$

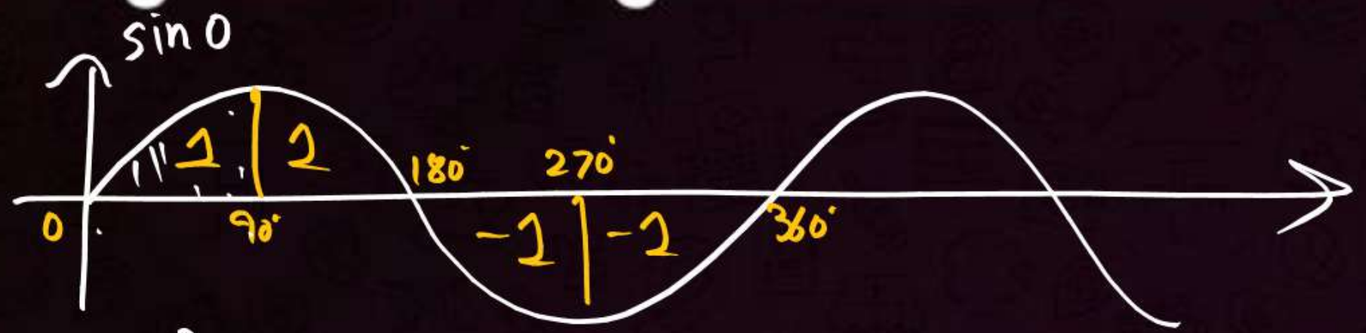
Q $\cos 3^\circ =$ (A) 0 (B) 3° (C) $\frac{3\pi}{180}$ (D) 1

Q $\sin 3^\circ = \theta_{rad}$

$3^\circ = \left(\frac{3\pi}{180}\right)^c$

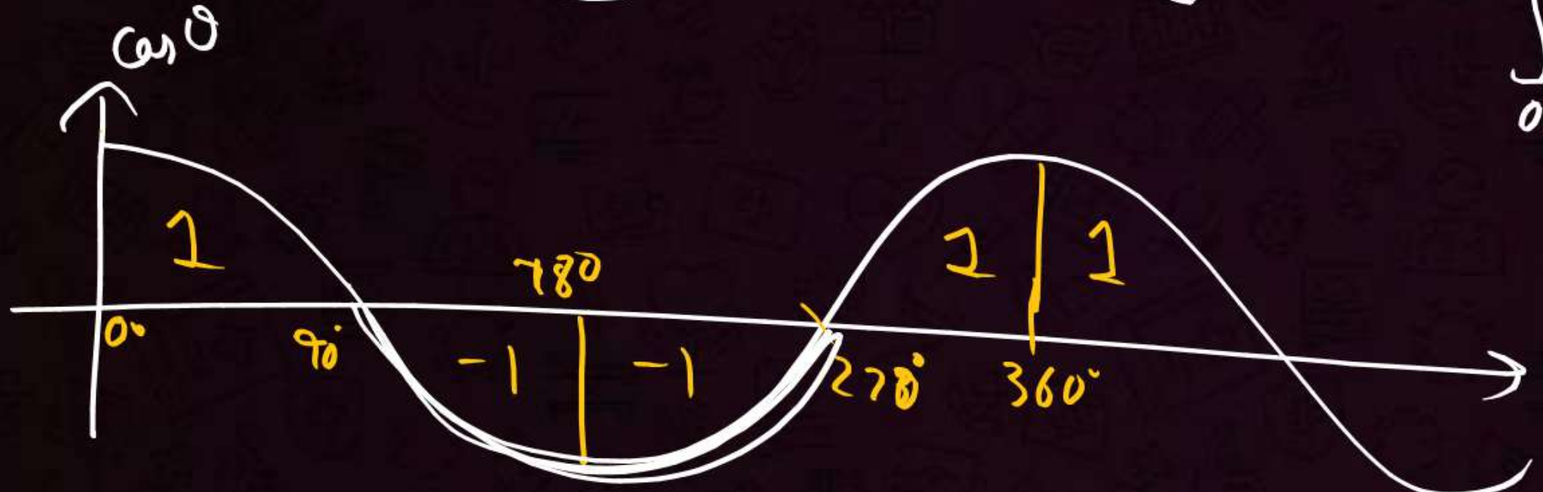
(A) 0 (B) 3° (C) $\frac{3\pi}{180}$ (D)

Integration of Trigonometric Functions



$$\int_0^{90} \sin\theta \, d\theta = 1 \checkmark$$

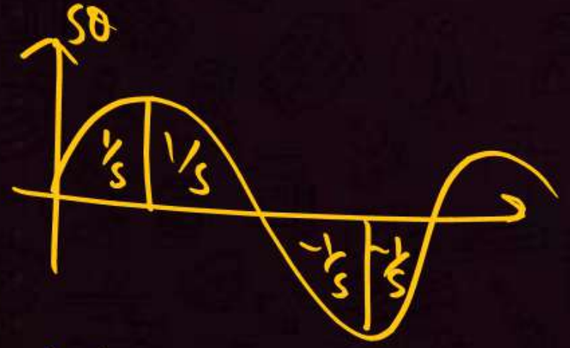
$$\int_0^{180} \sin\theta \, d\theta = 2$$



$$\int_0^{90} \cos\theta = 1$$

$$\int_{90}^{270} \cos\theta = -2$$

$$\int_0^{90} \sin 5\theta$$



$$= 1/5 \checkmark$$

PUPPY POINST-2 Trigo

	0°	30°	45°	60°	90°	120°	135°	150°	180°	37	53	−θ	θ±360
sin	0	1/2	1/√2	√3/2	1	√3/2	1/√2	1/2	0	3/5	4/5	−sinθ	sinθ
cos	1	√3/2	1/√2	1/2	0	−1/2	−1/√2	−√3/2	−1	4/5	3/5	cosθ	cosθ
tan	0	1/√3	1	√3	×	−√3	−1	−1/√3	0	3/4	4/3	−tanθ	tanθ

$2\pi = 360^\circ$
$\pi = 180^\circ$
$\pi/2 = 90^\circ$
$\pi/4 = 45^\circ$
$\pi/3 = 60^\circ$
$\pi/6 = 30^\circ$
$3\pi/2 = 270^\circ$
$2\pi/3 = 120^\circ$
$5\pi/6 = 150^\circ$
$3\pi/4 = 135^\circ$

$\operatorname{cosec}\theta = \frac{1}{\sin\theta}$

$\sec\theta = \frac{1}{\cos\theta}$

$\cot\theta = \frac{1}{\tan\theta}$

$\sin^2\theta + \cos^2\theta = 1$

$1 + \tan^2\theta = \sec^2\theta$

$1 + \cot^2\theta = \operatorname{cosec}^2\theta$

$\sin(A \pm B) = \sin A\cos B \pm \cos A \sin B$

$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$

$\sin 2\theta = 2\sin\theta\cos\theta$ ✓

$\cos 2\theta = \cos^2\theta - \sin^2\theta$

$\cos^2\theta = \frac{1+\cos 2\theta}{2}$

$\sin^2\theta = \frac{1-\cos 2\theta}{2}$ ✓

$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$

Small angle θ

$\cos\theta \approx 1$

$\sin\theta = \tan\theta = \theta \rightarrow$ radian

$l = R\theta$

$\sin\theta, \cos\theta \quad [-1 \text{ to } 1]$

$\sec\theta, \operatorname{cosec}\theta \quad (-\infty \text{ to } -1] \;\&\; [1 \text{ to } \infty)$

$\tan\theta, \cot\theta \rightarrow (-\infty \text{ to } \infty)$

$a\sin\theta + b\cos\theta \rightarrow (-\sqrt{a^2+b^2} \text{ to } \sqrt{a^2+b^2})$

Integration

$\sin\theta, \cos\theta$

$\sin 2\theta, \cos 2\theta$

Logarithms → types (bases)

