



# JEE (MAIN) 2024

MEMORY BASED QUESTIONS & SOLUTIONS

SHIFT-1

**DATE & DAY:** 31<sup>st</sup> January 2024 & Wednesday

**PAPER-1**

**Duration:** 3 Hrs.

**Time:** 09:00 - 12:00 IST

**SUBJECT: MATHEMATICS**

**ADMISSIONS OPEN FOR CLASS 12+**

ACADEMIC SESSION 2024-25



TARGET: JEE (ADV.) 2024

For Class XII Passed Student

**VISHESH COURSE**

MODE: OFFLINE/ONLINE



CLASS STARTS  
08<sup>th</sup> APRIL, 2024



TARGET: JEE (MAIN) 2024

For Class XII Passed Student

**ABHYAAS COURSE**

MODE: OFFLINE/ONLINE



CLASS STARTS  
08<sup>th</sup> APRIL, 2024

**SCHOLARSHIP ON THE BASIS OF JEE (MAIN) 2024 %ILE/AIR**

REGISTERED & CORPORATE OFFICE (CIN: U80302RJ2007PLC024029):

CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Rajasthan) - 324005

0744-2777777 | 73400 10345 | contact@resonance.ac.in | www.resonance.ac.in | Follow Us: @ResonanceEdu | @Resonance\_Edu

This solutions was download from Resonance JEE (Main) 2024 Solution Portal

Resonance® | JEE (Main) 2024 | DATE : 31-01-2024 (SHIFT-1) | PAPER-1 | MEMORY BASED | MATHEMATICS

## PART : MATHEMATICS

1. Number of 4 letter words with or without meaning by using letters of the word "DISTRIBUTION" is

Ans. (3734)

Sol. I → 3

T → 2

D → 1

S → 1

N → 1

M → 1  
B → 1  
U → 1  
O → 1  
N → 1

(1) no of words whose all letters are distinct =  ${}^9P_4 \times 4! = 126 \times 24 = 3024$

(2) no of words whose 2 letters are same and 2 letters are distinct =  ${}^2C_1 \times {}^8C_2 \times \frac{4!}{2!} = 672$

(3) no of words whose 2 letters are same and other 2 letters are same =  ${}^2C_2 \times \frac{4!}{2!2!} = 6$

(4) no of words whose 3 letters are same and 1 letter is distinct =  ${}^1C_1 \times {}^8C_1 \times \frac{4!}{3!} = 32$

total number of words = 3734

2. In the expansion of  $(1-x^2)(1+x)\left(1+\frac{3}{x}+\frac{3}{x^2}+\frac{1}{x^3}\right)^5$  the sum of the coefficient of  $x^3$  and  $x^{-13}$  is

Ans. (0118)

Sol.  $(1-x^2)(1+x)\left(1+\frac{3}{x}+\frac{3}{x^2}+\frac{1}{x^3}\right)^5 = (1-x^2)(1+x)\left(1+\frac{1}{x}\right)^{3 \cdot 5}$

$$= (1-x)(1+x)^2 \left(\frac{1+x}{x}\right)^{15} = \frac{(1-x)}{x^{15}}(1+x)^{17}$$

$$= \frac{(1-x)}{x^{15}} \sum_{r=0}^{17} {}^{17}C_r x^r = \sum_{r=0}^{17} {}^{17}C_r x^{r-15} - \sum_{r=0}^{17} {}^{17}C_r x^{r-14}$$

so coefficient of  $x^3 = -{}^{17}C_{17} = -1$

and coefficient of  $x^{-13} = {}^{17}C_2 = {}^{17}C_1 = 119$

sum of coefficient  $x^3$  and  $x^{-13}$  is  $= -1 + 119 = 118$

3. The sum of series  $\frac{1}{1-3 \cdot 1^2+1^4} + \frac{2}{1-3 \cdot 2^2+2^4} + \frac{3}{1-3 \cdot 3^2+3^4} + \dots$  up to 10 terms, is equal to

(1)  $-\frac{55}{109}$  (2)  $\frac{55}{109}$  (3)  $-\frac{45}{109}$  (4)  $\frac{45}{109}$

Ans. (1)

Sol. Given sum =  $\sum_{r=1}^{10} \frac{r}{1-3r^2+r^4}$

$$= \sum_{r=1}^{10} \frac{r}{(r^2-1)^2 - r^2}$$

## Resonance Eduventures Ltd.

Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph. No.: +91-744-2777777, 2777700 | FAX No. : +91-022-39167222

