YAKEEN NEET 2.0

2026

Kpp

Basic Maths and Calculus (Mathematical Tools)

PHYSICS | Lecture -06 and 07

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KPP 06

Question - 01

If temperature of a body changes wrt time as

$T = \alpha t^2 + \beta t^3$ where $\alpha = 2$, $\beta = -\dfrac{1}{3}$

Find ratio of temperature to the rate of change of temp wrt time at $t = 2$ sec.

$t = 2$ पर $\Rightarrow T = 8 - \dfrac{8}{3} = \dfrac{16}{3}$

$$T = \alpha t^2 + \beta t^3 = 2t^2 - \frac{1}{3}t^3$$

$$\frac{dT}{dt} = 2\alpha t + 3\beta t^2$$

$$\frac{dT}{dt} = 4t + 3\left(-\frac{1}{3}\right)t^2$$

$$\frac{dT}{dt} = 4t - t^2$$

$t = 2$ sec, $= 8 - 4 = 4$

$$\frac{T}{\left(\frac{dT}{dt}\right)} = \frac{16/3}{4}$$

$$= \frac{4}{3}$$

Question - 02

If charge flowing through an crossection is given as

$q = 3t^2 + 4t$

find value of current at $t = 2$ sec use $i = \frac{dq}{dt}$

$i = 6t + 4$

$i = 12 + 4 = 16$

Question - 03

Tangential acceleration is rate of change of speed. By using this concept find the value of tangential acc. of a particle moving in a circular path of radius 10 m. Such that its spedd $v = 3t^4 + 2t^2$. Also find value of tangential acc., K.E. of particle at t = 2 sec. (m = 2Kg)

$$\frac{d}{dt}(\text{speed}) = a_t$$

$$a_t = 12t^3 + 4t$$

$$t = 2, \quad a_t = 96 + 8 = 104$$

$$t = 2, \quad v = 3 \times 2^4 + 2 \times 2^2 = 48 + 8 = 56$$

$$KE = \frac{1}{2} m v^2 = \frac{1}{2} \times 2 \times (56)^2$$

Question - 04

Find rate of change of pressure with respect to volume for an ideal gas at constant temp. T_0 (Use $PV = nRT$)

$$PV = nRT_0 = \text{const}$$

$$\frac{dP}{dV}$$

$$P = \frac{nRT_0}{V}$$

$$\frac{dP}{dV} = -nRT_0 \frac{1}{V^2}$$

Question - 05

If potential energy of the system is given by $U = -\frac{A}{x^6} - \frac{B}{x^5}$ (where $A = 3,\ B = \frac{1}{5}$)

Find magnitude of force acting on particle at $X = 1$ $\left(\text{Use } F = -\frac{dU}{dx}\right)$ also find mean position where $F_{net} = 0$

Sol^n

$$\frac{dU}{dx} = -\frac{d}{dx}\left(Ax^{-6} + Bx^{-5}\right)$$

$$= -\left(A(-6)x^{-7} + B(-5)x^{-6}\right)$$

$$\frac{dU}{dx} = \frac{6A}{x^7} + \frac{5B}{x^6}$$

$$F = -\frac{dU}{dx} = -\frac{6A}{x^7} - \frac{5B}{x^6}$$

$$F = -6A - 5B = -19$$

$F = 0,$

$$-\frac{6A}{x^7} = \frac{5B}{\cancel{x^6}}$$

$$\boxed{x = \frac{-6A}{5B}}$$

Question - 06

For a particle moving in a straight line the position of the particle at time (t) is given by $x = \frac{t^3}{6} - t^2 - 9t + 18m$. What is the velocity of the particle when its acceleration is zero:

(1) 18 m/s (2) –9 m/s

(3) –11 m/s (4) 6 m/s

$v = \frac{3t^2}{6} - 2t - 9$

$a = t - 2$

$a = 0, \ t = 2$

$v = \frac{1}{2}(2)^2 - 2 \times 2 - 9 = 2 - 4 - 9$

$= -11$

Ans : (3)

Question - 07

A particle moves along a straight line such that at time t its displacement from a fixed point O on the line is $3t^2 - 2$. The velocity of the particle when $t = 2$ is:

(1) $8\ \text{ms}^{-1}$

(2) $4\ \text{ms}^{-1}$

(3) $12\ \text{ms}^{-1}$

(4) 0

$6t - 0 = 12$

Ans : (3)

Question - 08

Temperature of a body varies with time as $T = (T_0 + \alpha t^2 + \beta \sin t)K$, where T_0 is the temperature in Kelvin at $t = 0$ sec. and $\alpha = 2/\pi. K/s^2$ and $\beta = -4$ K, then rate of change of temperature at $t = \pi$ sec. is:

(1) 8K
(2) 8°K
(3) 8K/sec
(4) 8°K/sec

$T = T_0 + \frac{2}{\pi} t^2 - 4 \sin t$

$\frac{dT}{dt} = 0 + \frac{2}{\pi} 2t - 4\cos t$

$t = \pi$

$= \frac{4}{\pi} \pi - 4 \cos \pi$

$= 4 + 4$

$= \underline{8}$ K/sec

Ans : (3)

Question - 09

The velocity of a particle moving on the x-axis is given by $v = x^2 + x$ where v is in m/s and x is in m. Find its acceleration in m/s^2 when passing through the point $x = 2$m. use $a = V\frac{dV}{dX}$

(1) 0 (2) 5

(3) 11 (4) 30

$a = v\frac{dv}{dx}$

$a = (x^2+x).(2x+1)$

$x=2$ $a = 6\times5 = 30$

Ans : (4)

Question - 09

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$$a = (x^2+x).(2x+1)$$

$x=2$ $\quad a = 6 \times 5 = 30$

Ans : (4)

Question - 10

If $y = \sin^2 x - 2\tan^2 x$, then $\frac{dy}{dx}$ at $x = \frac{\pi}{4}$ is:

45°

(1) -11

~~(2)~~ -7

(3) -13

(4) -15

$$\frac{dy}{dx} = 2\sin x \cos x - 2 \times 2\tan x \times \sec^2 x$$

$$= 2\frac{1}{\sqrt{2}}\frac{1}{\sqrt{2}} - 4 \times 1 \times 2 = 1 - 8 = \underline{-7}$$

Ans : (2)

Question - 11

If $y = x^3 + 2x + 1$ then $\frac{dy}{dx}$ at $x = 1$ is:

(1) 6 (2) 7

(3) 8 (4) 5

$3x^2 + 2$

Ans : (4)

Question - 12

$y=\dfrac{1+x}{e^x}$ then $\dfrac{dy}{dx}$ is equal to:

(1) $\dfrac{x}{e^x}$

(2) $-\dfrac{x}{e^x}$

(3) $\dfrac{(x+1)}{e^x}$

(4) None of these

$\dfrac{u}{v} \Rightarrow \dfrac{vu'-uv'}{v^2}$

$\dfrac{e^x(0+1)-(1+x)e^x}{(e^x)^2}$

$\dfrac{\cancel{e^x}-\cancel{e^x}(1+x)}{\cancel{e^x}\cdot e^x} = \dfrac{1-(1+x)}{e^x} = \dfrac{-x}{e^x}$

Ans : (2)

Question - 13

If $y = x^2 + x - 1$ then $\frac{dy}{dx}$ at $x = 1$ is equal to:

(1) 3

(2) -3

(3) 0

(4) None

$2x+1$

Ans : (1)

Question - 14

Given $s = t^2 + 5t + 3$, find $\frac{ds}{dt}$.

(1) $2t + 5$

(2) $\frac{t^3}{3} + 5t^2 + 3t$

(3) $t + 5$

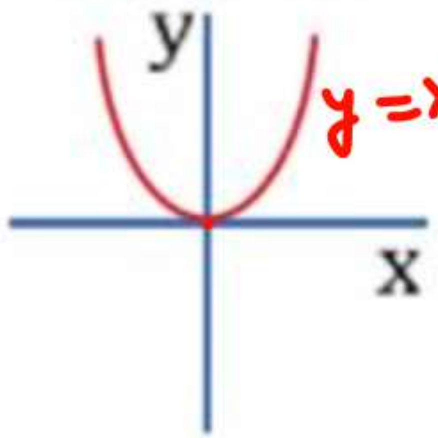
(4) None

Ans : (1)

Question - 15

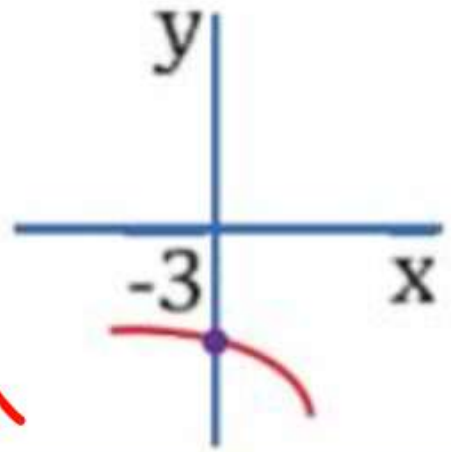
If $y = x^2 + 2x - 3$, then y-x graph is:

(1)



$y = x^2$

(2)



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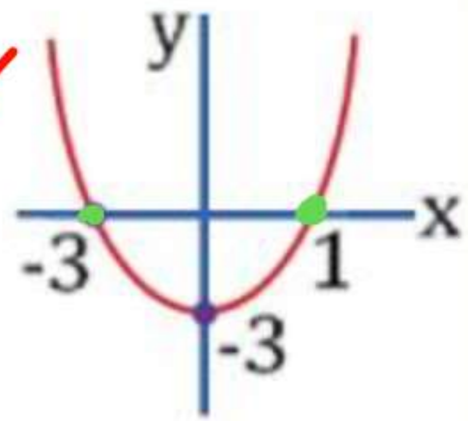

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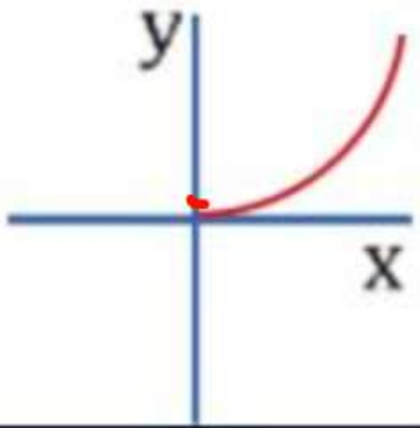
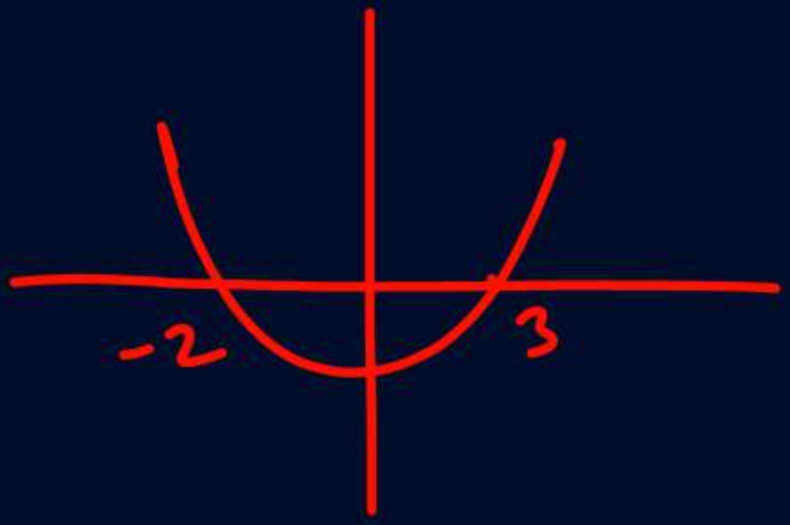




Ans : (3)

Question - 16

The sum of the series $1+\frac{1}{3}+\frac{1}{9}+\frac{1}{27}+\ldots\ldots\infty$ is:

(1) $\frac{8}{7}$

(2) $\frac{6}{5}$

(3) $\frac{2}{3}$

(4) $\frac{3}{2}$

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

Ans : (4)

Question - 17

The slope of straight line $\sqrt{3}y = 3x + 4$ is:

(1) 3

(2) $\sqrt{3}$

(3) $\frac{1}{\sqrt{3}}$

(4) $\frac{1}{3}$

$y = \frac{3}{\sqrt{3}}x + \frac{4}{\sqrt{3}}$

$\sqrt{3}$

Ans : (2)

Question - 18

Find value of $\frac{dy}{dx}$.