$\log_b a$ → base

$\log_{10} a$ ⇓ $\log a$

$\log_e a$ ⇓ $\ln a$ → Natural log

$\ln x = 2.303 \log x$

$\ln 2 = 0.693$
$\ln 10 = 2.303$
$\ln e = 1$

$\log$ (TDD)	$\ln$ (TDD)
what is the base = 10	base = e

Logarithms – 1 to 10

$\log 1 = 0$

$\log 2 = 0.3$

$\log 3 = 0.48$

$\log 4 = 0.6$

$\log 5 = 0.7$

$\log 6 = 0.78$

$\log 7 = 0.84$

$\log 8 = 0.9$

$\log 9 = 0.96$

$\log 10 = 1$

Logarithms – Identities

$\text{Log}(ab) = \log a + \log b$

$\text{Log}(a/b) = \log a - \log b$

$\text{Log}(1/a) = \log 1 - \log a = -\log a$

$\text{Log}\, x^a = a \,\text{Log}\, x$

$\text{Log}\, 10^a = a \,\underline{\text{Log}\, 10} = a$

$\text{Log}\, 2 = 0.3$
$\text{Log}\, 3 = 0.48$
$\text{Log}\, 5 = 0.7$

— $\text{Log}\, 7 = 0.84$

$\log 4 = \log(2\times2) = \log 2 + \log 2 = 0.3 + 0.3 = 0.6$

$\log 6 = \log(2\times3) = \log 2 + \log 3 = 0.3 + 0.48 = 0.78$

$\log 8 = \log(2\times2\times2) = \log 2 + \log 2 + \log 2 = 0.3 + 0.3 + 0.3 = 0.9$

$\log 9 = \log(3\times3) = \log 3 + \log 3 = 0.48 + 0.48 = 0.96$ ✓

Logarithms – Practise

$$\log(0.5) = \log\left(\frac{5}{10}\right) = \log 5 - \log 10 = 0.7 - 1 = -0.3$$ ✓

$$\log(2\times10^8) =$$

(A) 2.8 (B) 8.3 (C) 3.8 (D) None

$$= \log 2 + \log 10^8$$

$$= 0.3 + 8(\log 10)$$

$$= 0.3 + 8$$

8.
0.3
8.3

$$\log_b a = \frac{\log a}{\log b}$$

× useless

Logarithms - Calculus

$$\frac{d}{dx}(\ln x) = \frac{1}{x}$$

$$\int_a^b \frac{1}{x}\,dx = \ln\left(\frac{b}{a}\right)$$

~~0.3~~

$$\int_1^2 \frac{1}{x}\,dx = \ln\left(\frac{2}{1}\right) = \ln 2 \hookrightarrow 0.693$$

(A) ~~0.321~~

(B) 0.693

(C) 0.981

(D) None

$$\int_1^5 \frac{1}{x}\,dx = \ln\left(\frac{5}{1}\right) = 2.303 \log 5$$

$$= 2.3 \times 0.7$$

PUPPY - POINTS 3

$1^2 = 1$
$2^2 = 4$
$3^2 = 9$
$4^2 = 16$
$5^2 = 25$
$6^2 = 36$
$7^2 = 49$
$8^2 = 64$
$9^2 = 81$
$10^2 = 100$

$1^3 = 1$
$2^3 = 8$
$3^3 = 27$
$4^3 = 64$
$5^3 = 125$
$6^3 = 216$
$7^3 = 343$
$8^3 = 512$
$9^3 = 729$
$10^3 = 1000$

$2^1 = 2$
$2^2 = 4$
$2^3 = 8$
$2^4 = 16$
$2^5 = 32$
$2^6 = 64$
$2^7 = 128$
$2^8 = 256$
$2^9 = 512$
$2^{10} = 1024$

$\log 1 = 0$
$\log 2 = 0.3$
$\log 3 = 0.48$
$\log 4 = 0.6$
$\log 5 = 0.7$
$\log 6 = 0.78$
$\log 7 = 0.84$
$\log 8 = 0.9$
$\log 9 = 0.96$
$\log 10 = 1$

$\ln 2 = 0.693$
$\ln e = 1$
$\ln 10 = 2.303$
$\ln x = 2.303 \log x$
$e = 2.7$
$\pi = 3.14 = 22/7$
$1/e = 0.368$
$\pi^2 \approx 10$

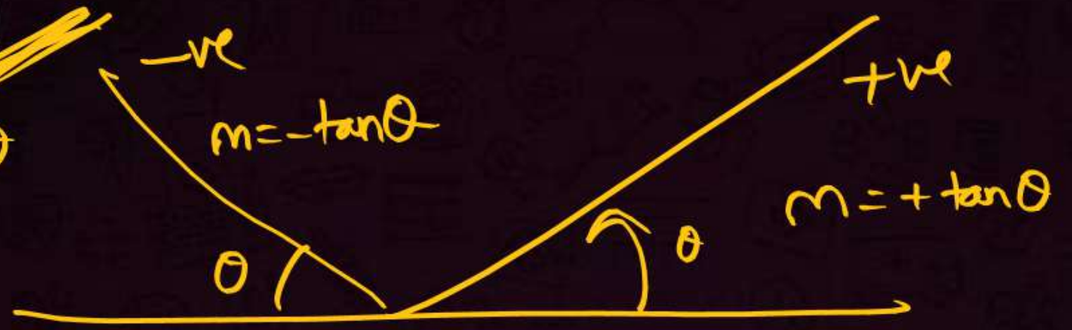
$\log(ab) = \log a + \log b$
$\log(a/b) = \log a - \log b$
$\log(1/a) = -\log a$
$\log x^n = n \log x$
$\log 10^n = n$
$\left(\log_b a = \frac{\log a}{\log b}\right) \times$
$\log_b a = x \rightarrow a = b^x$

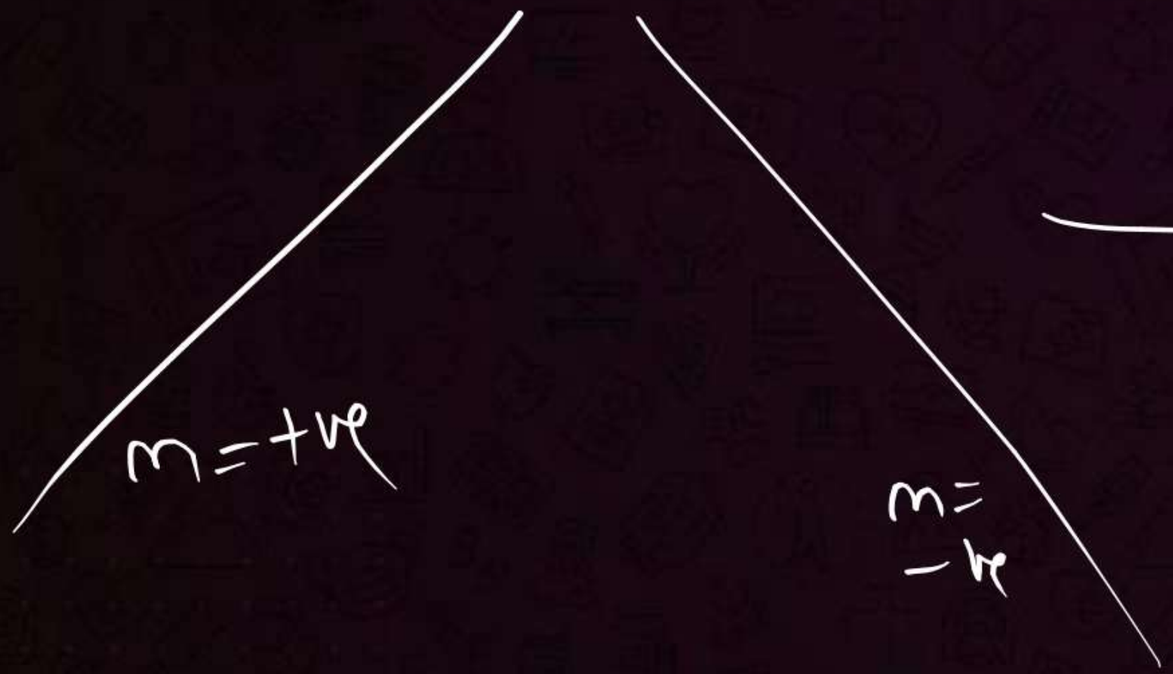
$$\int_a^b \frac{1}{x} dx = \ln\left(\frac{b}{a}\right)$$
$$= 2.303 \log\left(\frac{b}{a}\right)$$

