DPP – 6 (Basic Maths)

Video Solution on Website:- https://physicsaholics.com/home/courseDetails/36

Video Solution on YouTube:- https://youtu.be/fHeqMPCzWMI

Written Solution on Website:- https://physicsaholics.com/note/notesDetalis/70

Q 1. x varies with time as: $x = (3t^2 - 2)$, then minimum value of x is:
(a) 2 (b) -2 (c) zero (d) $-\infty$

Q 2. Maximum value of $y = 3\sin x + 4\cos x$ is:
(a) 5 (b) $\frac{5}{\sqrt{2}}$ (c) 1 (d) ∞

Q 3. Function $y = x^3 - 2x + 1$ will have its maxima at 'x' equal to:
(a) $\frac{2}{3}$ (b) $\sqrt{\frac{2}{3}}$ (c) $-\sqrt{\frac{2}{3}}$ (d) $\sqrt{\frac{3}{2}}$

Q 4. Function $y = F(x)$ has its maxima value at x = x_1, then:

(a) $F'(x_1) > 0$ (b) $F'(x_1) < 0$
(c) $F''(x_1) > 0$ (d) $F''(x_1) < 0$

Q 5. Number of minima for $y = \frac{x^3}{3} - 4x + 1$ are:
(a) 1 (b) 2
(c) 3 (d) zero

Q 6. Let $f(x) = x^3 - 12x + 7$. Which of the following statement is correct?
(a) The graph of y = f(x) has minimum, at x = -2
(b) The graph of y = f(x) has maximum, at x = 0
(c) The graph of y = f(x) has minimum, at x = 2
(d) None of these

Q 7. Let $f(x) = \sin x + \sqrt{3}\cos x$. Which of the following statement is correct?

(a) The graph of y = f(x) has minimum value $y = -1$
(b) The graph of y = f(x) has maximum value $y = 1$
(c) The graph of y = f(x) has minimum value $y = -2$
(d) None of these

Q 8. What will be the maximum value of $y = 3\sin x$ for interval $x \in [0, 2\pi]$?
(a) 3 (b) 1
(c) -3 (d) -1

Q 9. What is true about the derivative of a function at a maximum or minimum point of the function?
(a) The derivative is equal to zero.
(b) The derivative is always positive.
(c) The derivative is always negative.
(d) None of these are correct.

Q 10. Suppose we found the point (3,19) to be a minimum point of the function f. What must be true about the second derivative of f evaluated at x = 3?
(a) It must be less than zero
(b) It must be greater than zero
(c) It must be equal to zero
(d) None of these are correct

Q11. y = $2x^3$ - 15 x^2 + 36 x +10 maxima of y is at
(a) x = 3 (b) x = 2 (c) x = 1 (d) x = 4

Q12. A string of length 40 m is used to make a rectangle . Find maximum possible area of rectangle ?
(a) 100 m^2 (b) 200 m^2 (c) 400 m^2 (d) 900 m^2

Q13. A function has maxima at x = a, then slope at x = a is
(a) increasing
(b) decreasing
(c) zero
(d) May increase , may decrease

Q14. If $\frac{d^2y}{dx^2}$ = +ve at point A in graph then A
(a) Must be maxima
(b) Must be minima
(c) May be minima
(d) None of these

Q15. We have $128\pi\ m^3$ clay to make a solid cylinder. Radius of cylinder for minimum surface area is
(a) 6m (b) 8m (c) 4m (d) 12m

Answer Key

Q.1 b	Q.2 a	Q.3 c	Q.4 d	Q.5 a
Q.6 c	Q.7 c	Q.8 a	Q.9 a	Q.10 b
Q.11 b	Q.12 a	Q.13 c	Q.14 d	Q.15 a

Plus leaderboard

Based on educator activity in last 30 days

1. Prateek Jain — 11.4M mins
2. Ajay Mishra (Akm) — 6.3M mins
3. Shubh Karan Choudhary (Skc) — 5.9M mins
4. Dr Amit Gupta — 5.5M mins
5. Ramesh Sharda — 4.9M mins
6. Sandeep Nodiyal — 4.8M mins
7. Shailendra Tanwar — 3.6M mins
8. Vishal Vivek — 2.7M mins
9. Garima Goel — 2.7M mins
10. Saurabh Sharma — 2.6M mins
11. Dr S K Singh — 2.6M mins
12. Nishant Varshney