(1) $y = \cos(2x + 3)$ $= -\sin(2x+3)(2+0)$

(2) $y = \sin(x^2 + x^3)$

$y' = \cos(x^2+x^3) \times (2x+3x^2)$

Ans : $\boxed{(1)\ -2\sin(2x+3);\ (2)\ \cos(x^2+x^3)(2x+3x^2)}$

Question - 19

Find derivative of y w.r.t. x if: $y = \ln(x^3 + 4)$

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

Ans : $\dfrac{3x^2}{x^3+4}$

Question - 20

Find value of $\frac{dy}{dx}$.

$y = e^{(3x-6)}$

$y' = e^{3x-6} \times (3 - 0)$

Ans : $\boxed{3e^{3x-6}}$

Question - 21

If position of particle is given by
$x = (3t^2 + 4t - 1)\text{m}$.
Find its initial velocity and initial acceleration.

Use $v = \frac{dx}{dt}, a = \frac{dv}{dt}$

$t = 0,$

$v = 6t + 4 \longrightarrow v = 4$

$a = 6 \longrightarrow t = 0, a = 6$

Ans : 4 m/s, 6 m/s^2

Question - 22

If position of particle is given by
$x = (t^3 - 36t^2 + 30t - 1)$ m.
Find its velocity when acceleration becomes zero.
Use $v = \frac{dx}{dt}$, $a = \frac{dv}{dt}$

$v = 3t^2 - 72t + 30$

$a = 6t - 72 = 0$

$t = 12$

$v = 3 \times 144 - 72 \times 12 + 30$

$= 432 - 864 + 30$

$= -402$

$$\begin{array}{r} 864 \\ 462 \\ \hline 402 \end{array}$$

(2)

Ans : –402 m/s

Question - 23

Find the slope of the tangent of a curve $y = x^2 + 2x + 4$ at $x = 0$ and $x = -1$.

$y' = 2x + 2$

$x = 0, \; y' = 2$

$x = -1, \; y' = 0$

Ans : 2, 0

End KPP 06

KPP-07

Question - 01

A particle moves along the straight line $y = 3x + 5$. Which coordinate changes at a faster rate?

(1) x-coordinate
(2) y-coordinate
(3) Both x and y coordinates
(4) Data insufficient.

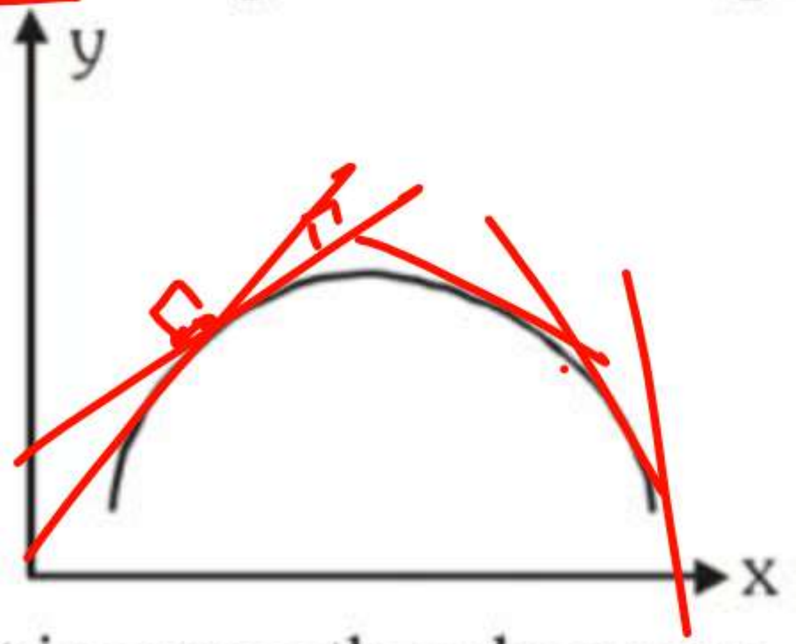
$x = 0$	$y = 5$
$x = 1$	$y = 8$
$x = 2$	$y = 11$
$x = 3$	$y = 14$

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

Ans : (2)

Question - 02

Magnitude of slope of the shown graph.



(1) First increases then decreases
(2) First decreases then increases
(3) Increases
(4) Decreases

Ans : (2)

Question - 03

The equation of a curve is given as $y = x^2 + 2 - 3x$.

The curve intersects the x-axis at.

(1) (1, 0)

(2) (2, 0)

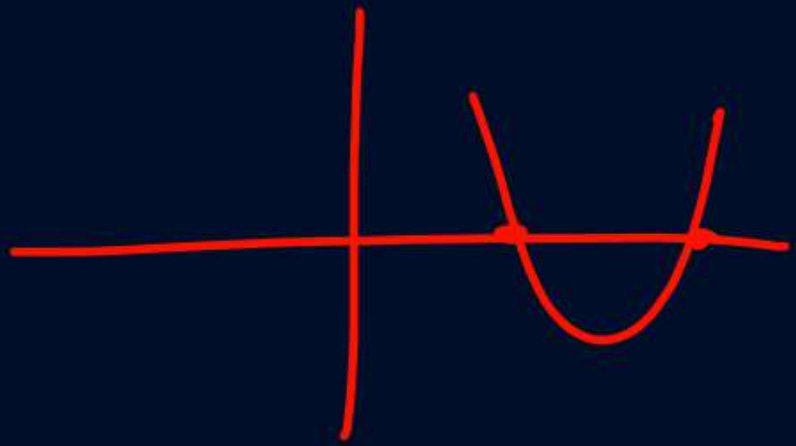
(3) Both (1) and (2)

(4) No where

$\rightarrow y = 0$

$x^2 - 3x + 2 = 0$

$x = 1, 2$



Ans : (3)

Question - 04

Two particles A and B are moving in XY-plane. Their positions vary with time t according to relation

$t=1,\ (3,1)\quad (6,5)$

$x_A(t) = 3t,\quad x_B(t) = 6$

$y_A(t) = t,\quad y_B(t) = 2 + 3t^2$

Distance between two particles at $t = 1$ is:

(1) 5 (2) 3

(3) 4 (4) $\sqrt{12}$

$$\sqrt{(5-1)^2+(6-3)^2} = 5$$

Ans : (1)

Question - 05

The side of a square is increasing at the rate of 0.2 cm/s. The rate of increase of perimeter w.r.t. time is:

(1) 0.2 cm/s (2) 0.4 cm/s

(3) 0.6 cm/s (4) 0.8 cm/s

P = perimeter $= 4l$

$$\frac{dP}{dt} = 4\left(\frac{dl}{dt}\right)$$

$$= 4 \times .2$$

Ans : (4)

Question - 06

$f(x) = \cos x + \sin x$ then value of $f(\pi/2)$ will be:

(1) 2 (2) 1

(3) 3 (4) 0

$$f(\pi/2) = \cos \pi/2 + \sin \pi/2$$
$$= 0 + 1$$

Ans : (2)

Direction (No. 7 to 8): Derivative of given function with respect to corresponding independent variable is:

Question - 07

$s = 5t^3 - 3t^5$

(1) $\frac{ds}{dt} = 15t^2 + 15t^4$

(2) $\frac{ds}{dt} = 15t^4 + 15t^3$

(3) $\frac{ds}{dt} = 15t^4 - 15t^2$

(4) $\frac{ds}{dt} = 15t^2 - 15t^4$

Ans : (4)

Question - 08

$y = 5\sin x$

(1) $\frac{dy}{dx} = 3\cos x$

(2) $\frac{dy}{dx} = 5\cos x$

(3) $\frac{dy}{dx} = 5\sin x$

(4) $\frac{dy}{dx} = 3\sin x$

Ans : (2)

Direction (No. 9 to 12): First derivative and second derivative of given functions with respect to corresponding independent variable is:

f'

f''

Question - 09

$y = 6x^2 - 10x - 5x^{-2}$

(1) $12x - 10 + 10x^{-3}, 12 - 30x^{-4}$

(2) $10x - 12 + 20x^{-3}, 15 - 30x^{-4}$

(3) $12x - 10 + 15x^{-3}, 12 - 30x^{-4}$

(4) $10x - 15 + 12x^{-3}, 12 - 30x^{-4}$

$y' = 12x - 10 + 10x^{-3}$

$y'' = 12 - 30x^{-4}$

Ans : (1)

Question - 10

$r=\frac{12}{\theta}-\frac{4}{\theta^3}+\frac{1}{\theta^4}$ $=12\theta^{-1}-4\theta^{-3}+\theta^{-4}$

(1) $12\theta^{-2}-12\theta^{-4}+4\theta^{-5}, 24\theta^{-3}+48\theta^{-5}+20\theta^{-6}$

(2) $-12\theta^{-2}+12\theta^{-4}-4\theta^{-5}, 24\theta^{-3}-48\theta^{-5}+20\theta^{-6}$

(3) $-6\theta^{-2}+12\theta^{-4}-8\theta^{-5}, 12\theta^{-3}-24\theta^{-5}+10\theta^{-6}$

(4) $-8\theta^{-2}+12\theta^{-4}-6\theta^{-5}, 24\theta^{-3}-24\theta^{-5}+10\theta^{-6}$

$r'=-12\theta^{-2}+12\theta^{-4}-4\theta^{-5}$

$r''=24\theta^{-3}-48\theta^{-5}+20\theta^{-6}$

Ans : (2)

Question - 11

$\omega = 3z^7 - 7z^3 + 21z^2$

(1) $21z^6 + 21z^2 - 42z, 126z^5 + 42z - 42$

(2) $14z^6 - 28z^2 + 22z, 120z^5 - 21z + 42$

(3) $28z^6 - 14z^2 + 42z, 122z^5 - 42z + 21$

(4) $21z^6 - 21z^2 + 42z, 126z^5 - 42z + 42$

Ans : (4)

Question - 12

$y = \sin x + \cos x$

(1) $\cos x - \cos x, -\sin x - \sin x$

(2) $\sin x - \sin x, -\sin x - \cos x$

(3) $\cos x - \sin x, -\sin x - \cos x$

(4) $\sin x + \cos x, -\cos x - \cos x$

Ans : (3)

Direction (No. 13 to 15): Derivative of given functions with respect to the independent variable x is:

Question - 13

$y = x \sin x$

(1) $\sin x + x\cos x$ (2) $\sin x - x\cos x$

(3) $\cos^2 x - x\sin^2 x$ (4) $\sin^2 x - x\cos^2 x$

$y' = x\cos x + \sin x \times 1$

Ans : (1)

Question - 14

$y = e^x \ln x$

(1) $e^x \ln x - \frac{e^x}{x}$

(2) $e^x \ln x - \frac{e^x}{x^2}$

(3) $e^x \ln x + \frac{e^x}{x^2}$

(4) $e^x \ln x + \frac{e^x}{x}$

$$y' = \frac{e^x}{x} + \ln x \cdot e^x$$

Ans : (4)

Question - 15

$y=(x-1)\left(x^{2}+x+1\right)$

(1) $\frac{dy}{dx}=3x$ (2) $\frac{dy}{dx}=3x^{2}$

(3) $\frac{dy}{dx}=2x^{2}$ (4) $\frac{dy}{dx}=2x$

$y' = (x-1)(2x+1) + (x^2+x+1) \times (1-0)$

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

$= 3x^2$

Ans : (2)

Direction (No. 16 to 18): Derivative of given function with respect to the independent variable is:

Question - 16

$y = \frac{\sin x}{\cos x}$ $= \tan x$

(1) $\sec^2 x$ (2) $\sec x$

(3) $\sec^2 2x$ (4) $\sec^3 2x$

Ans : (1)

Question - 17

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

(1) $y'=\frac{-19}{(3x-2)^2}$

(2) $y'=\frac{19}{(3x-2)^2}$

(3) $y'=\frac{19}{(3x-2)}$

(4) $y'=\frac{-19}{(3x+2)^2}$

$$y'=\frac{(3x-2)(2)-(2x+5)(3)}{(3x-2)^2}$$

$$=\cancel{6x}-4-\cancel{6x}-15$$

Ans : (1)

Question - 18

$z = \frac{2x+1}{x^2-1}$

(1) $\frac{-2x^2-2x+2}{\left(x^2+1\right)^2}$

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

(3) $\frac{-2x^2+2x+2}{(x+1)^2}$

(4) $\frac{-2x^2-2x-2}{\left(x^2-1\right)}$

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

$$= \frac{2x^2-2-4x^2-2x}{(x^2-1)^2} = \frac{-2x^2-2x-2}{(x^2-1)^2}$$

Ans : (2)

Direction (No. 19 to 20): $\dfrac{dy}{dx}$ for following functions is:

Question - 19

$y = (4 - 3x)^9$

(1) $-8(4 - 3x)^8$

(2) $-27(4 - 3x)^9$

(3) $-27(4 + 3x)^9$

(4) $-27(4 - 3x)^8$

$y' = 9(4-3x)^8 \times (0-3)$

Ans : (4)

Question - 20

$y = 2\sin(\omega x + \phi)$ where ω and ϕ constants

(1) $2\omega\cos(\omega x + \phi)$

(2) $2\omega\cos(\omega x - \phi)$

(3) $\omega\cos(\omega x + \phi)$

(4) $2\omega\text{cosec}(\omega x + \phi)$

$2\cos(\omega x + \phi)(\omega + 0)$

Ans : (1)

Question - 21

Find the slope of tangent of curve $y = 1 + x^2 - 2x$ at (3, 3).