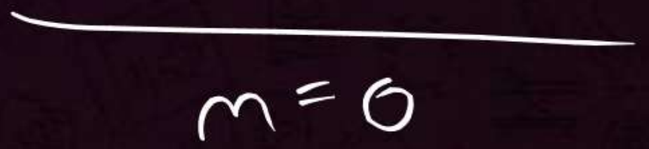
$$\frac{d}{dx}(\ln x) = \frac{1}{x}$$

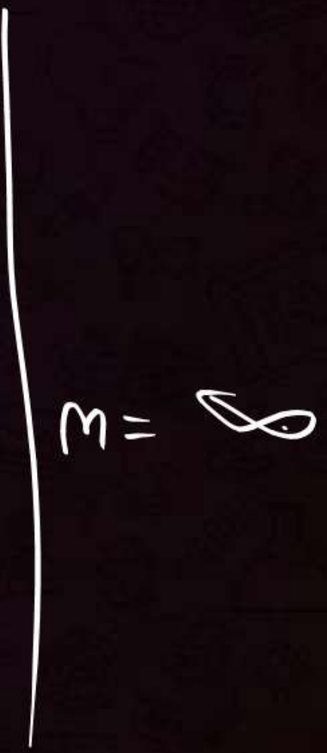
Differentiation

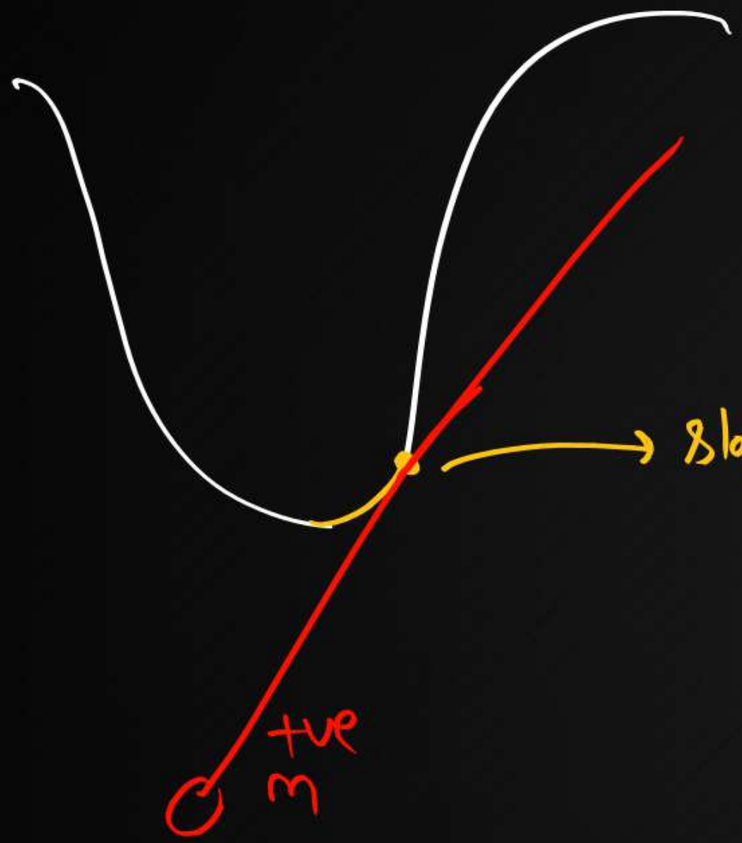
$m = \text{Slope} = \frac{dy}{dx} = \tan\theta$

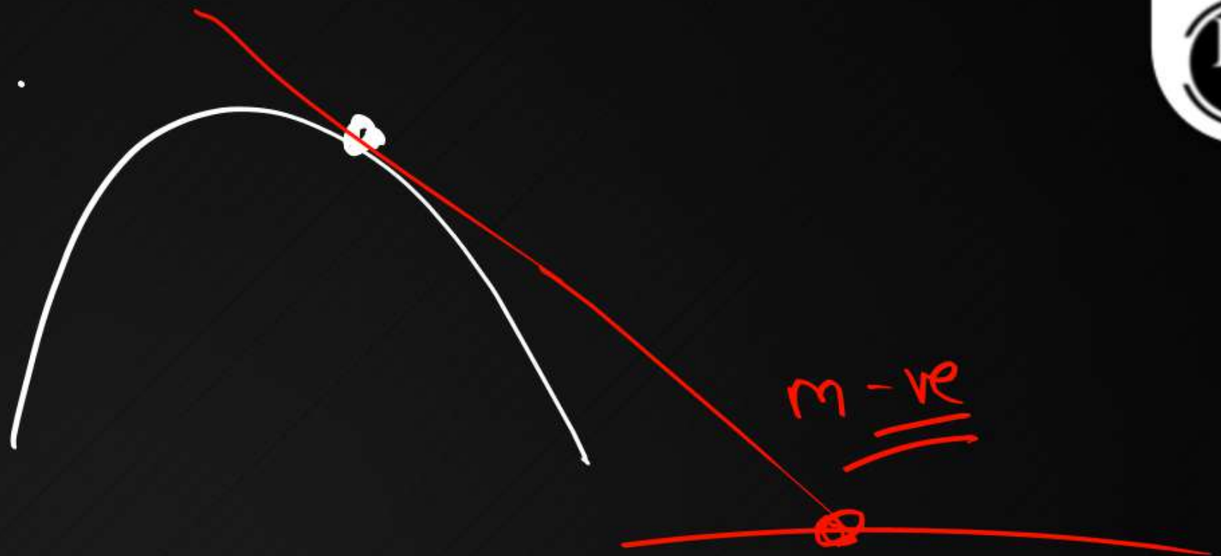


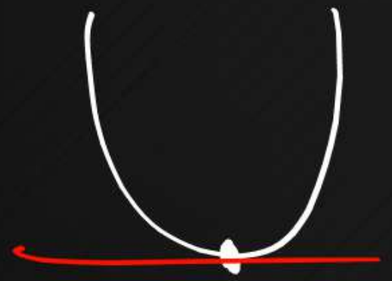












(A) +ve (B) -ve (C) 0 (D) ∞

$$\frac{dk}{dx} = 0$$

$$\frac{dx}{dx} = 1$$

$$\frac{dx^n}{dx} = n\,x^{n-1}$$

$$\frac{dx^2}{dx} = 2x$$

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

$$\frac{dx^{10}}{dx} = 10x^9$$

$$\frac{d}{dx}\left(\frac{1}{x^n}\right) = \frac{-n}{x^{n+1}}$$

$$\frac{d}{dx}\left(\frac{1}{x^2}\right) = \frac{-2}{x^3}$$

$$\frac{d}{dx}\left(\frac{1}{x^3}\right) = \frac{-3}{x^4}$$

$$\frac{d}{dx}\left(\frac{1}{x^{10}}\right) = \frac{-10}{x^{11}}$$

$$\frac{d\sqrt{x}}{dx} = \frac{1}{2\sqrt{x}}$$

$$\frac{d}{dx}\left(\frac{1}{a}\right) = \frac{-1}{x^2}$$

$$\frac{d\sin x}{dx} = \cos x$$

$$\frac{d\cos x}{dx} = -\sin x$$

$$\frac{de^x}{dx} = e^x$$

$$\frac{d\ln x}{dx} = \frac{1}{x}$$

$$\frac{d\sin ax}{dx} = a\cos ax$$

$$\frac{d\cos ax}{dx} = -a\sin ax$$

$$\frac{de^{ax}}{dx} = ae^{ax}$$

$$\frac{d\ln ax}{dx} = \frac{1}{x}$$

$$\frac{d}{dx}(x^4+x^3+x^2+x+1) = 4x^3+3x^2+2x+1+0$$

$$\frac{d}{dx}(e^x+\ln x+x^7) = e^x+\frac{1}{x}+7x^6$$

$$\frac{d}{dx}(\sin 8x+e^x) = 8\cos 8x + e^x$$

$$\frac{d}{dx}\left(x+\sqrt{x}+\frac{1}{x}\right) = 1+\frac{1}{2\sqrt{x}}-\frac{1}{x^2}$$

$$\frac{d}{dx}\left(\frac{1}{x}+x^2+\frac{1}{x^2}\right) = -\frac{1}{x^2}+2x-\frac{2}{x^3}$$

$$\frac{d}{dx}(\sin x + \sin 2x + \sin 3x) = \cos x + 2\cos 2x + 3\cos 3x$$ ✓

$$\frac{d}{dx}\left(x^{10} + e^{10x} + \ln 3x\right) = 10x^{9} + 10e^{10x} + \frac{1}{x}$$