To Know more : sms RESO at 56677 | Website : www.resonance.ac.in | E-mail : contact@resonance.ac.in | CIN : U80302RJ2007PLC024029

Toll Free : 1800 258 5555 | 7340010333 | [facebook.com/ResonanceEdu](https://www.facebook.com/ResonanceEdu) | [twitter.com/ResonanceEdu](https://twitter.com/ResonanceEdu) | [www.youtube.com/reswatch](https://www.youtube.com/reswatch) | [blog.resonance.ac.in](https://blog.resonance.ac.in)

This solution was download from Resonance JEE (main) 2024 Solution portal

PAGE # 1

Resonance® Educating for better tomorrow | JEE (Main) 2024 | DATE : 31-01-2024 (SHIFT-1) | PAPER-1 | MEMORY BASED | MATHEMATICS

$$\begin{aligned} &= \sum_{r=1}^{10} \frac{r}{(r^2+r-1)(r^2-r-1)} = \frac{1}{2} \sum_{r=1}^{10} \frac{(r^2+r-1) - (r^2-r-1)}{(r^2+r-1)(r^2-r-1)} \\ &= \frac{1}{2} \sum_{r=1}^{10} \left( \frac{1}{r^2-r-1} - \frac{1}{r^2+r-1} \right) = \frac{1}{2} \left[ \left( \frac{-1}{-1-1} \right) + \left( \frac{1}{1-5} \right) + \left( \frac{1}{5-11} \right) + \dots + \left( \frac{1}{89-109} \right) \right] \\ &= \frac{1}{2} \left[ \frac{-1}{-2} - \frac{1}{109} \right] \\ &= -\frac{1}{2} \left( \frac{110}{109} \right) = -\frac{55}{109} \end{aligned}$$

4.  $\lim_{x \rightarrow 0} \frac{e^{2\sin x} - 2\sin x - 1}{x^2}$  is equal to

Ans. (2)

Sol.  $\lim_{x \rightarrow 0} \frac{e^{2\sin x} - 2\sin x - 1}{x^2}$

since even function so LHL = RHL

$$\text{Now RHL} = \lim_{x \rightarrow 0} \frac{e^{2\sin x} - 2\sin x - 1}{x^2}$$

$$= \lim_{x \rightarrow 0} \frac{e^{2\sin x} \cdot 2\cos x - 2\cos x}{2x}$$

$$= \lim_{x \rightarrow 0} \cos x \left( \frac{e^{2\sin x} - 1}{2\sin x} \right) \times \frac{2\sin x}{x} = 1 \times 1 \times 2 = 2$$

5. 2 balls are selected with replacement from 10 red, 30 white, 15 orange and 20 blue balls then probability that first ball is red and second ball is white, is.

- (1)  $\frac{9}{25}$                       (2)  $\frac{4}{75}$                       (3)  $\frac{8}{75}$                       (4)  $\frac{7}{75}$

Ans. (2)

Sol. Probability =  $\frac{10}{75} \times \frac{30}{75} = \frac{2}{15} \times \frac{2}{5} = \frac{4}{75}$

6.  $\vec{a} = \hat{i} + 3\hat{j} + 4\hat{k}$ ,  $\vec{b} = 2\hat{i} - 3\hat{j} + 4\hat{k}$ ,  $\vec{c} = 5\hat{i} - 2\hat{j} + 4\hat{k}$  given that  $\vec{p} \times \vec{b} = \vec{b} \times \vec{c}$  and  $\vec{p} \cdot \vec{a} = 0$  then value of  $\vec{p}(\hat{i} - \hat{j} + \hat{k})$  is

Ans. (4)

Sol.  $(\vec{p} + \vec{c}) \times \vec{b} = \vec{0}$  so,  $(\vec{p} + \vec{c}) \parallel \vec{b}$

$\therefore \vec{p} + \vec{c} = \lambda \vec{b}$

$\vec{p} = \lambda \vec{b} - \vec{c}$

Now we have  $\vec{p} \cdot \vec{a} = 0$

$\vec{p} \cdot \vec{a} = \lambda \vec{b} \cdot \vec{a} - \vec{c} \cdot \vec{a}$

$0 = \lambda(2 - 9 + 16) - (5 - 6 + 16)$

$\lambda = \frac{15}{9} = \frac{5}{3}$

## Resonance Eduventures Ltd.

Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph. No.: +91-744-2777777, 2777700 | FAX No.: +91-022-39167222