(1) 1 (2) 2

(3) 3 (4) 4

$y' = 0 + 2x - 2$

$y' = 4$

Ans : (4)

Question - 22

Find the slope of tangent of curve $y = 5x^2 + 2x + 1$ at $(0, 0)$.

(1) 1

(2) 2

(3) 3

(4) 4

$10x + 2$

Ans : (2)

Question - 23

The slope of the normal to the curve $y = x^2 - \frac{1}{x^2}$ at $(-1, 0)$ is:

$y' = \frac{dy}{dx} = 2x + \frac{2}{x^3}$

$x = -1$ put

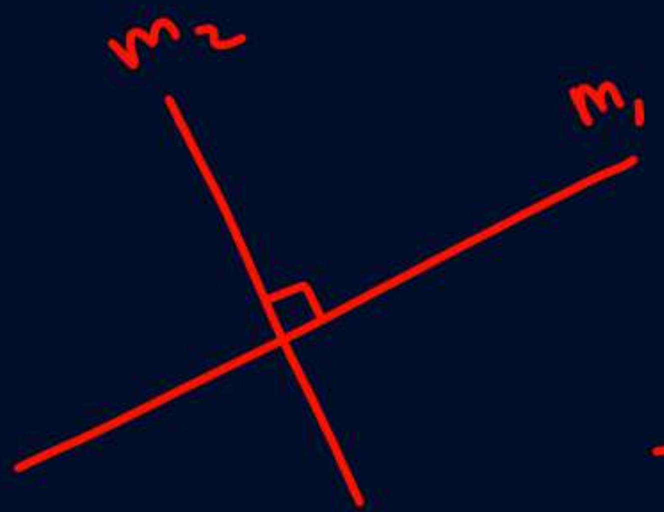
(1) $\frac{1}{4}$ ✓

(2) $-\frac{1}{4}$

(3) 4

(4) -4

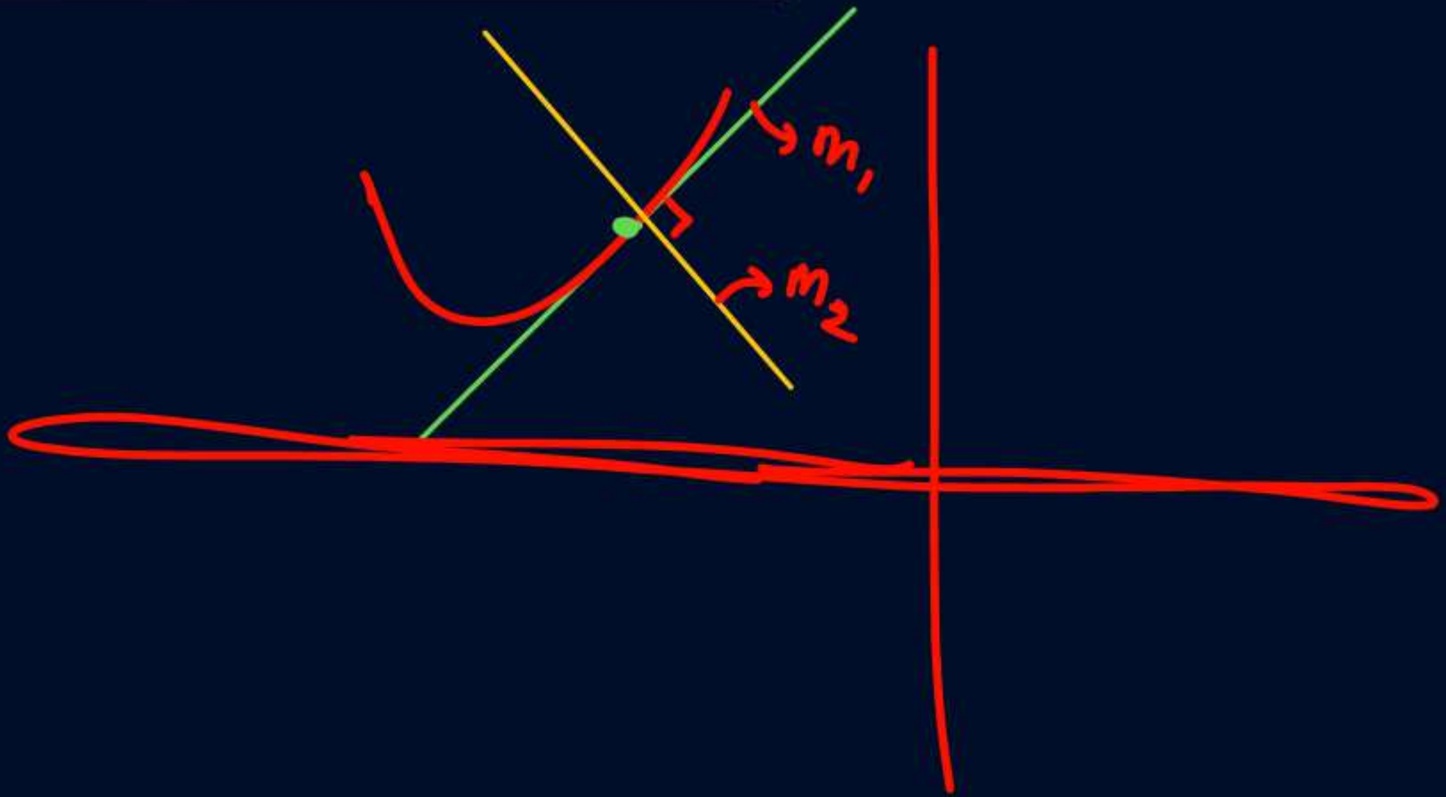
$\frac{dy}{dx} = -2-2$
$= -4$



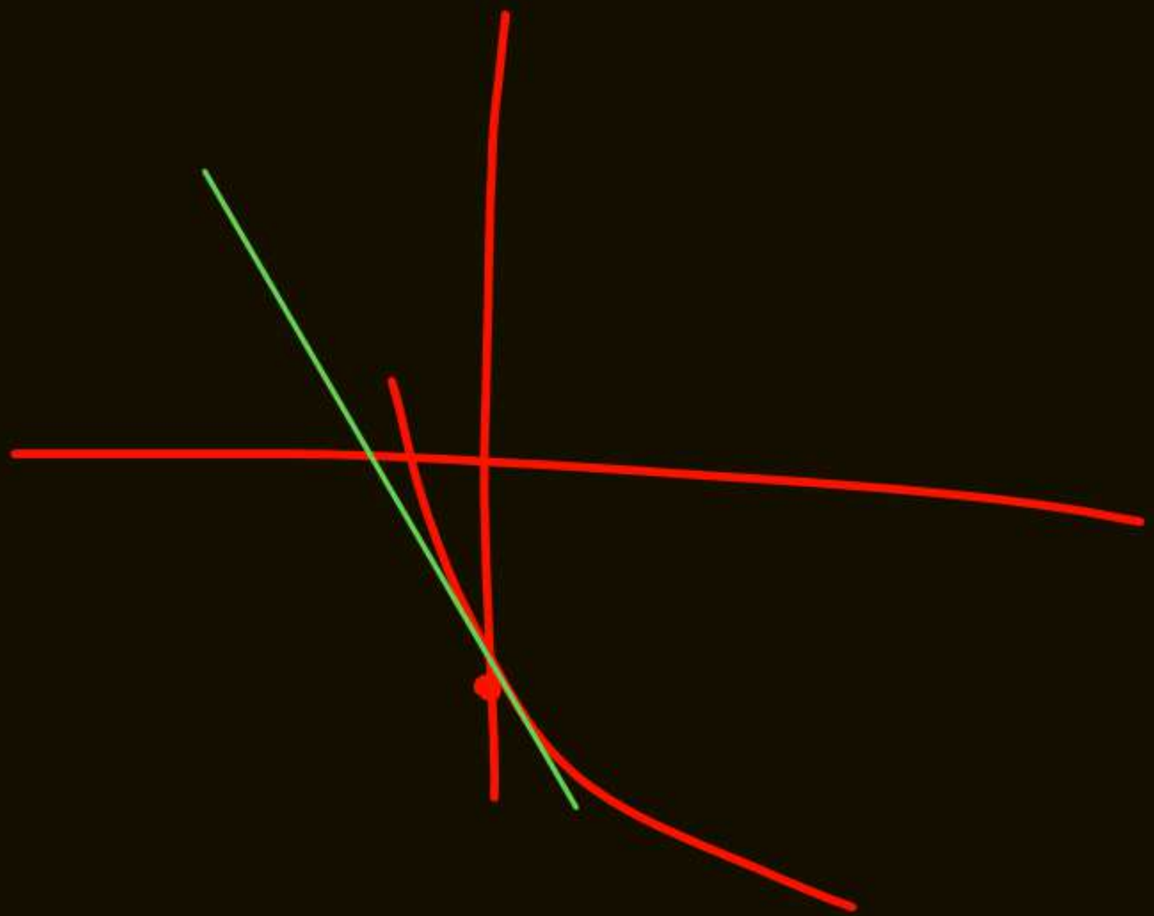
$m_1 m_2 = -1$

$-4 \times m_2 = -1$

$m_2 = 1/4$



Ans : (1)



$$\frac{dy}{dx}$$

Question - 24

Suppose that the radius r and area $A = \pi r^2$ of a circle are differentiable functions of t, equation that relates dA/dt to dr/dt is:

(1) $\frac{dA}{dt} = \pi r \frac{dr}{dt}$

(2) $\frac{dA}{dt} = \pi r^2 \frac{dr}{dt}$

(3) $\frac{dA}{dt} = 2\pi r^2 \frac{dr}{dt}$

(4) $\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$

$A = \pi r^2$

$\frac{dA}{dt} = \pi\, 2r \frac{dr}{dt}$

Ans : (4)

Question - 25

$y = 2u^3$, $u = 8x - 1$. Find $\frac{dy}{dx}$

(1) $48(8x-1)^2$ (2) $48(8x+1)^2$

(3) $48(8x-1)$ (4) $48(8x+1)$

$u = 8x - 1$

$8x = u + 1$

$x = \frac{u+1}{8}$

$\frac{dx}{du} = \frac{1}{8}(1+0) = \frac{1}{8}$

$\frac{dy}{du} = 6u^2$

$\frac{dx}{du} = \frac{1}{8}$

$\frac{dy/du}{dx/du} = \frac{6u^2}{1/8} = 48u^2 = 48(8x-1)^2$

Ans : (1)

Question - 26

$y = \sin u,\ u = 3x + 1$. Find $\frac{dy}{dx}$

(1) $3\cos(3x - 1)$ (2) $3\cos(3x + 1)$

(3) $3\sin(3x - 1)$ (4) $3\sin(3x + 1)$

$$\frac{dy}{du} = \cos u \qquad 3x = u - 1$$

$$\frac{dx}{du} = \frac{1}{3} \qquad x = \frac{1}{3}(u - 1)$$

$$\frac{dy}{dx} = 3\cos u = 3\cos(3x+1)$$

Ans : (2)

Question - 27

$y = 3t^2 - 1, x = t^2$. Find $\frac{dy}{dx}$.

(1) 3 (2) 2

(3) 1/3 (4) 1/2

$\frac{dy}{dt} = 6t$

$\frac{dx}{dt} = 2t$

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

Ans : (1)

Question - 28

Maximum and minimum values of function $y = 2x^3 - 15x^2 + 36x + 11$ respectively is:

(1) 39, 38 (2) 93, 83

(3) 45, 42 (4) 59, 58

$x=2, \quad y = 16 - 60 + 72 + 11 = 39$

$y' = 6x^2 - 30x + 36 = 0$

$x^2 - 5x + 6 = 0$

$\boxed{x = 2, 3} =$

Ans : (1)

Question - 29

Find out minimum/maximum value of $y = 1 - x^2$ also find out those points where value is minimum/maximum.