Double Differentiation

$y = \ln x$

$\frac{dy}{dx} = \frac{1}{x}$

$\frac{d^2y}{dx^2} = -\frac{1}{x^2}$

$y = e^x$

$\frac{dy}{dx} = e^x$

$\frac{d^2y}{dx^3} = e^x$

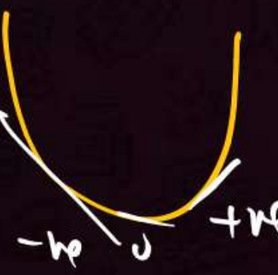
$y = \sin 3x$

$\frac{dy}{dx} = 3\cos 3x$

$\frac{d^2y}{dx^2} = 3(-3\sin 3x)$

$= -9\sin 3x$

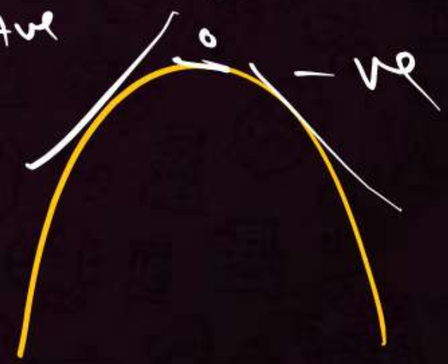
$\frac{d^2y}{dx^2}$ → given change of slope



$\frac{d^2y}{dx^2} = +ve$

Minima

Maxima



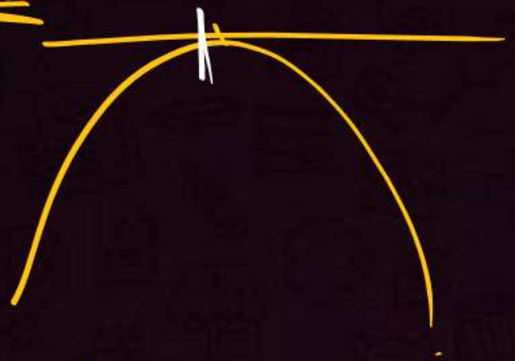
$\left(\frac{d^2y}{dx^2} = -ve\right)$

Maxima & Minima

$\frac{dy}{dx}=0$

$\frac{d^2y}{dx^2}=+ve$

Minima



$\frac{dy}{dx}=0$

$\frac{d^2y}{dx^2}=-ve$

Maxima

$ax^2+bx+c=0$

$a>0$ ∪

$\therefore a<0$ ∩

Useless

(I) $y=$ _____

$\frac{dy}{dx}=0$ → y ✓✓✓

$\frac{d^2y}{dx^2}$ → Check

OR

Direct $y_{max}=\frac{4ac-b^2}{4a}$ ✓

Direct $a\sin\theta+b\cos\theta \to \sqrt{a^2+b^2}$ ✓

Direct $x+y=A$ xy_{max} $x=y=A/2$

$y = 2x^2 - 8x + 1$

(I) $y = 2x^2 - 8x + 1$

$\frac{dy}{dx} = 4x - 8$

$\left(\frac{d^2y}{dx^2} = 4 \quad +ve\right)$

(II) $\frac{dy}{dx} = 0$

$4x - 8 = 0$

$x = \frac{8}{4} = 2$ ✓

(III) Put in y.

$y = 2x^2 - 8x + 1$

$= 2 \times 4 - 8 \times 2 + 1$

$= 8 - 16 + 1$

$= -8 + 1$

$= -7$

Minima

X

✓

$y_{max} = \frac{4ac - b^2}{4a}$

$= \frac{4 \times 2 \times 1 - 8 \times 8}{4 \times 2}$

$= \frac{8 - 64}{8}$

$= -\frac{56}{8}$

$= -7$ ✓

Integration = Area under

$$\int x^n dx = \frac{x^{n+1}}{n+1}$$

$$\int dx = x$$

$$\int x\,dx = \frac{x^2}{2}$$

$$\int x^2 dx = \frac{x^3}{3}$$

$$\int x^{10} dx = \frac{x^{11}}{11}$$

$$\int_a^b x^n dx = \frac{b^{n+1} - a^{n+1}}{n+1}$$

$$\int_1^{10} dx = 10 - 1 = 9$$

$$\int_1^{10} x^2 dx = \frac{10^3 - 1^3}{3} = \frac{1000-1}{3} = \frac{999}{3} = 333$$