PHYSICSLIVE

PLUS | ICONIC

- India's Best Educators
- Interactive Live Classes
- Structured Courses & PDFs
- Live Tests & Quizzes
- × Personal Coach
- × Study Planner

24 months No cost EMI	₹2,100/mo +10% OFF ₹50,400
18 months No cost EMI	₹2,363/mo +10% OFF ₹42,525
12 months No cost EMI	₹2,888/mo +10% OFF ₹34,650
6 months No cost EMI	₹4,200/mo +10% OFF ₹25,200

To be paid as a one-time payment

View all plans

Awesome! **PHYSICSLIVE** code applied

Use code PHYSICSLIVE to get Maximum OFF on Unacademy PLUS / Iconic and learn from India's Top Faculties

Written Solution

DPP-6: Basic Math: Applications of Differentiation (Maxima & Minima)

By Physicsaholics Team

Solution: 1

$x = 3t^2 - 2$

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

$\frac{dx}{dt} = 0$ [For max & Min]

$6t = 0$

$\boxed{t = 0}$

$\frac{d^2x}{dt^2} = 6 > 0$

$\therefore$ at $t=0$, function will have minima.

$\therefore$ $x_{min} = 3(0) - 2$

$\boxed{x_{min} = -2}$

Ans. b

Solution: 2

$$y = 3\sin x + 4\cos x$$

for $y = a\sin x + b\cos x$

$$y_{max} = \sqrt{a^2 + b^2}$$

$$y_{max} = \sqrt{3^2 + 4^2}$$

$$y_{max} = 5$$

Ans. a

Solution: 3

$$y = x^3 - 2x + 1$$

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

for max. or min:

$$\frac{dy}{dx} = 0 \Rightarrow 3x^2 - 2 = 0 \Rightarrow x = \pm\sqrt{\frac{2}{3}}$$

Now, $\frac{d^2y}{dx^2} = 6x$

for $x = +\sqrt{\frac{2}{3}} \Rightarrow \frac{d^2y}{dx^2} > 0 \Rightarrow$ minima

for $x = -\sqrt{\frac{2}{3}} \Rightarrow \frac{d^2y}{dx^2} < 0 \Rightarrow$ maxima

$\therefore$ function will have maxima at $x = -\sqrt{\frac{2}{3}}$ Ans. c

Solution: 4

$y = f(x)$

for maxima at $x = x_1$

$f'(x_1) = 0$

and $f''(x_1) < 0$

Ans. d

Solution: 5

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

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

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

for max. & minima:

$$\frac{dy}{dx} = 0 \Rightarrow x^2 - 4 = 0$$

$$\Rightarrow \boxed{x = \pm 2}$$

Now; $\frac{d^2y}{dx^2} = 2x$

for; $x = -2$; $\frac{d^2y}{dx^2} = -4 < 0 \Rightarrow$ maxima

for; $x = 2$; $\frac{d^2y}{dx^2} = 4 > 0 \Rightarrow$ minima

so; function will have 1 minima at, $x = +2$

Ans. a

Solution: 6

$f(x) = x^3 - 12x + 7$

$f'(x) = 3x^2 - 12$

for max & min.

$f'(x) = 3x^2 - 12 = 0 \Rightarrow x^2 = 4$

$\boxed{x = \pm 2}$

Now; $\frac{d^2y}{dx^2} = f''(x) = 6x$

for; $x = 2$, $\frac{d^2y}{dx^2} = 12 > 0 \Rightarrow$ Minima

for; $x = -2$; $\frac{d^2y}{dx^2} = -12 < 0 \Rightarrow$ Maxima

$\therefore$ $f(x)$ will have its maxima at, $x = -2$

and, Minimum, at, $x = +2$

Ans. c

Solution: 7

$$y = \sin x + \sqrt{3}\cos x$$

for ; $y = a\sin x + b\cos x$

$$y_{min} = -\sqrt{a^2 + b^2}$$

$$\therefore y_{min} = -\sqrt{1^2 + (\sqrt{3})^2}$$

$$\boxed{y_{min} = -2}$$

Ans. c

Solution: 8

$y = 3\sin x$

$\therefore -1 \le \sin x \le 1$

So, $\max(\sin x) = 1$

$\therefore y_{max} = 3 \times 1 = 3$

(or)