(1) max $2, x = -1$ (2) max $1, x = 0$

(3) min $1, x = -1$ (4) min $2, x = 0$

$y' = 0 - 2x = 0$

$x = 0$

$y'' = -2 < 0 \rightarrow x = 0$ पर max $\Rightarrow y_{max} = 1$

Ans : (2)

Question - 30

For $y = (x - 2)^2$, what is the maximum/minimum value and the point at which y is maximum/minimum?

(1) max 2, $x = 0$ (2) max 0, $x = 0$

(3) min 1, $x = -1$ (4) min 0, $x = 2$

$y_{min} = 0$, जब $x = 2$

Ans : (4)

Question - 31

Particle's position as a function of time is given by $x = -t^2 + 4t + 4$, find the maximum value of position co-ordinate of particle.

(1) 2 (2) 4

(3) –8 (4) 8

$x_{max} = ?$

$x' = 0$

$-2t + 4 = 0$

$t = 2$

Ans : (4)

Question - 32

Find minimum value of the function:

$y = 25x^2 + 5 - 10x$

(1) 4 (2) 3

(3) 2 (4) 1

Ans : (1)

Question - 33

Determine the position where potential energy will be minimum if $U(x) = 100 - 50x + 1000x^2$.

(1) 0.25×10^{-2}
(2) 2.5×10^{-2}
(3) 2.5×10^{-1}
(4) 250×10^{-2}

$-50 + 2000x = 0$

$x = \frac{50}{2000} = \frac{1}{40} = \frac{100}{40} \times 10^{-2}$

$= 2.5 \times 10^{-2}$

Ans : (2)

Question - 34

Find out minimum/maximum value of $y = 4x^2 - 2x + 3$ also find out those points where value is minimum/maximum.

(1) $\min = \frac{11}{4}, x = \frac{1}{2}$

(2) $\max = \frac{11}{4}, x = \frac{1}{4}$

(3) $\min = \frac{11}{4}, x = \frac{1}{4}$

(4) $\max = \frac{11}{4}, x = \frac{1}{2}$

$8x - 2 = 0$

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

min

Ans : (3)

Question - 35

$\int\left(x^2-2x+1\right)dx$ will be

(1) $\frac{x^3}{3}-x^2-x+C$

(2) $\frac{x^3}{3}-x^2+x+C$

(3) $\frac{x^3}{3}+x^2-x+C$

(4) $\frac{x^3}{3}+x^2+x+C$

$\frac{x^3}{3}-2\frac{x^2}{2}+x+c$

Ans : (2)

Question - 36

$\int(-3x^{-4})dx$ will be:

(1) $x^{-3}+C$ (2) $x^{3}+C$

(3) $-3x^{-3}+C$ (4) $3x^{-3}+C$

$$-3\times\frac{x^{-4+1}}{-4+1} = \underline{\underline{x^{-3}}}$$

Ans : (1)

Question - 37

$\int\left(\frac{5}{x^2}\right)dx$ will be:

(1) $-\frac{5}{x}+C$

(2) $\frac{5}{x}+C$

(3) $\frac{x}{5}+C$

(4) $-\frac{x}{5}+C$

$5\,\frac{x^{-2+1}}{-2+1}$

Ans : (1)

Question - 38

$\int\left(\frac{3}{2\sqrt{x}}\right)dx$ will be:

(1) $2\sqrt{x^3}+C$

(2) $3\sqrt{x}+C$

(3) $\sqrt{x^3}+C$

(4) $\sqrt{x^4}+C$

$\frac{3}{2}\int x^{-\frac{1}{2}}dx$

$\frac{3}{2}\cdot\frac{\sqrt{x}}{\frac{1}{2}}$

Ans : (2)

Question - 39

$\int\left(\frac{1}{3\sqrt[3]{x}}\right)dx$ will be

(1) $\frac{x^{\frac{3}{4}}}{2}+C$

(2) $\frac{x^{\frac{2}{3}}}{3}+C$

(3) $x^{\frac{2}{3}}+C$

(4) $\frac{x^{\frac{2}{3}}}{2}+C$

$$\frac{1}{3}\int x^{-\frac{1}{3}}dx = \frac{1}{3}\,\frac{x^{-\frac{1}{3}+1}}{-\frac{1}{3}+1}$$

$$= \frac{1}{\cancel{3}}\times\frac{x^{2/3}}{\frac{2}{\cancel{3}}}$$

$$= \frac{1}{2}\cdot x^{2/3}$$

Ans : (4)

Question - 40

$\int (3\sin x)dx$ will be

(1) $+3\cos x + C$

(2) $+4\cos x + C$

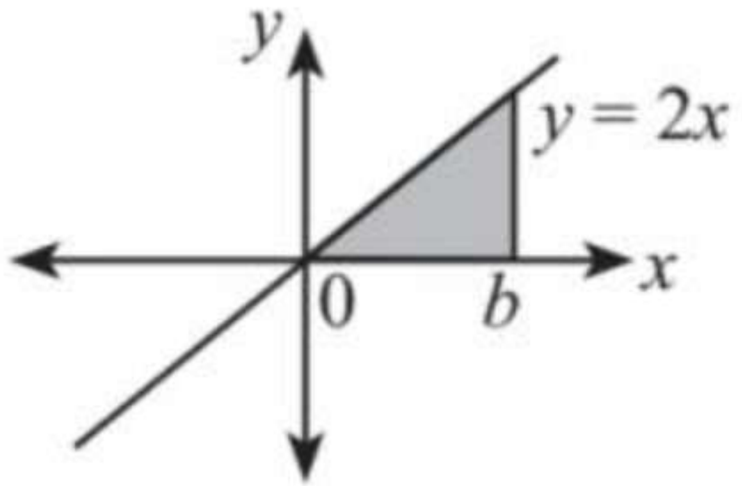
(3) $-3\cos x + C$

(4) $-4\cos x + C$

Ans : (3)

Question - 41

Use a definite integral to find the area of the region between the given curve $y = 2x$ and the x-axis on the interval $[0, b]$.



(1) b^2 (2) b^3

(3) $2b^2$ (4) $\frac{b^3}{3}$

$$\int y\,dx = \int_0^b 2x\,dx$$

$$= 2 \times \frac{x^2}{2}\Big|_0^b$$

$$= b^2 - 0$$

Ans : (1)

Question - 42

Find $\frac{dy}{dx}$ and $\frac{dy}{dt}$.

(1) $y = \sin^2(x^2 + 5x)$

(2) $y = \sin^3(x^3 + 3x^2)$

(3) $y = ln\,(x^2 + 2)$

(2) $\frac{dy}{dx} = 3\sin^2(x^3+3x^2) \times \cos(x^3+3x^2) \times (3x^2+6x)$

$\frac{dy}{dt} = [\quad] \times \frac{dx}{dt}$

(3) $\frac{dy}{dx} = \frac{1}{x^2+2} 2x$

(1) $\frac{dy}{dx} = 2\sin(x^2+5x) \times \cos(x^2+5x)(2x+5)$

$\frac{dy}{dt} = (\quad) \times \frac{dx}{dt}$

Question - 43

Find slope of tangent at $x = 2$ in following curve.

(a) $y = x^2$

(b) $y = x^3$

(c) $y = x^2 - 5x + 6$

(d) $y = 4x^3 - 3x^2 + 10$

(e) $y = e^{-x}$

(f) $y = e^x$

y' at $x = 2$

(1) $y' = 2x$ Ans $y' = 4$

(2) $y' = 3x^2$ Ans $y' = 12$

(3) $y' = 2x - 5$ Ans $y' = -1$

(4) $y' = 12x^2 - 6x$ Ans $\Rightarrow 36 = y'$

(5) $y' = e^{-x} \times -1$

$x = 2$ $y' = -e^{-2}$

(6) $y' = e^2$

Question - 44

Find slope of tangent at $x = \pi/2$

(a) $y = \sin x$

(b) $y = \sin^2 x$

(c) $y = \cos x$

(d) $y = \tan x$

(e) $y = \sin x + \cos x$

Ans

(a) $y' = \cos x$ — 0

(b) $y' = 2\sin x \cos x$ — 0

(c) $y' = -\sin x$ — -1

(d) $y' = \sec^2 x$ — ∞

(e) $\cos x - \sin x$ — $0 - 1$

Question - 45

If $i = i_0(1 - e^{-t})$.

Find rate of charge of current at $t = 1$sec wrt tin

$$i = i_0 - i_0 e^{-t}$$

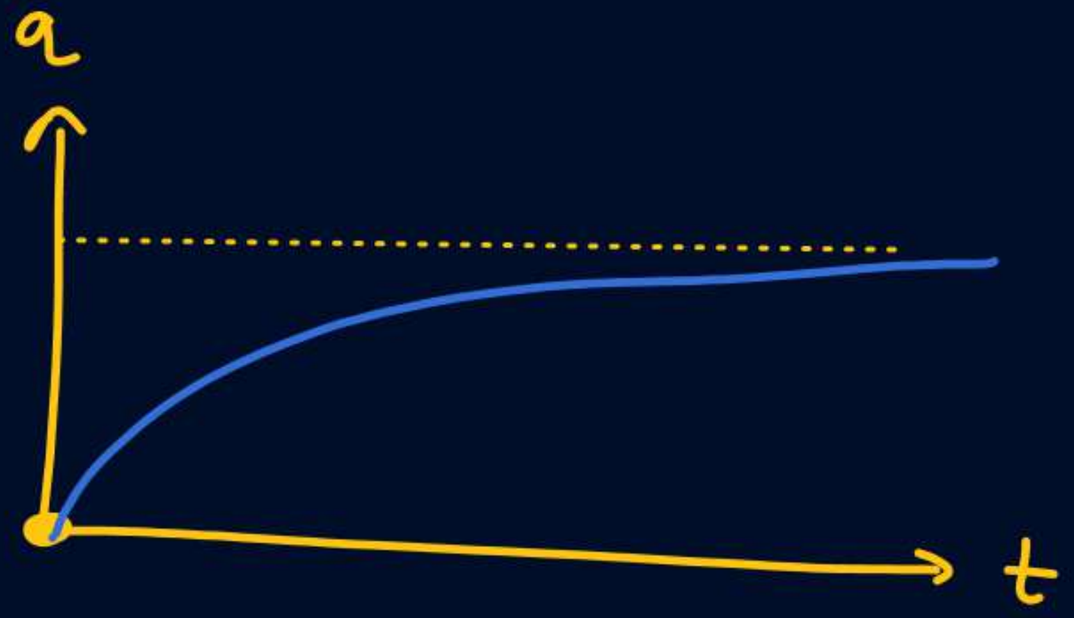
$$\frac{di}{dt} = 0 + i_0 e^{-t} \times 1$$

$$i_0 e$$

Question - 46

If $q = 50(1 - e^{-2t})$. Draw 'q' vs 't' graph also find current at $t = 0$. $\left(\text{use } i = \dfrac{dq}{dt}\right)$

$t \to \infty \quad q = 50(1 - e^{-\infty})$

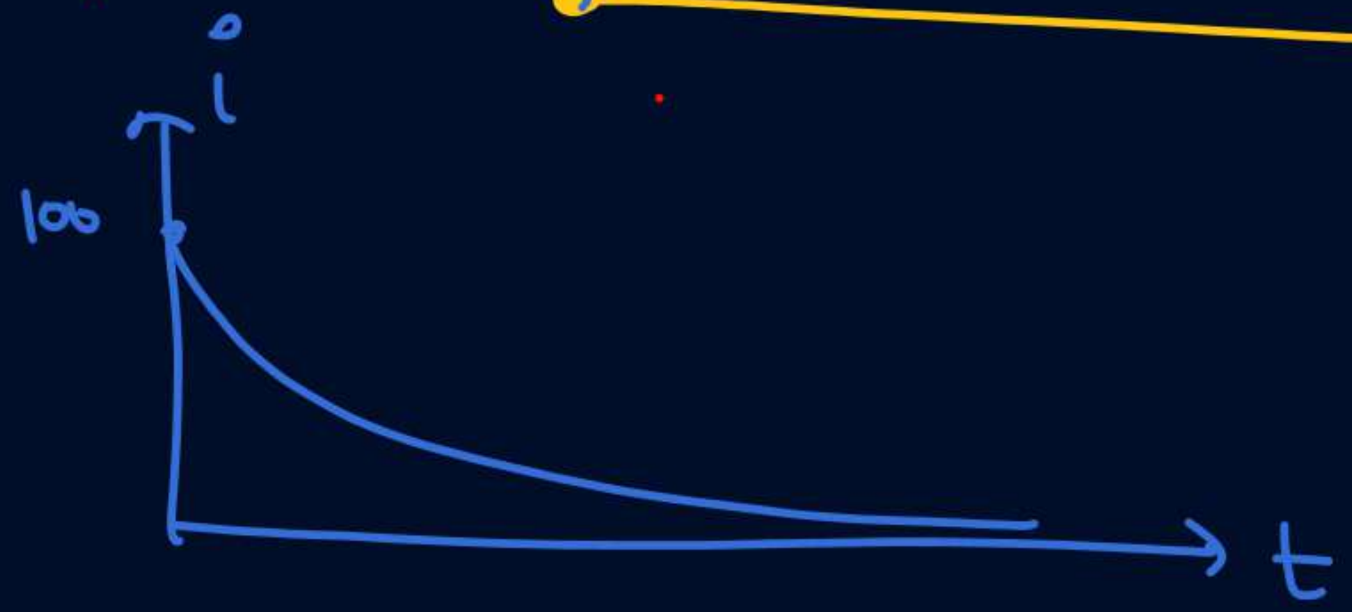


$$i = \frac{dq}{dt} = 50\left(0 - e^{-2t}\cdot(-2)\right)$$

$$= 50 \times 2 e^{-2t}$$

$$\boxed{i = 100 e^{-2t}}$$

$$i = 100$$



Question - 47

$81-4\times5\times3 = 21$

If particle is moving on x-axis such that $x = 5t^2 - 9t + 3$. Find x_{max} and plot the x-t graph.