To Know more : sms RESO at 56677 | Website : www.resonance.ac.in | E-mail : contact@resonance.ac.in | CIN : U80302RJ2007PLC024029

Toll Free : 1800 258 5555 | 7340010333 | [facebook.com/ResonanceEdu](https://www.facebook.com/ResonanceEdu) | [twitter.com/ResonanceEdu](https://twitter.com/ResonanceEdu) | [www.youtube.com/resonance](https://www.youtube.com/resonance) | [blog.resonance.ac.in](https://blog.resonance.ac.in)

This solution was download from Resonance JEE (main) 2024 Solution portal

PAGE # 2

$\therefore \vec{p} = \frac{5}{3} \vec{b} - \vec{c}$

and  $\vec{p}(\hat{i} - \hat{j} - \hat{k})$

$= \left[ \hat{i} \left( \frac{10}{3} - 5 \right) + \hat{j} \left( \frac{-15}{3} + 2 \right) + \hat{k} \left( \frac{20}{3} - 4 \right) \right] (\hat{i} - \hat{j} + \hat{k})$

$= \frac{-5}{3} + 3 + \frac{8}{3}$

$= 4$

7. If  $f(x) = \frac{4x-3}{6x-4}$ ,  $x \neq \frac{2}{3}$ ,  $g: \mathbb{R} - \left\{ \frac{2}{3} \right\} \rightarrow \mathbb{R} - \left\{ \frac{2}{3} \right\}$ ,  $g(x) = f \circ f(x)$  then value of  $g \circ g(4)$  is equal to

Ans. (4)

Sol.  $g(x) = f \left( \frac{4x-3}{6x-4} \right) = \frac{4 \left( \frac{4x-3}{6x-4} \right) - 3}{6 \left( \frac{4x-3}{6x-4} \right) - 4} = \frac{16x - 12 - 18x + 12}{24x - 18 - 24x + 16} = \frac{-2x}{-2} = x$

$g \circ g(4) = g(g(4)) = g(4) = 4$

8. Let 'S' be the set of positive integer values of a for which  $\frac{ax^2 + 2(a+1)x + 9a + 4}{x^2 + 8x + 32} < 0 \forall x \in \mathbb{R}$ , then the

number of elements is 'S' is

Ans. (0)

Sol.  $ax^2 + 2(a+1)x + 9a + 4 < 0$  as  $x^2 + 8x + 32$  is always positive

case-I when  $a \neq 0$  and  $a < 0$

then  $D < 0$

$4(a+1)^2 - 4a(9a+4) < 0$

$a^2 + 2a + 1 - 9a^2 - 4a < 0$

$0 < 8a^2 + 2a - 1$

$a \in \left( -\infty, -\frac{1}{2} \right) \cup \left( \frac{1}{4}, \infty \right)$

So  $a \in \left( -\infty, -\frac{1}{2} \right)$

case -II when  $a = 0$

then  $2x + 4 < 0$  is not always true

So,  $a \neq 0$   
 So number of positive integer values of 'a' = 0

## Resonance Eduventures Ltd.

Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph. No.: +91-744-2777777, 2777700 | FAX No. : +91-022-39167222

To Know more : sms RESO at 56677 | Website : www.resonance.ac.in | E-mail : contact@resonance.ac.in | CIN : U80302RJ2007PLC024029

Toll Free : 1800 258 5555 | 7340010333 | [facebook.com/ResonanceEdu](https://www.facebook.com/ResonanceEdu) | [twitter.com/ResonanceEdu](https://twitter.com/ResonanceEdu) | [www.youtube.com/resowatch](https://www.youtube.com/resowatch) | [blog.resonance.ac.in](https://blog.resonance.ac.in)

This solution was download from Resonance JEE (main) 2024 Solution portal

PAGE # 3

**Resonance**  
 Educating for better tomorrow | JEE (Main) 2024 | DATE : 31-01-2024 (SHIFT-1) | PAPER-1 | MEMORY BASED | MATHEMATICS

9. Solution of the differential equation  $y \frac{dx}{dy} = x(\ln x - \ln y + 1)$  is given by  $y = y(x)$  such that  $y(e) = 1$  then equation of curve is given by

- (1)  $y = \ln \frac{x}{y}$       (2)  $y = \ln \frac{y}{x}$       (3)  $x = \ln \frac{x}{y} + e - 1$       (4)  $x = \ln \frac{y}{x} + e + 1$

Ans. (1)