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

For max & min,

$\frac{dy}{dx} = 3\cos x = 0$

$\Rightarrow \cos x = 0;\ x = \frac{\pi}{2}, \frac{3\pi}{2}, \ldots$

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

at, $x = \pi/2$, $\frac{d^2y}{dx^2} = -3 < 0 \Rightarrow$ Maximum

at, $x = 3\pi/2$; $\frac{d^2y}{dx^2} = +3 > 0 \Rightarrow$ Minimum

$\therefore$ Max. at, $x = \pi/2$, $y_{max} = 3\sin\frac{\pi}{2}$

$y_{max} = 3$

Ans. a

Solution: 9

$y = f(x)$

For max. & min.

derivative of function $f(x)$

$\frac{dy}{dx}$ or $f'(x) = 0$

Because, at point of max. or min.

slope of curve will be zero

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

Ans. a

Solution: 10

$y = f(x)$

$y = f(x)$ has minima, at $x = 3$

& min. value of $f(x) = 19$

for minima, $\frac{d^2y}{dx^2} > 0$

so, at, $x = 3$

$$f''(3) > 0$$

Ans. b

Solution: 11 $y = 2x^3 - 15x^2 + 36x + 10$

$$\Rightarrow \frac{dy}{dx} = 6x^2 - 30x + 36$$

$$\frac{dy}{dx} = 0 \Rightarrow 6(x^2 - 5x + 6) = 0$$

$$\Rightarrow (x-2)(x-3) = 0$$

$$\Rightarrow x = \underbrace{2, 3}_{\text{Critical points}}$$

$$\frac{d^2y}{dx^2} = 12x - 30$$

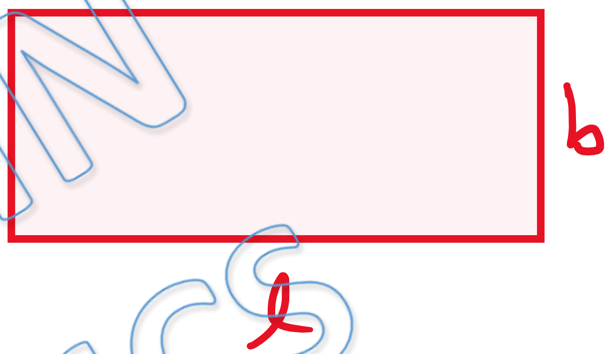
at $x = 2$, $\frac{d^2y}{dx^2} = 24 - 30 = -6$

$\Rightarrow$ maxima at $x = 2$

Ans (b)

Solution: 12 given

$$2(l+b) = 40 \quad \text{---}(1)$$



$$\Rightarrow \quad b = 20 - l$$

Area of rectangle.

$$A = lb = l(20-l) = 20l - l^2$$

$$\frac{dA}{dl} = 20 - 2l = 0 \Rightarrow l = 10\,m$$

Since minimum possible area is zero. There must be maxima at $l = 10,\ b = 10$

$$A_{max} = 10 \times 10 = 100\,m^2$$

Ans (a)