$x = 5\left(t^2 - \frac{9}{5}t + \frac{3}{5}\right)$

$x = 5\left(\left(t - \frac{9}{10}\right)^2 - \frac{81}{100} + \frac{3}{5}\right)$

$x = 5t^2 - 9t + 3$

$\frac{dx}{dt} = 10t - 9$

$\frac{d^2x}{dt^2} = 10 > 0$ minima

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

$t = \frac{9}{10}$

$x = 5 \times \frac{81}{100} - 9 \times \frac{9}{10} + 3$

$x = \frac{405}{100} - \frac{810}{100} + \frac{300}{100} = \frac{-105}{100}$

Ans ∞

$$x = 5t^2 - 9t + 3$$

$$x = 5\left(t^2 - \frac{9}{5}t + \frac{3}{5}\right)$$

$$x = 5\left(t^2 + \frac{81}{100} - \frac{9t}{5} - \frac{81}{100} + \frac{3}{5}\right)$$

$$x = 5\left(\left(t - \frac{9}{10}\right)^2 - \frac{81}{100} + \frac{3}{5}\right)$$

$$x = 5\left(t - \frac{9}{10}\right)^2 - \frac{405}{100} + \frac{15}{5}$$

max

Question - 48

If $y=\dfrac{\sin x}{x+\cos x}$, then find $\dfrac{dy}{dx}$. at $x=\pi/2$

$$\frac{(x+\cos x)\cos x-\sin x(1-\sin x)}{(x+\cos x)^2}=\frac{0-1(1-1)}{(\pi/2+0)}=0$$

Ans : (0)

Question - 49

If $y = 4e^{x^2-2x}$, find $\frac{dy}{dx}$

$4\ e^{x^2-2x} \times (2x-2)$

Ans : $8(x-1)e^{x^2-2x}$

Question - 50

If $y = (x^2 + 1)^{1/2}$, find $\frac{dy}{dx}$

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

$= \frac{x}{\sqrt{x^2+1}}$

Ans : $\frac{x}{(x^2+1)^{1/2}}$

Question - 51

Find the derivative of $y = \sin(x^2 - 4)$.

$\cos(x^2-4) \times 2x$

Question - 52

If $y = \cos^2 x$, then find $\frac{dy}{dx}$.

$2\cos x \cdot (-\sin x)$

$= -2\sin x \cos x$

$= -\sin 2x$

Ans : $-\sin 2x$

Question - 53

If $y = \cos x^3$, then find $\frac{dy}{dx}$.

$-(\sin x^3) \times 3x^2$

Ans : $-3x^2 \sin x^3$

Question - 54

If $x = at^4$, $y = bt^3$, then find $\frac{dy}{dx}$.

$$\frac{dy}{dt} = 3bt^2$$

$$\frac{dx}{dt} = 4at^3$$

$$\frac{dy}{dx} = \frac{3b}{4a} \cdot \frac{1}{t}$$

Ans : $\frac{3b}{4at}$

Question - 55

If $f(x) = x \cos x$, find $f''(x)$.

$-x \sin x + \cos x \cdot \times 1$

$f'(x) \quad x(-\sin x) + \cos x$

$f'(x) = \cos x - x \sin x$

$f''(x) = -\sin x - [x \cos x + \sin x \times 1]$

$= -\sin x - x \cos x - \sin x$

$= -2 \sin x - x \cos x$

Ans : $-x \cos x - 2 \sin x$

Question - 56

The position of a particle as a function of time is given as $x = 5t^2 - 9t + 3$. Here x is in metre and t is in sec. Find the maximum/minimum value of position of the particle and plot the graph.

Qus 47

Ans : –1.05 m

Question - 57

A particle starts from rest and its angular displacement (in rad) is given by $\theta = \frac{t^2}{20} + \frac{t}{5}$.

Calculate the angular velocity at the end of $t = 4$ s.

$\omega = \frac{d\theta}{dt}$

$\frac{2t}{20} + \frac{1}{5}$

$\frac{t}{10} + \frac{1}{5} = \frac{4}{10} + \frac{2}{5 \times 2} = \frac{6}{10} = .6$

Ans : 0.6 rad/s

Question - 58

A metallic disc is being heated. Its area A (in m^2) at any time t (in second) is given by $A = 5t^2 + 4t + 8$. Calculate the rate of increase in area at $t = 3$ s.

$$\frac{dA}{dt} = 10t + 4$$

34

Ans : $34\ m^2/s$.

Question - 59

Integrate $\int \left(2\cos x + 6x^2\right) dx$

$$2\sin x + 6\frac{x^3}{3} + c$$

Ans : $2 \sin x + 2x^3 + c$

Question - 60

A stone is dropped into a quiet lake and waves moves in circles at the speed of 5 cm/s. At the instant when the radius of circular wave is 8 cm, how fast is the enclosed area increasing?

$$A = \pi r^2$$

$$\frac{dA}{dt} = \pi \, 2r \frac{dr}{dt}$$

$$= \pi \times 2 \times 8 \times 5$$

$$= 80\pi \, (cm)^2/sec$$

$$\frac{dr}{dt} = 5 \text{ cm/sec}$$

Ans : $80\pi \text{ cm}^2/\text{s}$

Question - 61

If $y = 3t^2 - 4t$, then find minima of y.

$y' = 6t - 4 = 0$

$y'' = 6 > 0$ min

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

$y = 3 \times \left(\frac{2}{3}\right)^2 - 4 \times \frac{2}{3}$

$= \frac{4}{3} - \frac{8}{3} = \frac{-4}{3}$

Ans : $-\frac{4}{3}$

Question - 62

Find maximum and minimum value of y in $y = x^3 - 6x^2 + 9x + 15$

$y' = 3x^2 - 12x + 9$

$y'' = 6x - 12$

$y' = 0$

$x^2 - 4x + 3 = 0$

$x = 1, 3$

$\boxed{x = 1,\ y'' = -6 < 0 \text{ max}}$

$\boxed{x = 3,\ y'' = 6 > 0 \text{ min}}$

$x = 1,\ y_{max} = 1 - 6 + 9 + 15$

$= \underline{19}$

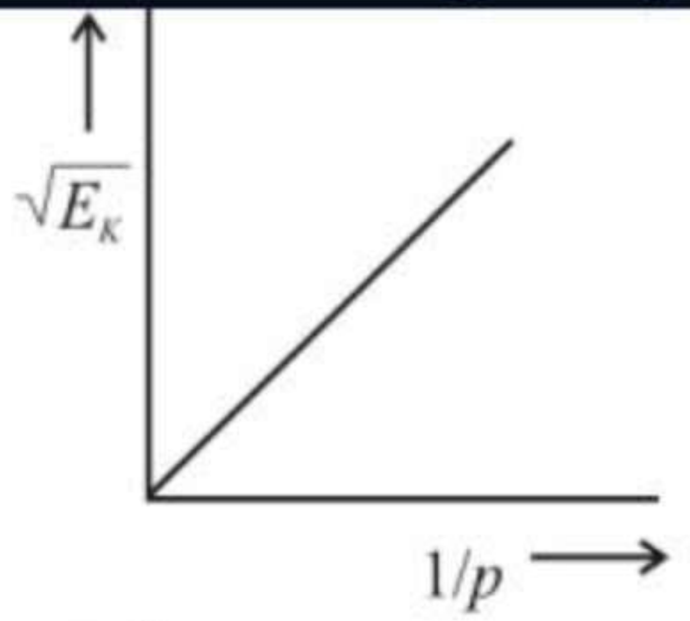
Ans : 19, 15

Question - 63

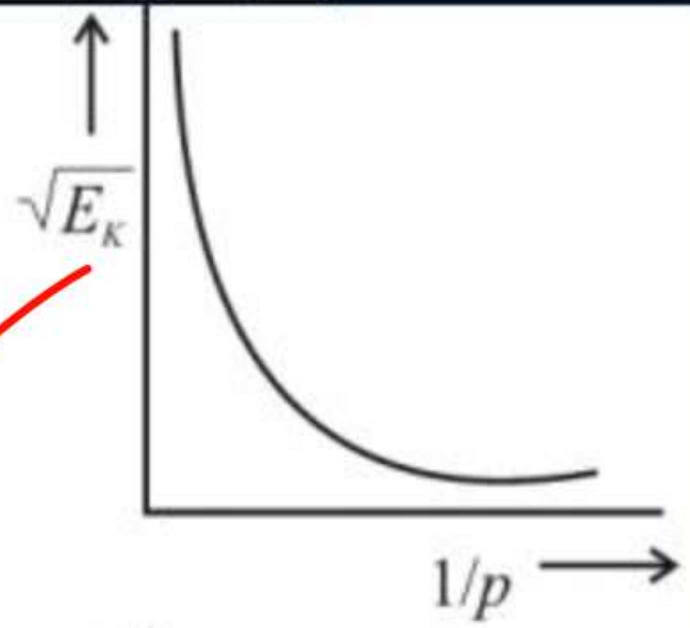
The graph between $\sqrt{E_K}$ and $\frac{1}{p}$ is

(E_K = kinetic energy and p = momentum)

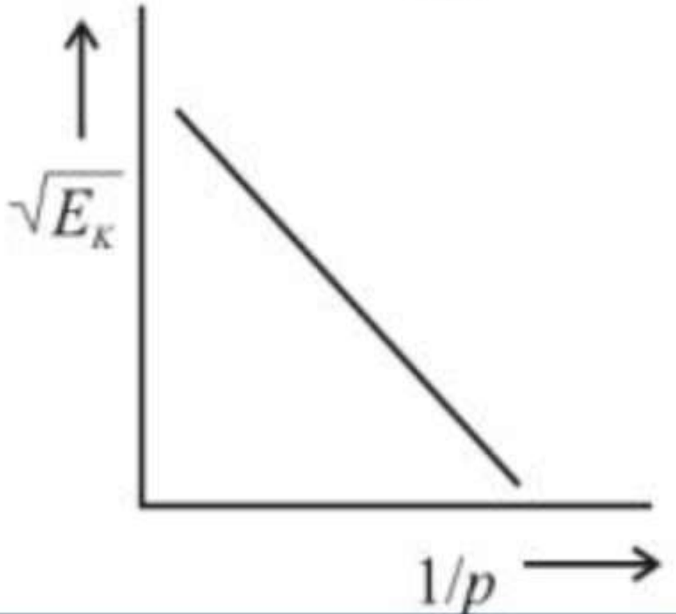
(1)



(3) ✓



(2)