$$\int_1^2 x^3 dx = \frac{2^4 - 1^4}{4} = \frac{16-1}{4} = \frac{15}{4}$$

$$\int_a^b \sin x\,dx = -[\cos x] = \cos a - \cos b$$

$$\int_a^b \cos x\,dx = [\sin x] = \sin b - \sin a$$

$$\int_a^b e^x\,dx = [e^x] = e^b - e^a$$

$$\boxed{\int_a^b \frac{1}{x}\,dx = \ln\left(\frac{b}{a}\right)}$$

$$\int \sin ax\,dx = \frac{-\cos ax}{a}$$

$$\int \cos ax\,dx = \frac{\sin ax}{a}$$

$$\int e^{ax}\,dx = \frac{e^{ax}}{a}$$

PUPPY POINTS 4

Calculus

slope $= \frac{dy}{dx}$

$\frac{dk}{dx} = 0$

$\frac{dx}{dx} = 1$

$\frac{dx^n}{dx} = nx^{n-1}$

$\frac{d}{dx}\left(\frac{1}{x^n}\right) = \frac{-n}{x^{n+1}}$

$\frac{d}{dx}\sqrt{x} = \frac{1}{2\sqrt{x}}$

$\frac{d}{dx}\left(\frac{1}{x}\right) = -\frac{1}{x^2}$

$\frac{d}{dx}\sin x = \cos x$

$\frac{d}{dx}\cos x = \sin x$

$\frac{d}{dx}e^x = e^x$

$\frac{d}{dx}\ln x = \frac{1}{x}$

$\int k\,dx = [kx] = k(b-a)$

$\int x^n dx = \left[\frac{x^{n+1}}{n+1}\right] = \frac{b^{n+1} - a^{n+1}}{n+1}$

$\int \sin x\,dx = [-\cos x] = \cos a - \cos b$

$\int \cos x\,dx = [\sin x] = \sin b - \sin a$

$\int \frac{1}{x}dx = [\ln x] = \ln\left(\frac{b}{a}\right)$

$\int e^x dx = [e^x] = e^b - e^a = e^{b/a}$

$\int \sin\theta\,d\theta =$ 

$\int \cos\theta\,d\theta =$ 

$\frac{dy}{dx}$ slope +ve / -ve $\Rightarrow$ Op

$\frac{d^2y}{dx^2}$ is change in slope

$\frac{d^2y}{dx^2}$ +ve  Minima -ve  Maxima

$\frac{d}{dx}\sin ax = a\cos ax$

$\frac{d}{dx}\cos ax = -a\sin ax$

$\frac{d}{dx}e^{ax} = ae^{ax}$

$\frac{d}{dx}(\ln ax) = \frac{1}{x}$

$\int \sin ax = -\frac{\cos ax}{a}$

$\int \cos ax = \frac{\sin ax}{a}$

$\int e^{ax} = \frac{e^{ax}}{a}$

useless

$\frac{d}{dx}\tan x = \sec^2 x$

$\frac{d}{dx}\cot x = -\operatorname{cosec}^2 x$

$\frac{d}{dx}\sec x = \sec x \tan x$

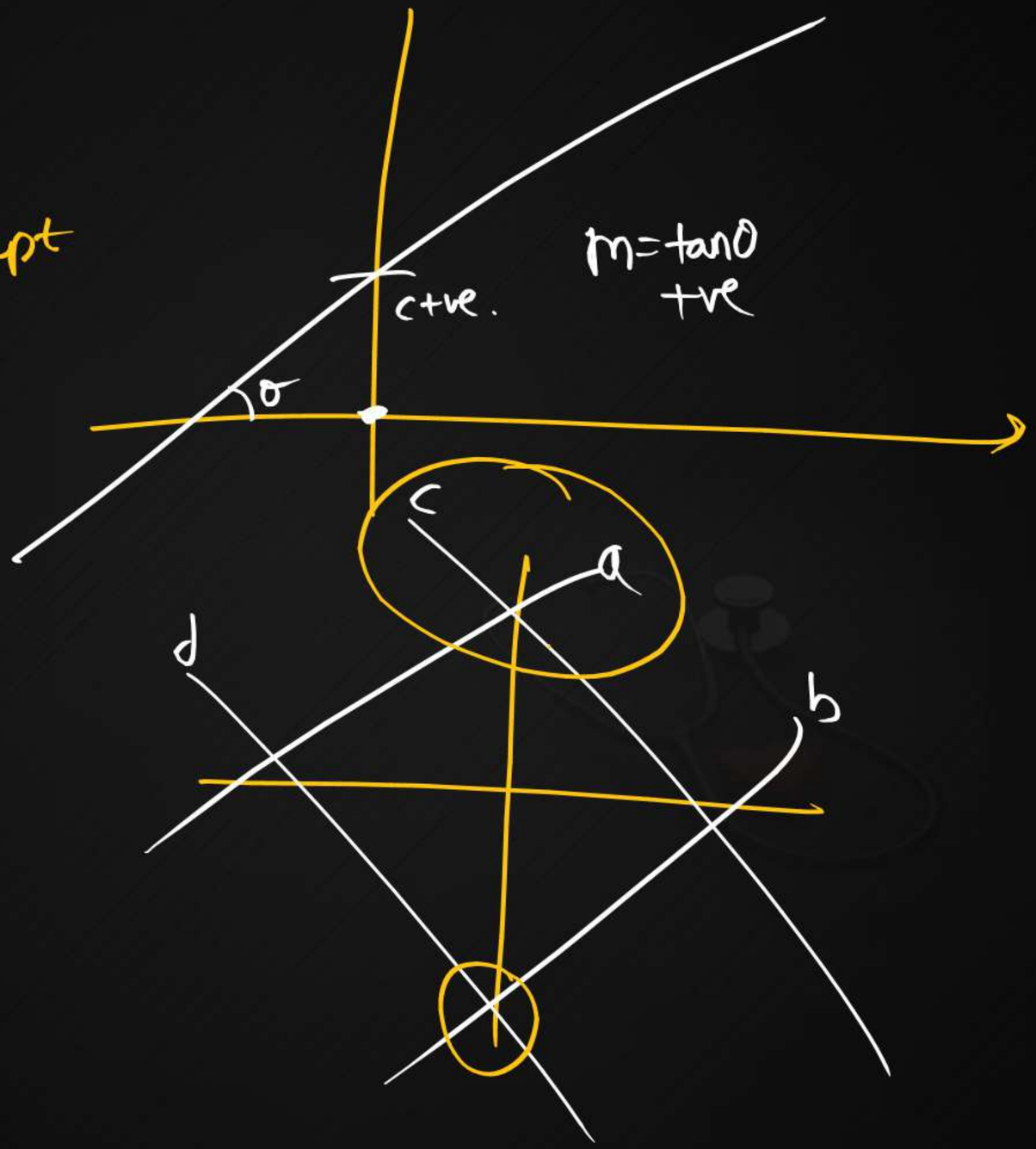
$\frac{d}{dx}\operatorname{cosec} x = -\operatorname{cosec} x \cot x$

GRAPHS

St. line $y = mx + c$

m → slope, c → y intercept

	m	c
a	+	+
b	+	−
c	−	+
d	−	−



Parabolas

$y = x^2$

$y = -x^2$

$x = y^2$

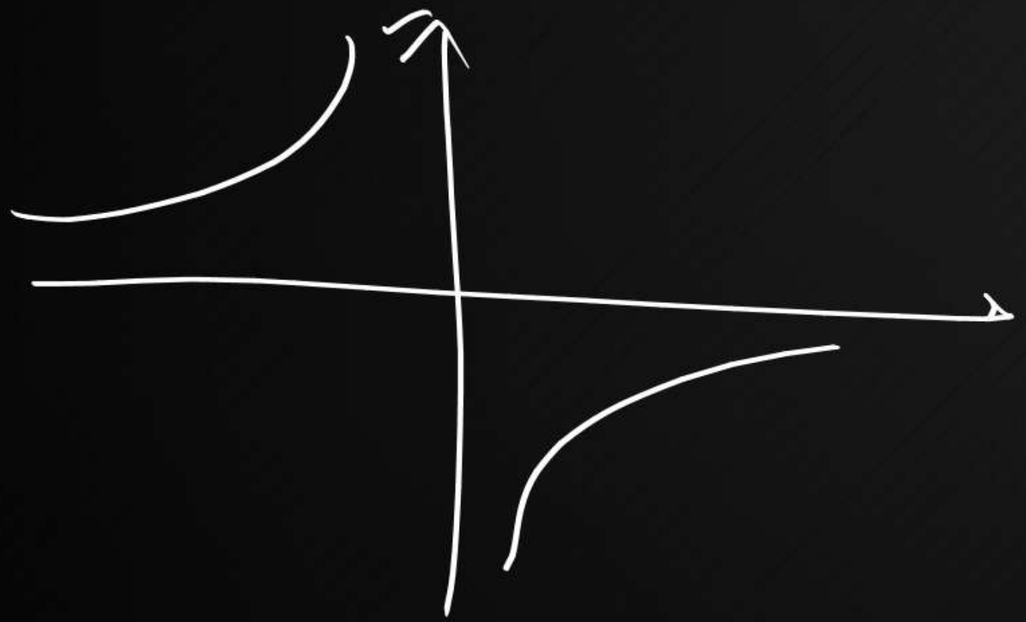
$x = -y^2$

$y = \sqrt{x}$

Parabola

Hyperbola

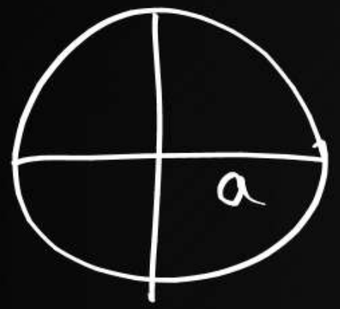
$\left(y=\frac{1}{x}\right), \frac{1}{x^2}, \frac{1}{x^3} \cdots$