Solution: 13

Just before maxima

Slope = +ve

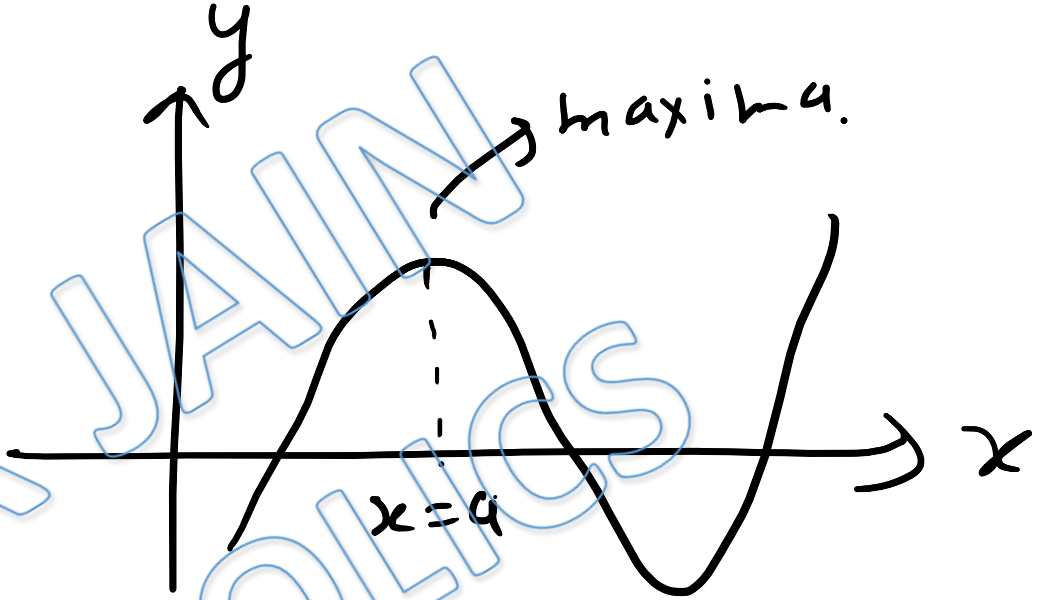
at maxima

Slope = 0

Just after maxima

Slope = -ve

$\Rightarrow$ Slope is decreasing at $x=a$.



Ans (b)

OR:

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

$\Rightarrow \frac{d}{dx}(\text{Slope}) = -ve \Rightarrow$ Slope is decreasing.

Solution: 14

If $\frac{dy}{dx} = 0$ & $\frac{d^2y}{dx^2} = +ve$

at a point, then that point is minima.

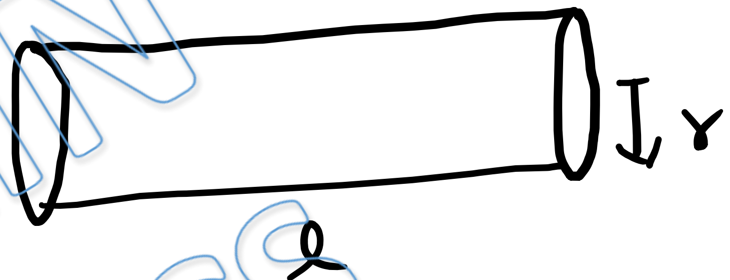
If only $\frac{d^2y}{dx^2} = 0$

point may be minima.

Ans (c)

Solution: 15

Volume of cylinder $= 128\pi\ m^3$



$$\Rightarrow \quad \pi r^2 l = 128\pi$$

$$l = \frac{128}{r^2} \quad \text{---} (1)$$

Surface area $A = 2\pi r l + 2\pi r^2$

$$A = 2\pi r \times \frac{128}{r^2} + 2\pi r^2$$

$$A = \frac{256\pi}{r} + 2\pi r^2$$

$$\frac{dA}{dr} = -\frac{256\pi}{r^2} + 4\pi r$$

$$\frac{dA}{dr} = 0 \Rightarrow 4\pi r = \frac{256\pi}{r^2}$$

$$\Rightarrow r^3 = 64$$

$$\Rightarrow r = 4$$

Ans (c)

For Video Solution of this DPP, Click on below link

Video Solution on Website:- https://physicsaholics.com/home/courseDetails/36

Video Solution on YouTube:- https://youtu.be/fHeqMPCzWMI

Written Solution on Website:- https://physicsaholics.com/note/notesDetalis/70

SUBSCRIBE

@Physicsaholics

@Physicsaholics_prateek

@NEET_Physics
@IITJEE_Physics

physicsaholics.com

Unacademy

CLICK

Chalo Niklo