Sol.  $y \frac{dx}{dy} = x(\ln x - \ln y + 1)$

$$\frac{dx}{dy} = \frac{x}{y} \left( \ln \frac{x}{y} + 1 \right)$$

$$\text{Let } x = vy \Rightarrow \frac{dx}{dy} = v + y \frac{dv}{dy}$$

$$\Rightarrow v + y \frac{dv}{dy} = v \ln v + v$$

$$\Rightarrow y \frac{dv}{dy} = v \ln v$$

$$\Rightarrow \int \frac{dv}{v \ln v} = \int \frac{dy}{y}$$

$$\Rightarrow \ln(\ln v) = \ln y + \ln c$$

$$\Rightarrow \ln v = yc$$

$$\Rightarrow \ln \left( \frac{x}{y} \right) = yc$$

passes through  $(e, 1) \Rightarrow \ln e = c \Rightarrow c = 1$

$$\Rightarrow y = \ln \left( \frac{x}{y} \right)$$

10.  $525 \int_0^{\frac{\pi}{2}} \sin 2x (\cos x)^2 \left( 1 + (\cos x)^2 \right)^{\frac{1}{2}} dx$

(1)  $64 + 176\sqrt{2}$

(2)  $176\sqrt{2} - 64$

(3)  $64 - 128\sqrt{2}$

(4)  $64 + 128\sqrt{2}$

Ans. (2)

Sol.  $525 \int_0^{\frac{\pi}{2}} 2 \sin x \cos^{13/2} x (1 + (\cos x)^2)^{1/2} dx$

$$1 + (\cos x)^2 = t$$

$$-\frac{5}{2} (\cos x)^{3/2} \sin x dx = dt$$

$$= -1050 \int_2^1 (t-1)^2 (t)^{1/2} \cdot \frac{2dt}{5}$$

$$= -420 \int_2^1 (t^{5/2} - 2t^{3/2} + t^{1/2}) dt$$

## Resonance Eduventures Ltd.

Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph. No.: +91-744-2777777, 2777700 | FAX No. : +91-022-39167222

To Know more : sms RESO at 56677 | Website : www.resonance.ac.in | E-mail : contact@resonance.ac.in | CIN : U80302RJ2007PLC024029

Toll Free : 1800 258 5555 | 7340010333 | [facebook.com/ResonanceEdu](https://www.facebook.com/ResonanceEdu) | [twitter.com/ResonanceEdu](https://twitter.com/ResonanceEdu) | [www.youtube.com/resowatch](https://www.youtube.com/resowatch) | [blog.resonance.ac.in](https://blog.resonance.ac.in)

This solution was download from Resonance JEE (main) 2024 Solution portal

PAGE # 4

$$= -420 \left[ \frac{t^{7/2}}{2} - 2 \frac{t^{5/2}}{2} + \frac{t^{3/2}}{2} \right]_2^1 = -420 \left[ \left( \frac{2}{7} - \frac{4}{5} + \frac{2}{3} \right) - \left( \frac{2}{7} 8\sqrt{2} - \frac{4}{5} 4\sqrt{2} + \frac{2}{3} 2\sqrt{2} \right) \right]$$

$$= -120 + 336 - 280 + 960\sqrt{2} - 1344\sqrt{2} + 560\sqrt{2} = 176\sqrt{2} - 64$$

11. Let  $f(x) = \begin{cases} g(x) & : x < 0 \\ \left(\frac{1+x}{2+x}\right)^{\frac{1}{x}} & : x \geq 0 \end{cases}$  where  $g(x)$  is a linear function and  $f(x)$  is continuous function and  $f'(1)$

$= f(-1)$  then  $g(3) =$

- (1)  $\frac{3}{2} \ln\left(\frac{3}{2}\right) - \frac{1}{4}$       (2)  $\frac{1}{2} \ln\left(\frac{3}{2}\right) + \frac{1}{4}$       (3)  $\ln\left(\frac{4}{9}\right) - \frac{1}{3}$       (4)  $\ln\left(\frac{4}{9}\right) + \frac{1}{3}$

Ans. (3)