$y=\frac{-1}{x}, \frac{-1}{x^2}, \frac{-1}{x^3}$

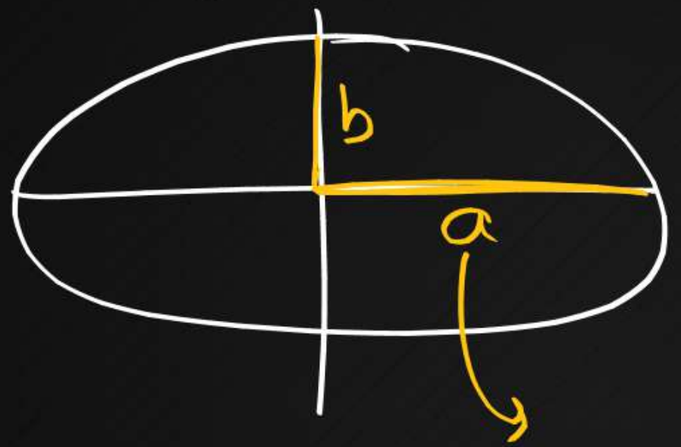
Circle

$x^2+y^2=a^2$

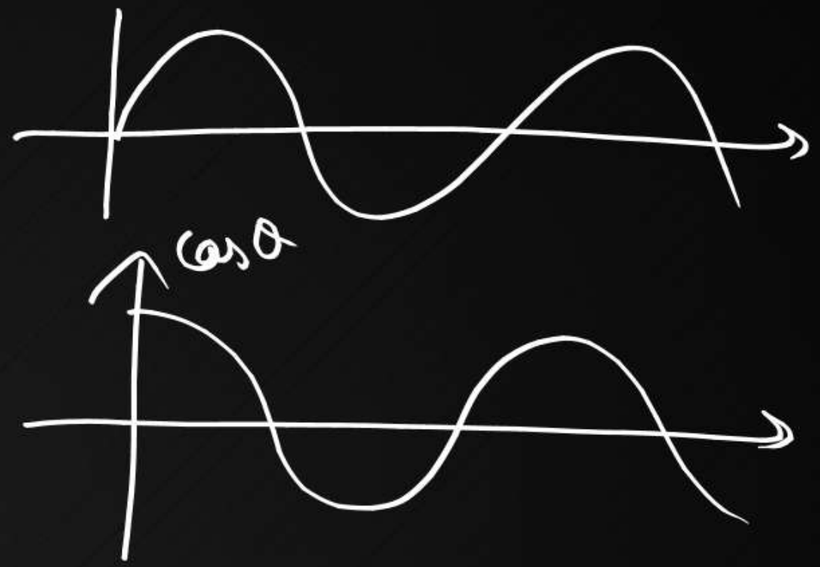


Ellipse

$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$



$\sin\theta$



a Semi-major axis

b Semi-minor axis

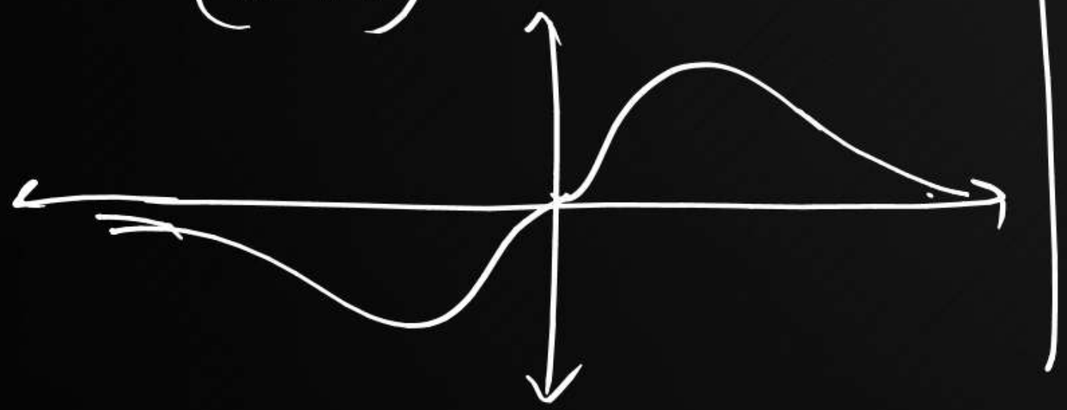
Log

e^x

$a^0 = 1$

$$y = \frac{x}{(x^2+a^2)^{3/2}}$$

Ring Rule

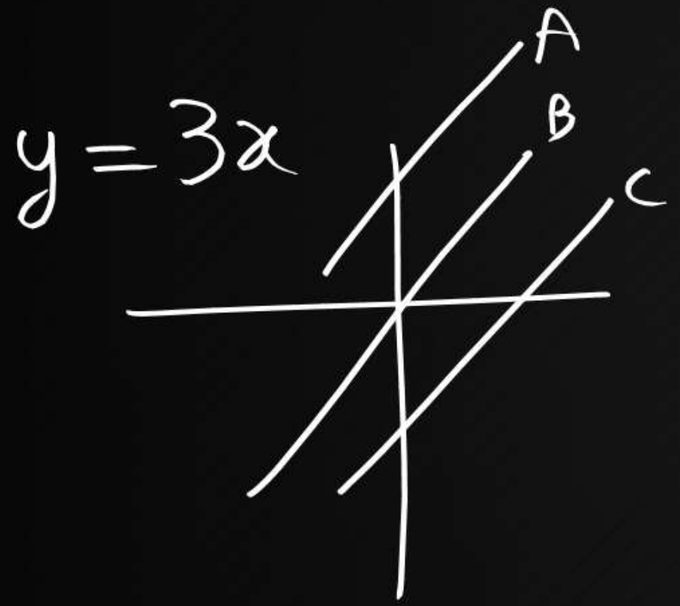


e^{-x}

Will a graph pass through origin or not?

$y = ax^2 + bx + c$

c → constant → then – it will no pass thru origin



$y = 3x$ — B

$y = 3x + 8$ — A

$y = 3x - 5$ — C

$y = x^2$ — B

$y = x^2 + 2$ — A

$y = x^2 - 3$ — C

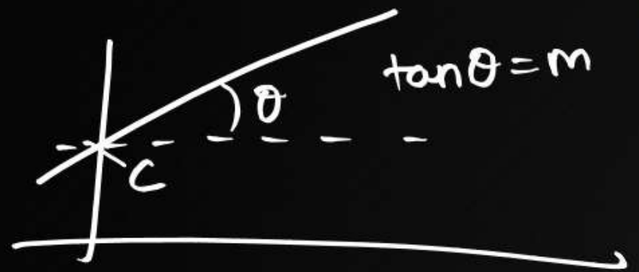
$3x+2y=6$

x-intercept $\quad y=0 \quad 3x=6 \quad x=2$

y-intercept $\quad x=0 \quad 2y=6 \quad y=3$

PUPPY POINTS-5

$y = mx + c$



x intercept Put $y = 0$

y intercept Put $x = 0$

Parabolas

$y = x^2$ ∪

$y = -x^2$ ∩

$x = y^2$ ⊂

$x = -y^2$ ⊃

$y = \sqrt{x}$ ∩

Hyperbola

$y = \frac{1}{x}, \frac{1}{x^2}, \cdots \frac{1}{x^n}$ →

$y = \frac{-1}{x}, \frac{-1}{x^2}, \cdots \frac{-1}{x^n}$

Circle

$x^2 + y^2 = a^2$

Ellipse

$\frac{x}{a^2} + \frac{y^2}{b^2} = 1$

$y = \log x$

$y = e^x$

$y = e^{-x}$

$PV^n = k$

$\frac{dP}{dV} = -\frac{nP}{V}$

→ Theorem (HW)

$y = \frac{x}{(x^2 + a^2)^{3/2}}$

Ring

Revision + Short Notes + PUPPY POINTS

PUPPY POINTS-1

LCM = 8812 = 4(2,3) = 4×2×3 = 12

$\frac{5}{8}+\frac{7}{12}=\frac{1}{4}\left(\frac{5}{2}+\frac{7}{3}\right)=\frac{1}{4}\left(\frac{15+14}{6}\right)=\frac{19}{24}$

$\frac{1}{2}=0.5$ $\frac{1}{3}=0.33$ $\frac{2}{3}=0.66$ $\frac{1}{4}=0.25$ $\frac{3}{4}=0.75$ $\frac{1}{5}=0.2$ $\frac{2}{5}=0.4$

$\frac{1}{6}=0.16$ $\frac{5}{6}=0.83$ $\frac{1}{7}=0.142857$ $\frac{1}{8}=0.125$ $\frac{1}{9}=0.111$ $\frac{2}{9}=0.22..$ $\frac{8}{9}=0.88.$

$\frac{1}{2}=0.5$ $\frac{1}{4}=0.25$ $\frac{1}{8}=0.125$ $\frac{1}{16}=0.0625$ $\frac{1}{5}=0.2$ $\frac{1}{25}=0.04$ $\frac{1}{125}=0.008$ $\frac{1}{625}=0.0016$

n^2	n^3	$\sqrt{n}$
$1^2=1$	$1^3=1$	$\sqrt{1}=1$
$2^2=4$	$2^3=8$	$\sqrt{4}=2$
$3^2=9$	$3^3=27$	$\sqrt{9}=3$
$4^2=16$	$4^3=64$	$\sqrt{16}=4$
$5^2=25$	$5^3=125$	$\sqrt{25}=5$
$6^2=36$	$6^3=216$	$\sqrt{36}=6$
$7^2=49$	$7^3=343$	$\sqrt{49}=7$
$8^2=64$	$8^3=512$	$\sqrt{64}=8$
$9^2=81$	$9^3=729$	$\sqrt{81}=9$
$10^2=100$	$10^3=1000$	$\sqrt{100}=10$

$\sqrt{2}=1.414$ $\sqrt{3}=1.732$

$\sqrt{5}=2.23$ $\sqrt{10}=3.16$

$\sqrt{p^2\pm e}=p\pm\frac{e}{2p}$

$(1+x)^n=1+nx$ $(x\ll 1)$

$2^2=16$ $3^2=81$

$4^4=256$ $5^4=625$

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

GP $a_n=ar^{n-1}$ $S_n=a\left(\frac{r^n-1}{r-1}\right)$ $\left(S_\infty=\frac{a}{1-r}=\left(1+\frac{1}{x}+\frac{1}{x^2}\cdots=\frac{x}{x-1}\right)\right)$