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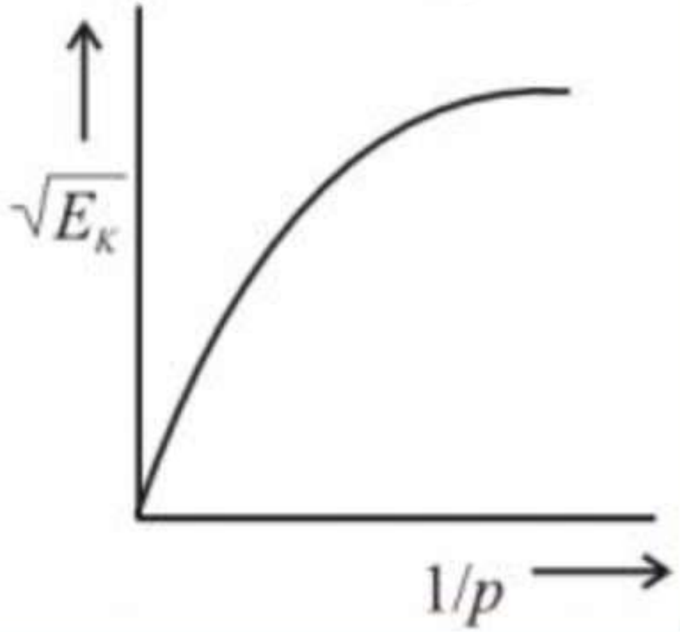


$\frac{1 \cdot \sqrt{K}}{p} = \frac{1}{\sqrt{2m}}$ $\quad yx = \text{const}$

$KE = \frac{1}{2}\frac{m^2v^2}{m} = \frac{p^2}{2m}$

$K = \frac{p^2}{2m}$ $\quad \frac{1}{p} \equiv x$

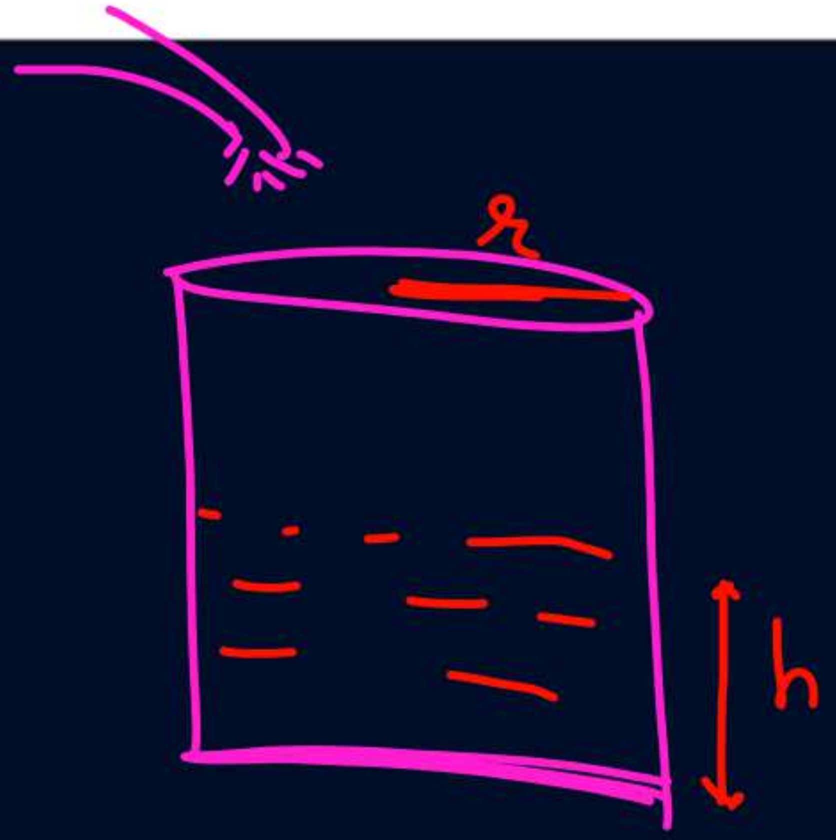
$\sqrt{K} = \frac{p}{\sqrt{2m}} =$ $\quad p \equiv \frac{1}{x}$

$xy = \frac{1}{\sqrt{2m}}$

Ans : (3)

Question - 64

Water pours out at the rate of Q from a tap, into a cylindrical vessel of radius r. The rate at which the height of water level rises when the height is h, is ______.



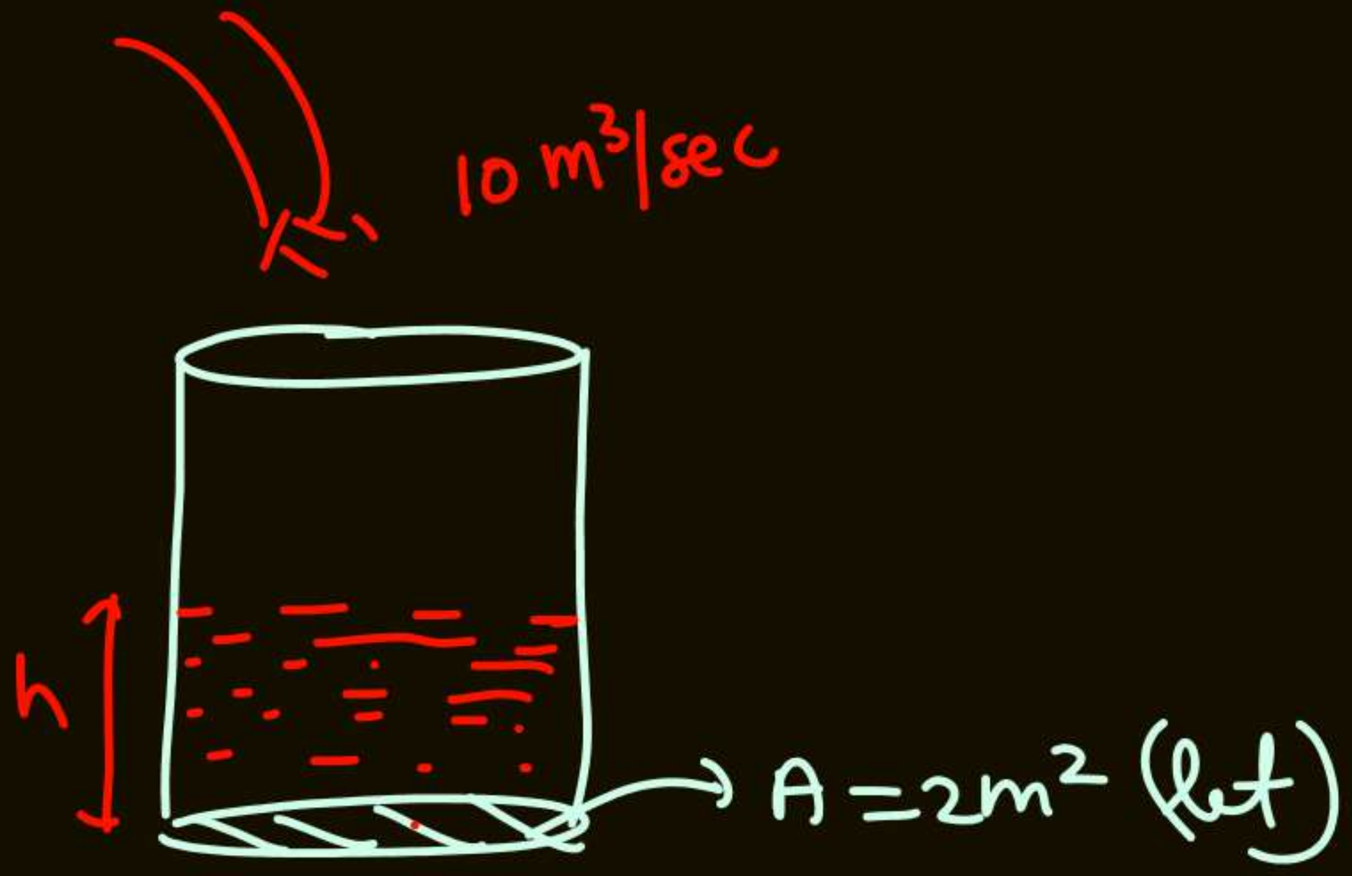
$V = \text{vol}^n = \pi r^2 h$

$\frac{dV}{dt} = \pi r^2 \frac{dh}{dt}$

$Q = \pi r^2 \frac{dh}{dt}$

$\frac{dh}{dt} = \frac{Q}{\pi r^2}$

Ans : $\frac{dh}{dt} = \frac{Q}{\pi r^2}$


10 m³/sec
h
A = 2m² (let)

Question - 65

Stress-strain curve for four metals are shown in figure. The maximum Young's modulus of elasticity for metal, is:

Use (stress = y strain)

y → young's modulus

$x = y\,y$

(1) A

(2) B

(3) C

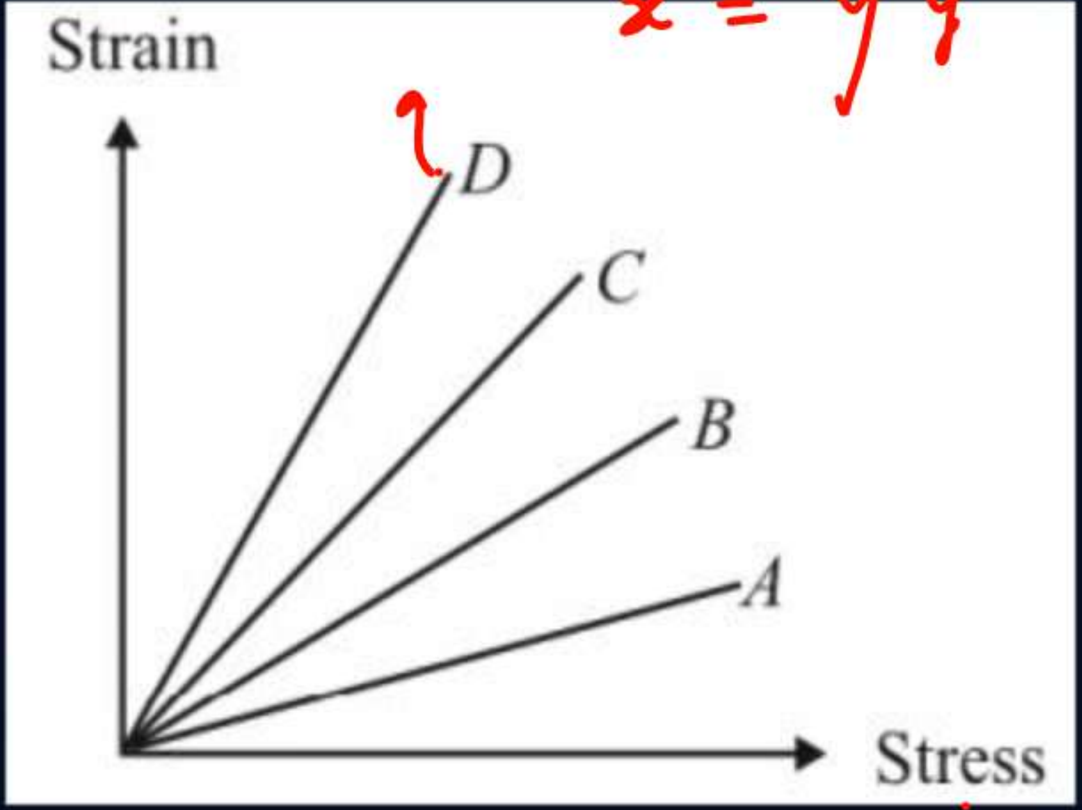
(4) D

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

$\boxed{\text{Slope} \uparrow = y \downarrow}$

stress = y strain

$x = y\,y$

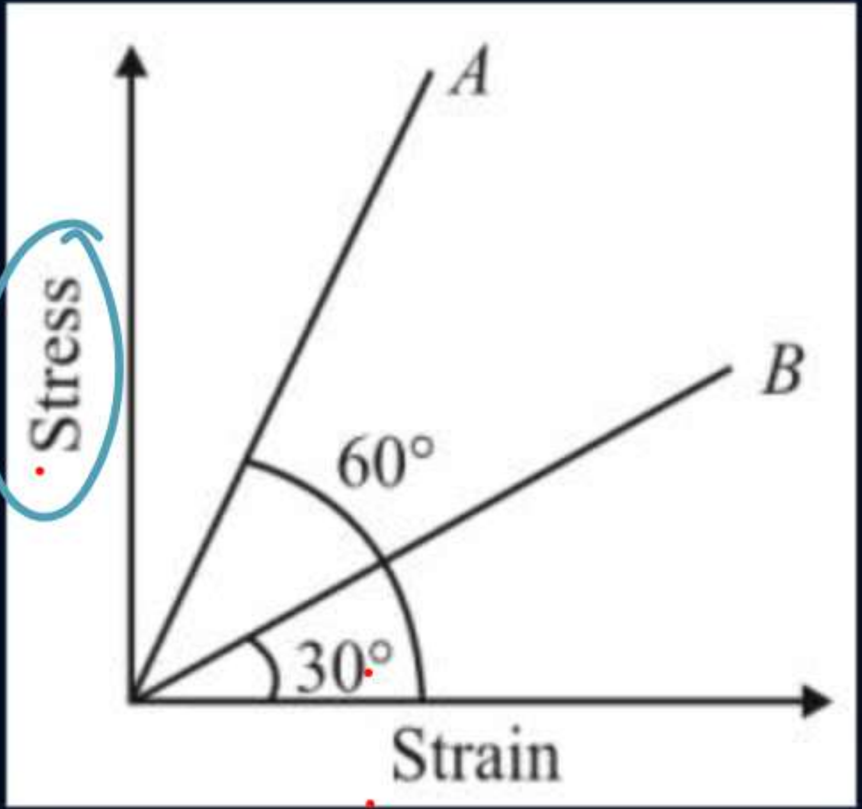


$Y_D < Y_C < Y_B < Y_A$

Ans : (*)

Question - 66

The stress versus strain graphs for wires of two materials A and B are as shown in the figure. If Y_A and Y_B are the Young's moduli of the materials, then



(1) $Y_B = 2Y_A$

(2) $Y_A = Y_B$

(3) $Y_B = 3Y_A$

(4) $Y_A = 3Y_B$

Stress = Y strain

$y = Y x$

$m = \text{slope} = Y$

$\frac{(\text{slope})_A}{(\text{slope})_B} = \frac{Y_A}{Y_B}$

$\frac{\tan 60}{\tan 30} = \frac{Y_A}{Y_B}$

$\frac{\sqrt{3}}{\frac{1}{\sqrt{3}}} = 3 = \frac{Y_A}{Y_B}$

$\boxed{Y_A = 3Y_B}$

Ans : (4)

Question - 67

From amongst the following curves, which one shows the variation of the velocity v with time t for a small sized spherical body falling vertically in a long column of a viscous liquid?