Sol. Let  $g(x) = ax + b$   
 $f(x)$  is continuous at  $x = 0$

$$\text{so } \lim_{x \rightarrow 0^+} \left(\frac{1+x}{2+x}\right)^{\frac{1}{x}} = \left(\frac{1}{2}\right)^{\infty} = 0$$

$$\lim_{x \rightarrow 0^-} g(x) = \lim_{x \rightarrow 0^-} ax + b = b$$

$$\text{So } b = 0$$

$$\text{Now } f(x) = \left(\frac{1+x}{2+x}\right)^{\frac{1}{x}}$$

$$\ln f(x) = \frac{1}{x} [\ln(1+x) - \ln(2+x)]$$

$$\frac{1}{f(x)} f'(x) = \frac{x \left[ \frac{1}{1+x} - \frac{1}{2+x} \right] - \ln\left(\frac{1+x}{2+x}\right)}{x^2}$$

$$f'(1) = f(1) \times \left[ \frac{\left[ \frac{1}{2} - \frac{1}{3} \right] - \ln\left(\frac{2}{3}\right)}{1} \right]$$

$$f'(1) = \frac{2}{3} \left[ \frac{1}{6} - \ln\left(\frac{2}{3}\right) \right]$$

$$\text{Also } f(-1) = (ax + b) \text{ at } x = -1 = -a$$

$$\text{So, } -a = \frac{1}{9} - \frac{2}{3} \ln\left(\frac{2}{3}\right)$$

$$a = \frac{2}{3} \ln\left(\frac{2}{3}\right) - \frac{1}{9}$$

$$g(x) = ax$$

$$g(3) = 3 \left( \frac{2}{3} \ln\left(\frac{2}{3}\right) - \frac{1}{9} \right)$$

$$= \left( 2 \ln\left(\frac{2}{3}\right) - \frac{1}{3} \right) = \left( \ln\left(\frac{4}{9}\right) - \frac{1}{3} \right)$$

## Resonance Eduventures Ltd.

Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph. No.: +91-744-2777777, 2777700 | FAX No.: +91-022-39167222

To Know more : sms RESO at 56677 | Website : www.resonance.ac.in | E-mail : contact@resonance.ac.in | CIN : U80302RJ2007PLC024029

Toll Free : 1800 258 5555    7340010333    facebook.com/ResonanceEdu    twitter.com/ResonanceEdu    www.youtube.com/resowatch    blog.resonance.ac.in

This solution was download from Resonance JEE (main) 2024 Solution portal

PAGE # 5

12. If  $|\vec{a}| = 1$ ,  $|\vec{b}| = 4$ ,  $\vec{a} \cdot \vec{b} = 2$ ,  $\vec{c} = (2\vec{a} \times \vec{b}) - 3\vec{b}$  and  $\vec{b} \cdot \vec{c} = \alpha$  then value of  $192 \sin^2 \alpha$  is

Ans. (48)

Sol.  $\vec{c} = (2\vec{a} \times \vec{b}) - 3\vec{b}$  ..... (1)

taking dot product with  $\vec{b}$

$$\vec{b} \cdot \vec{c} = -3(\vec{b} \cdot \vec{b})$$

$$|\vec{b}| |\vec{c}| \cos \alpha = -3|\vec{b}|^2$$

$$|\vec{b}| \cos \alpha = -3 \times 4 = -12$$

$$|\vec{d}| \cos \alpha = -12$$

$$|\vec{d}|^2 \cos^2 \alpha = 144 \quad \dots (2)$$

$$\vec{a} \cdot \vec{b} = 2$$

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

$$\theta = \frac{\pi}{3} \quad \dots (3)$$

$$|\vec{d}|^2 = ((2\vec{a} \times \vec{b}) - 3\vec{b})^2$$

$$= (2\vec{a} \times \vec{b})^2 + 9(\vec{b})^2 - 12(\vec{a} \times \vec{b}) \cdot \vec{b} = 4|\vec{a}|^2|\vec{b}|^2 \sin^2 \theta + 9|\vec{b}|^2 = 64 \times \frac{3}{4} + 144$$

$$|\vec{d}|^2 = 48 + 144 = 192$$

By equation (2)

$$|\vec{d}|^2 \cos^2 \alpha = 144$$

$$192 \cos^2 \alpha = 144$$

$$192 - 192 \sin^2 \alpha = 144$$

$$192 \sin^2 \alpha = 48$$

13. Let  $\sin^{-1} \alpha + \sin^{-1} \beta + \sin^{-1} \gamma = \pi$  and  $\alpha, \beta, \gamma$  are non zero real numbers such that  $(\alpha + \beta + \gamma)(\alpha + \beta - \gamma) = 3\alpha\beta$  then value of  $\gamma$

(1) 1

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

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

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

Ans. (4)