$ax^2+bx+c=0$

$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$

Max/Min $=\frac{4ac-b^2}{4a}$

at $x=-b/2a$

$D=b^2-4ac$

$D=0$ 1 root

$D>0$ 2 root

$D<0$ no root

$a>0$ ∪ $a<0$ ∩

$x=a+b$ ab max when $a=b=\frac{x}{2}$

$(a+b)^2=a^2+b^2+2ab$

$(a-b)^2=a^2+b^2-2ab$

$a^2-b^2=(a+b)(a-b)$

$(a+b)^3=a^3+b^3+3ab(a+b)$ ×

$(a-b)^3=a^3-b^3-3ab(a-b)$ ×

$\frac{a}{b}=\frac{c}{d}=\frac{a+c}{b+d}=\frac{a-c}{b-d}$ ✓

↳ $\frac{a+b}{a-b}=\frac{c+d}{c-d}$

$\left(\frac{\frac{a}{b}}{\frac{c}{d}}\right)=\frac{ad}{bc}$

23·2	$\times 10^{-5}$
2·32	$\times 10^{-4}$
232	$\times 10^{-6}$

$(ab)^x=a^x b^x$

$(a/b)^x=a^x/b^x$

$a^x a^y=a^{x+y}$

$a^x/a^y=a^{x-y}$

$(a^x)^y=a^{xy}$

$a^{-x}=\frac{1}{a^x}$ $\frac{1}{a^x}=a^{-x}$

PUPPY POINST-2

	0°	30°	45°	60°	90°	120°	135°	150°	180°	37	53	−θ	θ±360
sin	0	1/2	1/√2	√3/2	1	√3/2	1/√2	1/2	0	3/5	4/5	−sinθ	sinθ
cos	1	√3/2	1/√2	1/2	0	−1/2	−1/√2	−√3/2	−1	4/5	3/5	cosθ	cosθ
tan	0	1/√3	1	√3	×	−√3	−1	−1/√3	0	3/4	4/3	−tanθ	tanθ

$2\pi = 360^\circ$
$\pi = 180^\circ$
$\pi/2 = 90^\circ$
$\pi/4 = 45^\circ$
$\pi/3 = 60^\circ$
$\pi/6 = 30^\circ$
$3\pi/2 = 270^\circ$
$2\pi/3 = 120^\circ$
$5\pi/6 = 150^\circ$
$3\pi/4 = 135^\circ$

$\operatorname{cosec}\theta = \frac{1}{\sin\theta}$

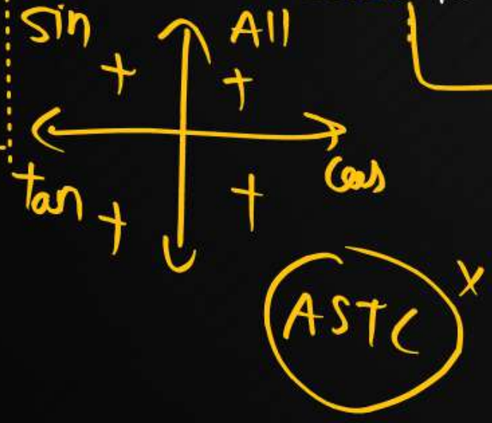
$\sec\theta = \frac{1}{\cos\theta}$

$\cot\theta = \frac{1}{\tan\theta}$

$\sin^2\theta + \cos^2\theta = 1$

$1 + \tan^2\theta = \sec^2\theta$

$1 + \cot^2\theta = \operatorname{cosec}^2\theta$



$\sin(A \pm B) = \sin A\cos B \pm \cos A \sin B$

$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$

$\sin 2\theta = 2\sin\theta\cos\theta$ ✓

$\cos 2\theta = \cos^2\theta - \sin^2\theta$

$\cos^2\theta = \frac{1+\cos 2\theta}{2}$

$\sin^2\theta = \frac{1-\cos 2\theta}{2}$ ✓

$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$

$\sin(90-\theta) = \cos\theta$	$\sin(180-\theta) = \sin\theta$
$\cos(90-\theta) = \sin\theta$	$\cos(180-\theta) = -\cos\theta$
$\tan(90-\theta) = \cot\theta$	$\tan(180-\theta) = -\tan\theta$

Small angle θ

$\cos\theta \approx 1$

$\sin\theta = \tan\theta = \theta$ → radian

$l = R\theta$

$\sin\theta, \cos\theta$ $[-1 \text{ to } 1]$

$\sec\theta, \operatorname{cosec}\theta$ $(-\infty \text{ to } -1] \& [1 \text{ to } \infty)$

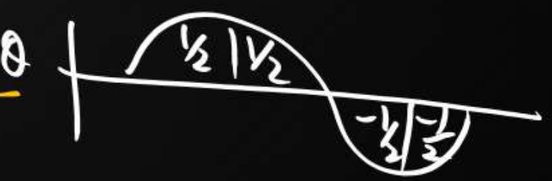
$\tan\theta, \cot\theta \rightarrow (-\infty \text{ to } \infty)$

$a\sin\theta + b\cos\theta \rightarrow (-\sqrt{a^2+b^2} \text{ to } \sqrt{a^2+b^2})$

Integration

$\sin\theta, \cos\theta$

$\sin^2\theta, \cos^2\theta$



PUPPY - POINTS 3

$1^2 = 1$
$2^2 = 4$
$3^2 = 9$
$4^2 = 16$
$5^2 = 25$
$6^2 = 36$
$7^2 = 49$
$8^2 = 64$
$9^2 = 81$
$10^2 = 100$

$1^3 = 1$
$2^3 = 8$
$3^3 = 27$
$4^3 = 64$
$5^3 = 125$
$6^3 = 216$
$7^3 = 343$
$8^3 = 512$
$9^3 = 729$
$10^3 = 1000$

$2^1 = 2$
$2^2 = 4$
$2^3 = 8$
$2^4 = 16$
$2^5 = 32$
$2^6 = 64$
$2^7 = 128$
$2^8 = 256$
$2^9 = 512$
$2^{10} = 1024$

$\log 1 = 0$
$\log 2 = 0.3$
$\log 3 = 0.48$
$\log 4 = 0.6$
$\log 5 = 0.7$
$\log 6 = 0.78$
$\log 7 = 0.84$
$\log 8 = 0.9$
$\log 9 = 0.96$
$\log 10 = 1$