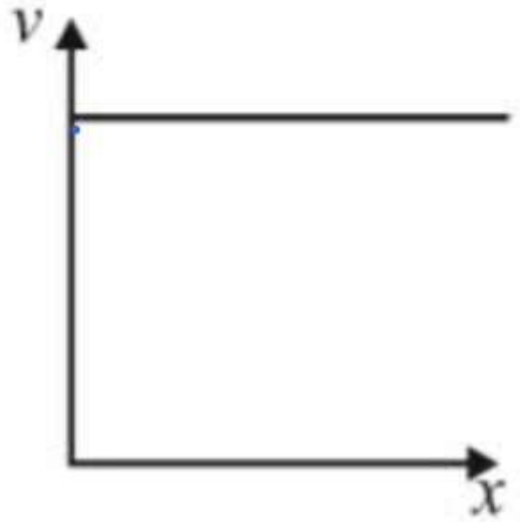
If $V = V_0(1 - e^{-kt})$

$V = V_0(1 - e^{-kt})$

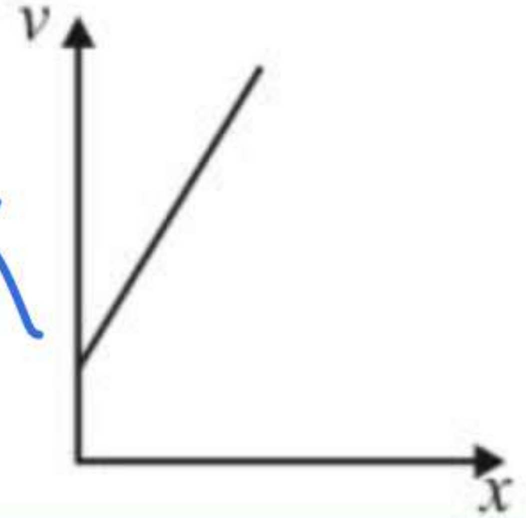
$t = 0$

$V = V_0(1 - e^{0})$

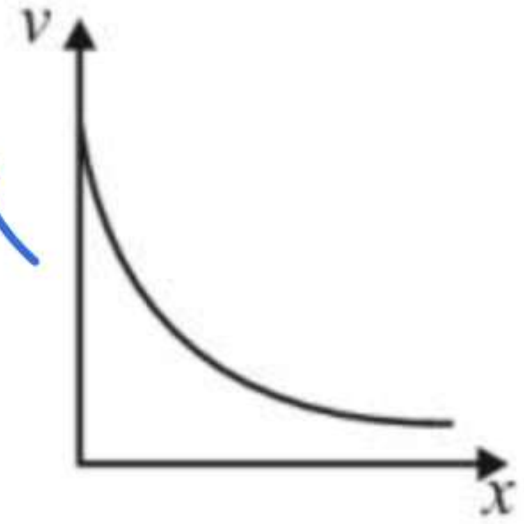
(1)



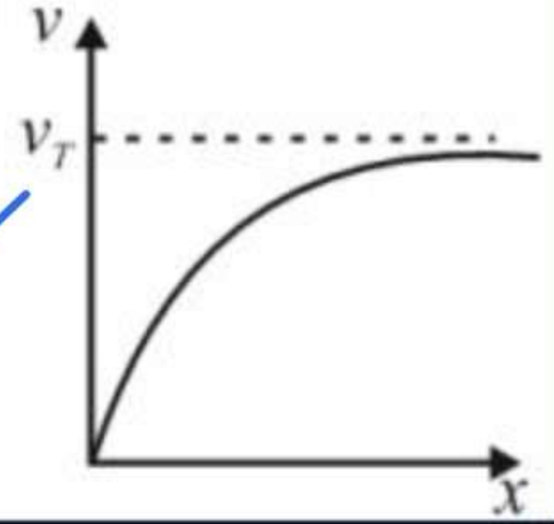
(2)



(3)



(4)

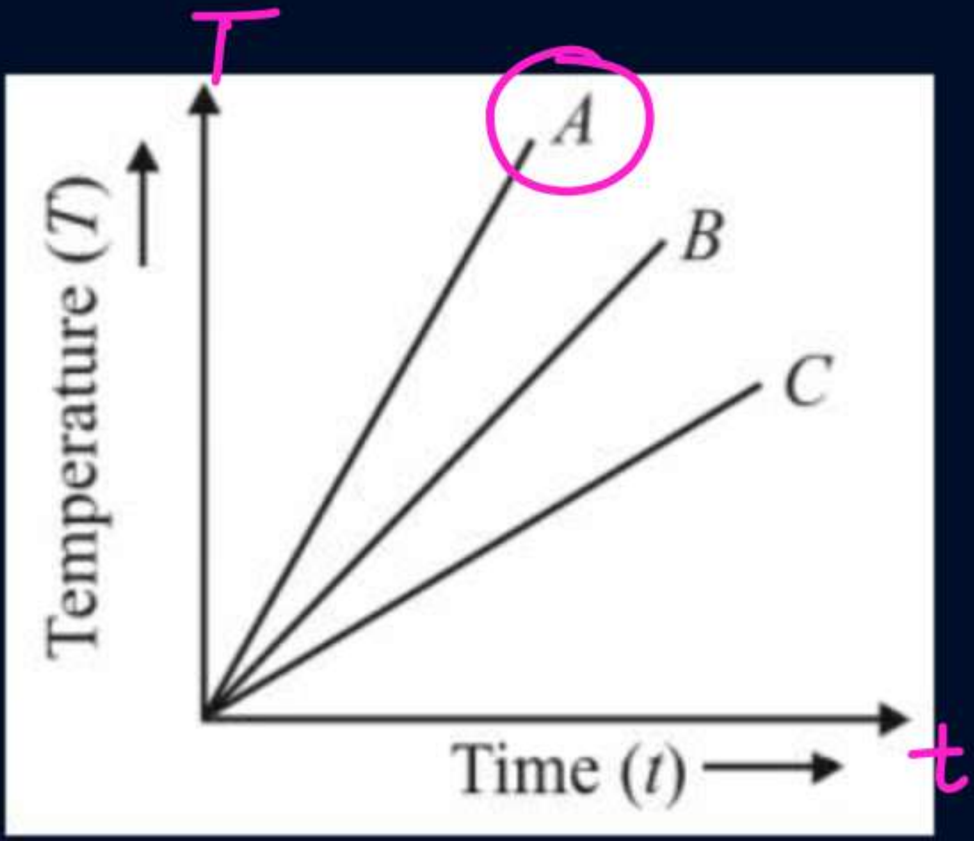


Ans : (4)

Question - 68

The temperature versus time graph is shown in figure. Which of the substance A, B and C has the lowest heat capacity, if heat is supplied to all of them at equal rates? Use $\left(\frac{dQ}{dt} = ms\frac{dT}{dt}\right)$

$\boxed{\text{Heat capacity} = ms}$ = K(let)



(1) A
(2) B
(3) C
(4) All have equal specific heat

same

$$\frac{d\theta}{dt} = \boxed{ms\frac{dT}{dt}}$$

$$\frac{dT}{dt} = \text{slope}$$

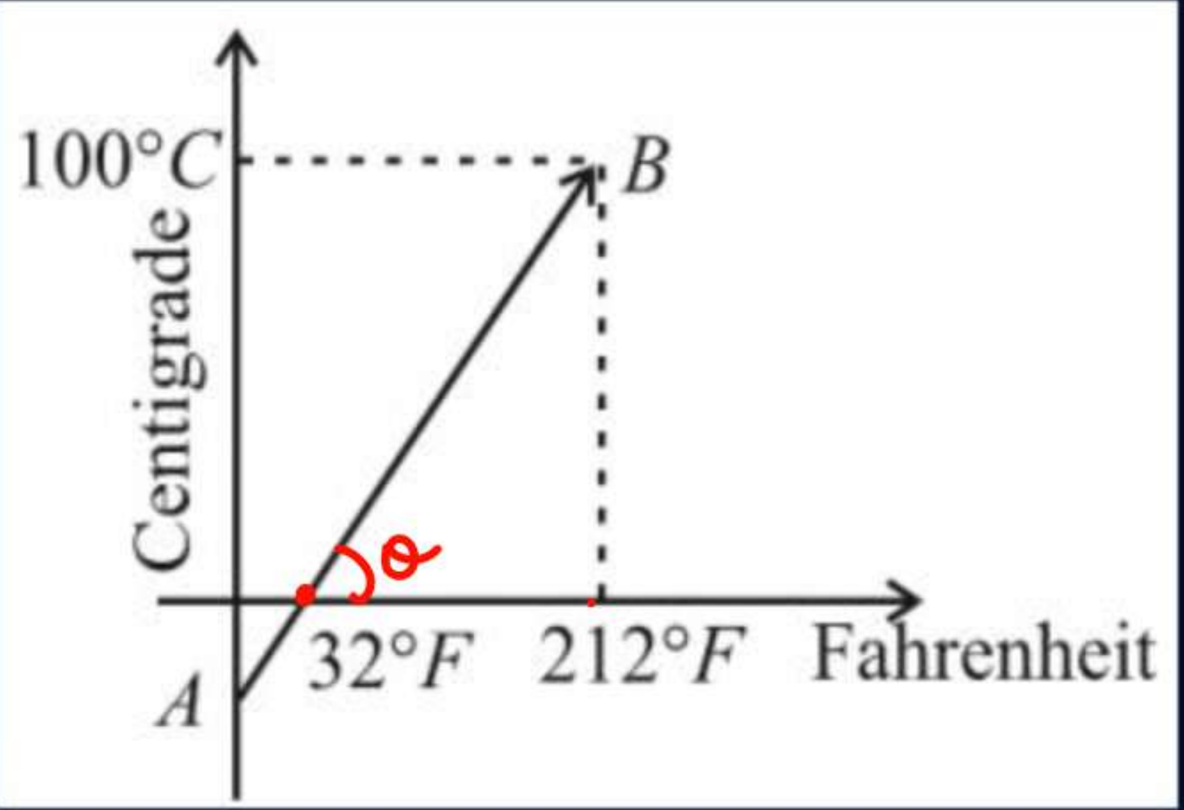
heat cap. × slope = same

slope ↑ ≡ h.c. ↓

Ans : (1)

Question - 69

The graph AB shown in figure is a plot of temperature of a body in degree celsius and degree fahrenheit, then