$\ln 2 = 0.693$
$\ln e = 1$
$\ln 10 = 2.303$

$\ln x = 2.303 \log x$

$e = 2.7$ $\quad \pi = 3.14 = 22/7$

$1/e = 0.368$ $\quad \pi^2 \approx 10$

$\log(ab) = \log a + \log b$

$\log(a/b) = \log a - \log b$

$\log(1/a) = -\log a$

$\log x^n = n \log x$

$\log 10^n = n$

$\log_b a = \frac{\log a}{\log b}$ X

$\log_b a = x \rightarrow a = b^x$

$\int_a^b \frac{1}{x} dx = \ln\left(\frac{b}{a}\right)$

$= 2.303 \log\left(\frac{b}{a}\right)$

$\frac{d}{dx}(\ln x) = \frac{1}{x}$

PUPPY POINTS 4

slope $= \frac{dy}{dx}$

$\frac{dk}{dx} = 0$

$\frac{dx}{dx} = 1$

$\frac{dx^n}{dx} = nx^{n-1}$

$\frac{d}{dx}\left(\frac{1}{x^n}\right) = \frac{-n}{x^{n+1}}$

$\frac{d}{dx}\sqrt{x} = \frac{1}{2\sqrt{x}}$

$\frac{d}{dx}\left(\frac{1}{x}\right) = -\frac{1}{x^2}$

$\frac{d}{dx}\sin x = \cos x$

$\frac{d}{dx}\cos x = \sin x$

$\frac{d}{dx}e^x = e^x$

$\frac{d}{dx}\ln x = \frac{1}{x}$

$\int k\,dx = [kx] = k(b-a)$

$\int x^n dx = \left[\frac{x^{n+1}}{n+1}\right] = \frac{b^{n+1} - a^{n+1}}{n+1}$

$\int \sin x\,dx = [-\cos x] = \cos a - \cos b$

$\int \cos x\,dx = [\sin x] = \sin b - \sin a$

$\int \frac{1}{x}dx = [\ln x] = \ln\left(\frac{b}{a}\right)$

$\int e^x dx = [e^x] = e^b - e^a$

$\int \sin\theta\,d\theta =$ 

$\int \cos\theta\,d\theta =$ 

$\frac{dy}{dx}$ slope +ve / \ -ve $\frac{}{0}$ $|^{\infty}$

$\frac{d^2y}{dx^2}$ is change in slope

$\frac{d^2y}{dx^2}$ +ve  Minima -ve  Maxima

$d(uv) = v\,du + u\,dv$

$d\left(\frac{u}{v}\right) = \frac{v\,du - u\,dv}{v^2}$ ✗

Chain Rule ✗ ✗

$\frac{d}{dx}\sin ax = a\cos ax$ ✓

$\frac{d}{dx} = \cos ax = -a\sin ax$ ✓

$\frac{d}{dx} = e^{ax} = ae^{ax}$ ✓

$\frac{d}{dx}(\ln ax) = \frac{1}{x}$ –

$\int \sin ax = -\frac{\cos ax}{a}$ –

$\int \cos ax = \frac{\sin ax}{a}$ –

$\int e^{ax} = \frac{e^{ax}}{a}$ –

$\frac{d}{dx}\tan x = \sec^2 x$

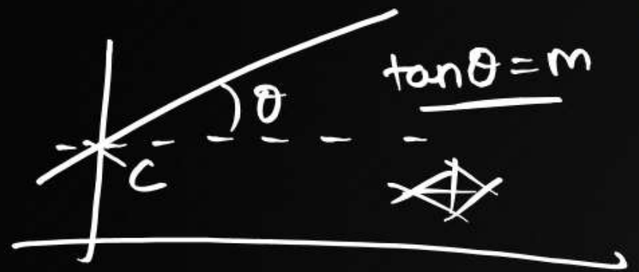
$\frac{d}{dx}\sec = \sec x \tan x$

$\frac{d}{dx}\cot x = -\operatorname{cosec}^2 x$

$\frac{d}{dx}\operatorname{cosec} x = -\operatorname{cosec} x \cot x$

PUPPY POINTS-5

$y = mx + c$



x intercept Put $y = 0$

y intercept Put $x = 0$

- $y = x^2$ ∪
- $y = -x^2$ ∩
- $x = y^2$ ⊂
- $x = -y^2$ ⊃
- $y = \sqrt{x}$ ⌒

Parabolas

Hyperbola

$y = \frac{1}{x}, \frac{1}{x^2}, \cdots \frac{1}{x^n} \rightarrow$

$y = \frac{-1}{x}, \frac{-1}{x^2}, \cdots \frac{-1}{x^n}$

Circle

$x^2 + y^2 = a^2$

Ellipse

$\frac{x}{a^2} + \frac{y^2}{b^2} = 1$

$y = \log x$

$y = e^x$

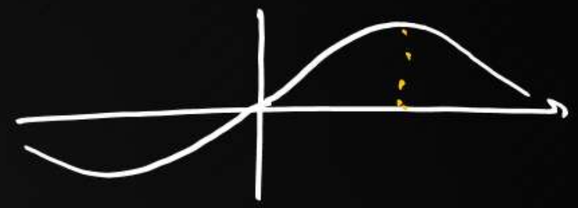
$y = e^{-x}$

$PV^n = K$

$\frac{dP}{dV} = -n\frac{P}{V}$

→ nw

$y = \frac{x}{(x^2 + a^2)^2}$



Basic Worksheet

↳ Sunday

dx/dn $d\left(\frac{1}{x}\right)$ $dx^{1/2}$ $x^{-1/2}$

dx^2 $d\left(\frac{1}{x^2}\right)$ $dx^{1/3}$ $x^{-1/3}$

dx^3 ⋮ ⋮ ⋮

⋮ ⋮ ⋱ ⋮

⋮ ⋮ $x^{1/10}$ $x^{-1/10}$

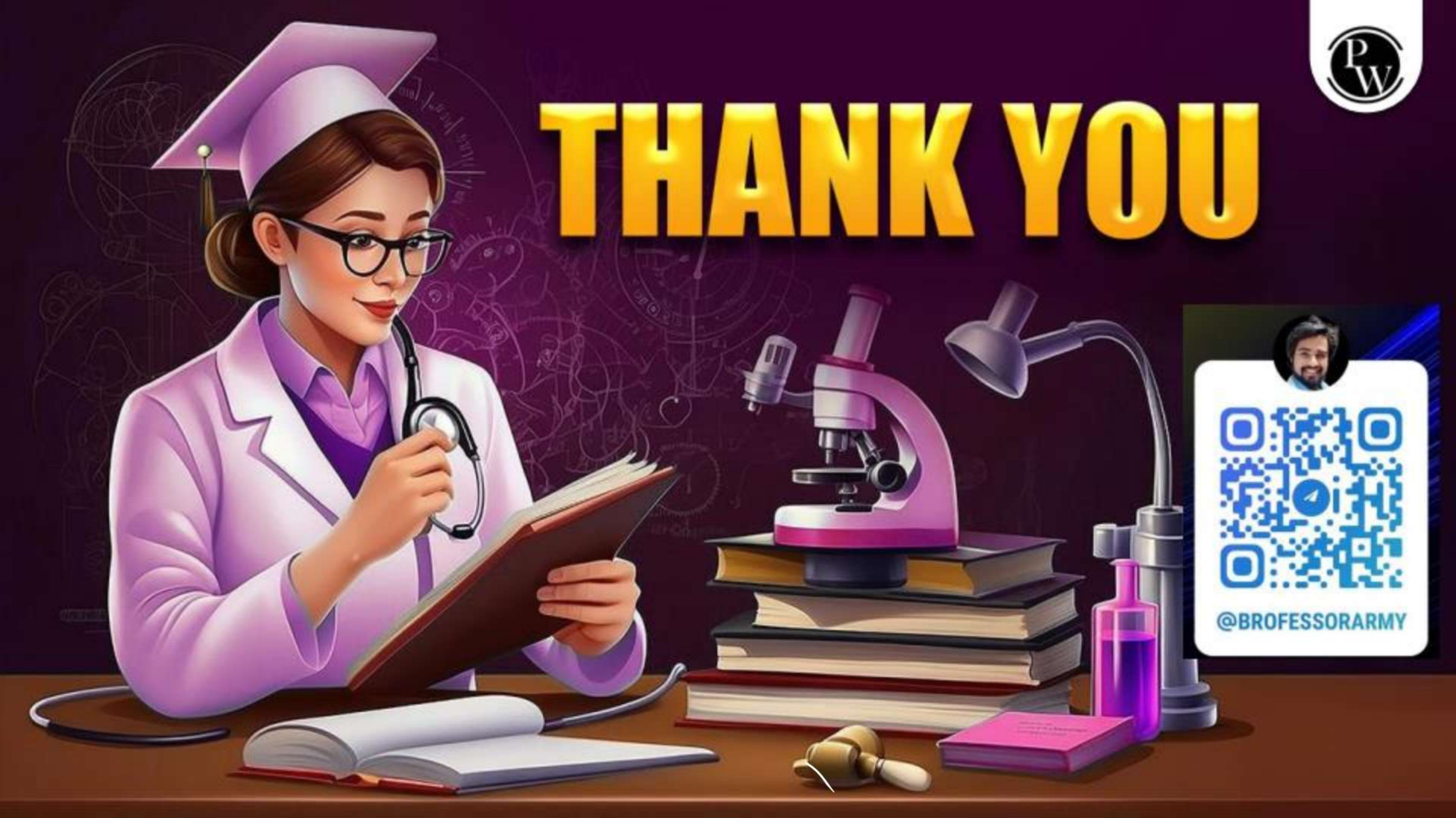
⋮ ⋮

dx^{10} $\frac{d\left(\frac{1}{x^{10}}\right)}{dx}$

→ Diff, Double Diff

Integration

→ Worksheet Sunday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