(1) slope of line AB is 9/5

(2) slope of line AB is 5/9

(3) slope of line AB is 1/9

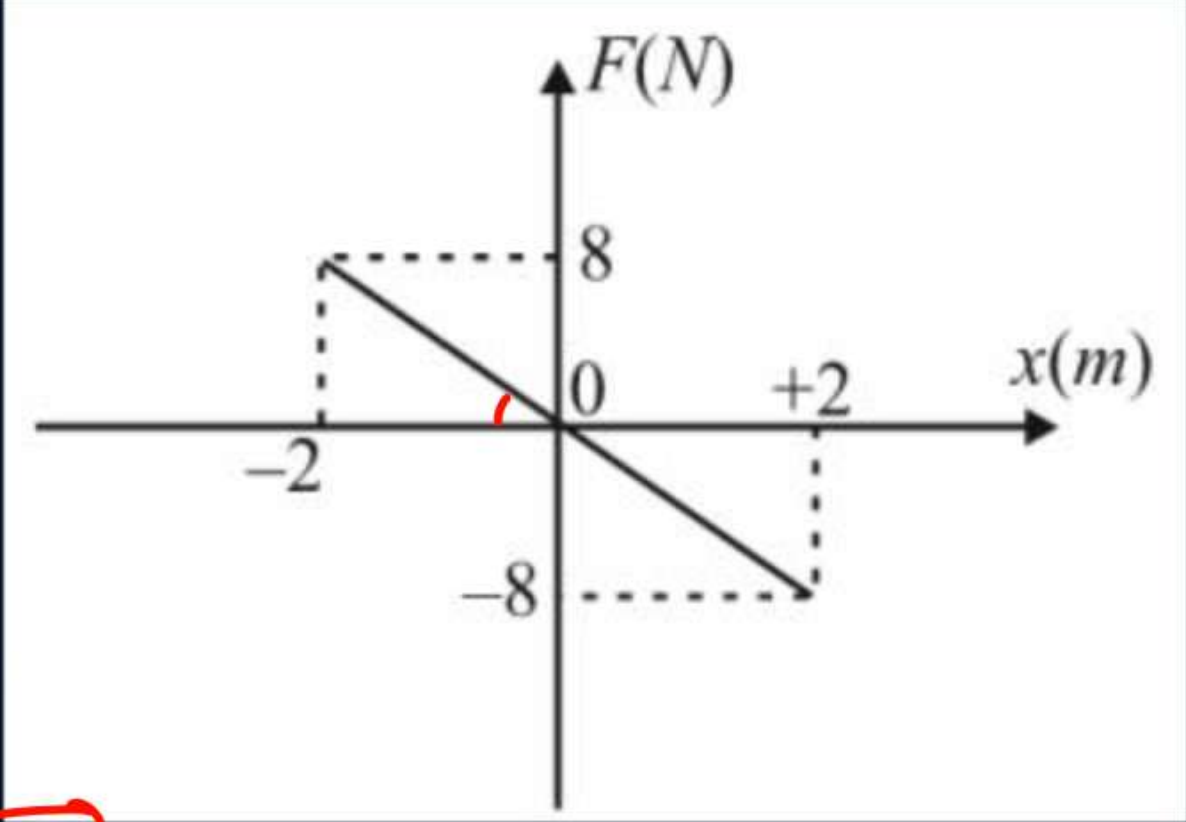
(4) slope of line AB is 3/9

$$\frac{100}{212-32} = \frac{100}{180}$$

Ans : (2)

Question - 70

A body of mass 0.01 kg executes simple harmonic motion (SHM) about $x = 0$ under the influence of a force as shown in figure. The period of the SHM is: $\boxed{\text{Use } \vec{F} = -k\vec{x}\ ,\ T = 2\pi\sqrt{\frac{m}{k}}}$



(1) 1.05 s

(2) 0.52 s

(3) 0.25 s

(4) 0.31 s

$\vec{F} = -4\vec{x}$

$\vec{F} = -k\vec{x}$

slope =

$T = 2\pi\sqrt{\frac{.01}{4}}$

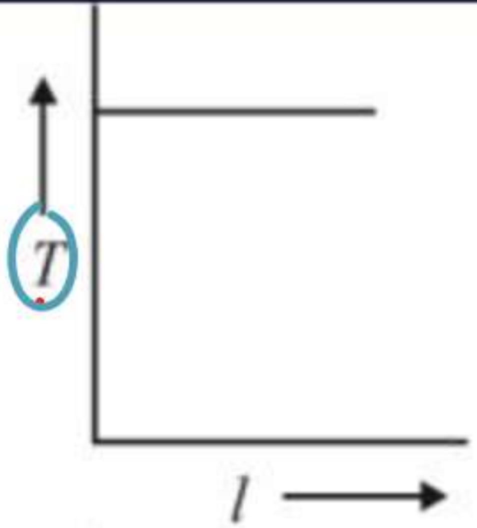
$T = \frac{2\pi}{20} = \frac{\pi}{10}$

Ans : (*)

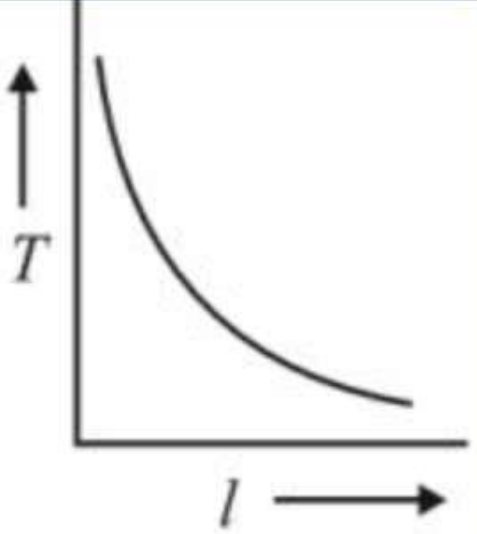
Question - 71

In case of a simple pendulum, time period versus length is depicted by: Use $T = 2\pi\sqrt{\frac{l}{g}}$.

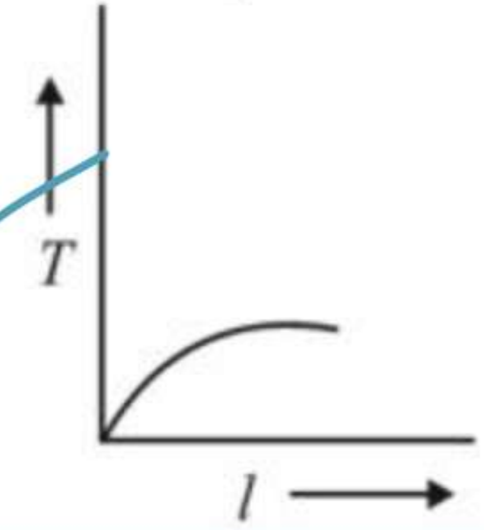
(1)



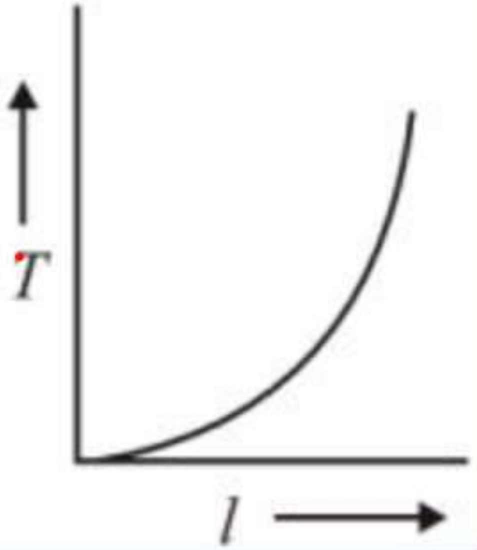
(3)

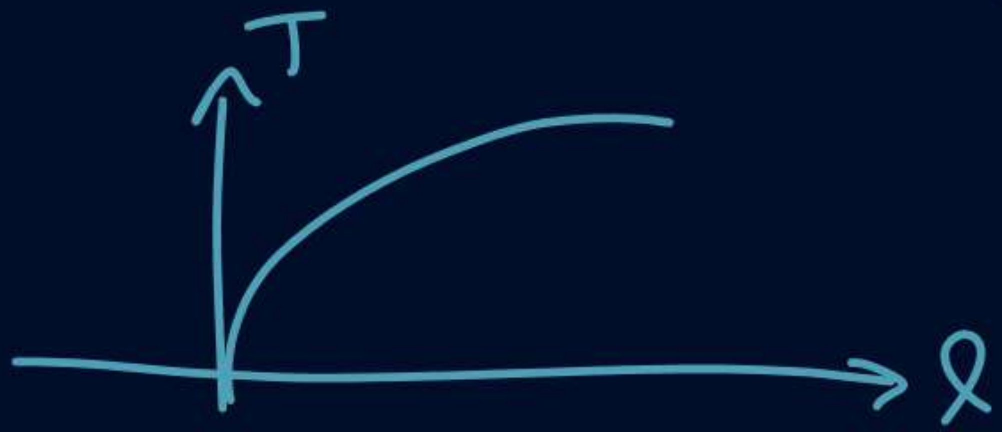


(2)



(4)





$$T^2 = \frac{4\pi^2 l}{g}$$

$$y^2 = \frac{4\pi^2}{g} x$$

Ans : (2)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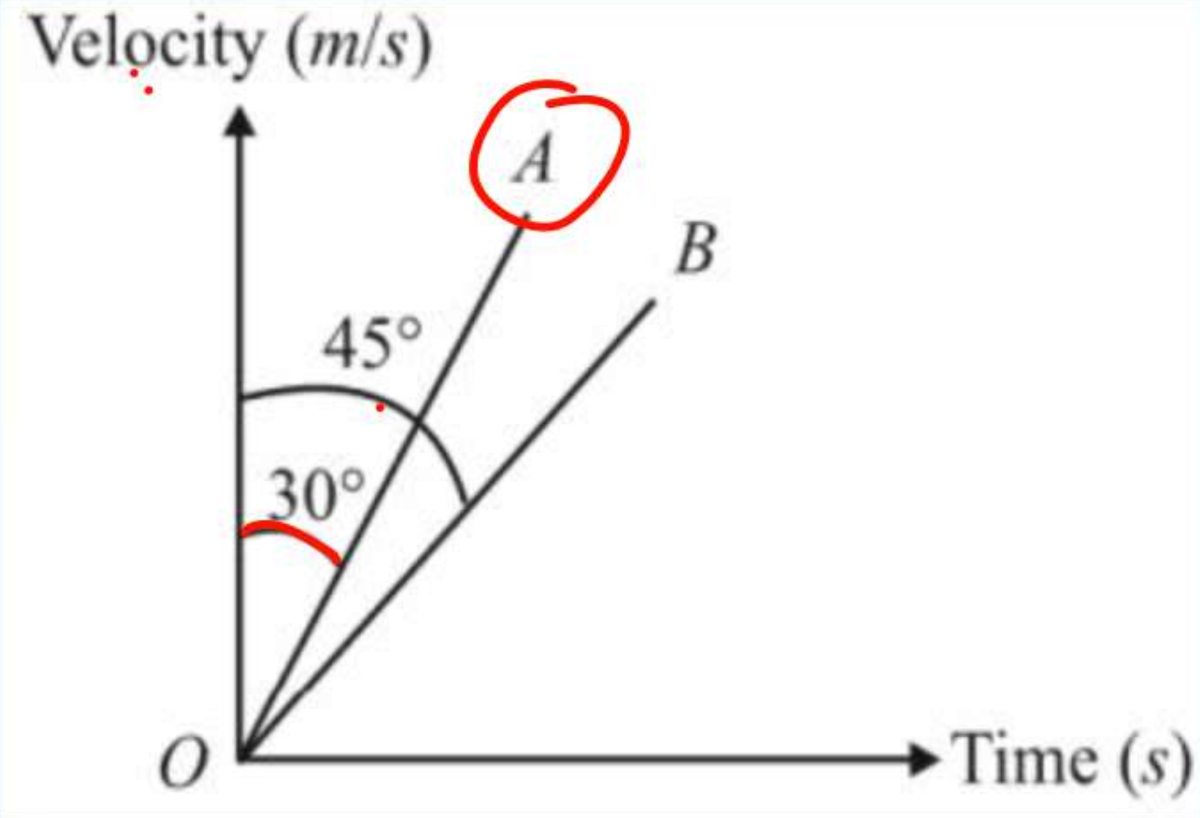
Question - 72

Two graphs between velocity and time of particles A and B are given. The ratio of their acceleration $\frac{a_A}{a_B}$ is: $\left(\text{use } a = \frac{dv}{dt}\right)$ = slope $\frac{dv}{dt} \equiv \frac{dy}{dx}$



(1) $\frac{\sqrt{3}}{2}$

(2) $\frac{1}{\sqrt{3}}$

(3) $\sqrt{3}$

(4) $\frac{2}{\sqrt{3}}$

$$\frac{a_A}{a_B} = \frac{(\text{slope})_A}{(\text{slope})_B} = \frac{\tan 60}{\tan 45} = \frac{\sqrt{3}}{1}$$

Ans : (*)

THANK
YOU