Sol. Let  $\sin^{-1} \alpha = A$ ,  $\sin^{-1} \beta = B$  and  $\sin^{-1} \gamma = C$  then  $A + B + C = \pi$  ..... (1)

also  $(\alpha + \beta + \gamma)(\alpha + \beta - \gamma) = 3\alpha\beta$

$$\Rightarrow \alpha^2 + \beta^2 - \gamma^2 = \alpha\beta$$

$$\Rightarrow \sin^2 A + \sin^2 B - \sin^2 C = \sin A \sin B$$

$$\Rightarrow \sin^2 A + \sin(B + C) \sin(B - C) = \sin A \sin B$$

$$\Rightarrow \sin^2 A + \sin A \sin(B - C) = \sin A \sin B$$

$$\Rightarrow \sin A [\sin A + \sin(B - C) - \sin B] = 0$$

$$\Rightarrow \sin A [\sin(B + C) + \sin(B - C) - \sin B] = 0$$

$$\Rightarrow \sin A [2 \sin B \cos C - \sin B] = 0$$

$$\Rightarrow \sin A \sin B (2 \cos C - 1) = 0$$

$$\Rightarrow \sin A = 0 \text{ or } \sin B = 0 \text{ or } 2 \cos C = 1$$

but  $\alpha, \beta$  are non zero  $\Rightarrow \cos C = \frac{1}{2} \Rightarrow \sin C = \frac{\sqrt{3}}{2} \Rightarrow \gamma = \frac{\sqrt{3}}{2}$

## Resonance Eduventures Ltd.

Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph. No.: +91-744-2777777, 2777700 | FAX No.: +91-022-39167222

To Know more : sms RESO at 56677 | Website : www.resonance.ac.in | E-mail : contact@resonance.ac.in | CIN : U80302RJ2007PLC024029

Toll Free : 1800 258 5555 | 7340010333 | Facebook.com/ResonanceEdu | Twitter.com/ResonanceEdu | www.youtube.com/resonance | blog.resonance.ac.in

This solution was download from Resonance JEE (main) 2024 Solution portal

PAGE # 6

**Resonance**  
Educating for better tomorrow | JEE (Main) 2024 | DATE : 31-01-2024 (SHIFT-1) | PAPER-1 | MEMORY BASED | MATHEMATICS

14. If system of linear equations

$$x - 2y + z = -4$$

$$2x + \alpha y + 3z = 5$$

$$3x - y + \beta z = 3$$

has infinite solution then the value of  $12\alpha + 13\beta$  is equal to

Ans. (58)

Sol. for infinite solution

$$D = 0$$

$$\begin{vmatrix} 1 & -2 & 1 \\ 2 & \alpha & 3 \\ 3 & -1 & \beta \end{vmatrix} = 0$$

$$1(\alpha\beta + 3) + 2(2\beta - 9) + 1(-2 - 3\alpha) = 0$$

$$\alpha\beta + 4\beta - 3\alpha - 17 = 0 \quad \dots (1)$$

Also for infinite solution

$$\text{Compare } P_1 + \lambda P_2 = 0$$

$$\& \quad P_3 = 0$$

$$x(1 + 2\lambda) + y(-2 + \alpha\lambda) + z(1 + 3\lambda) = -4 + 5\lambda$$

$$3x - y + \beta z = 3$$

$$\frac{1 + 2\lambda}{3} = \frac{-2 + \alpha\lambda}{-1} = \frac{1 + 3\lambda}{\beta} = \frac{-4 + 5\lambda}{3}$$

Solving first and last

$$3\lambda = +5$$

$$\lambda = \frac{+5}{3}$$

$$10$$

$$5\alpha$$

$$25$$

$$\text{Now } \frac{1+\frac{-2}{3}}{3} = \frac{-2+\frac{-2}{3}}{-1} = \frac{1+5}{\beta} = \frac{-4+\frac{-2}{3}}{3}$$

$$\frac{6}{\beta} = \frac{13}{9}$$

$$\alpha = \frac{1}{3} \text{ and } \beta = \frac{54}{13}$$

$$\text{So } 12\alpha + 13\beta = 4 + 54 = 58$$

15. Let  $A = \{1, 2, 3, 4\}$  and  $R$  is relation defined on set  $A$  such that  $R = \{(1, 2), (1, 4), (2, 3)\}$  then minimum number of elements added to  $R$  so that it becomes equivalence

- (1) 10 (2) 11 (3) 13 (4) 14

Ans. (2)

Sol. for reflexive add elements

$(1, 1), (2, 2), (3, 3), (4, 4)$

For symmetric add elements

$(2, 1), (4, 1), (3, 2)$

For Transitive add

$(1, 3), (3, 1)$

$(4, 2), (2, 4)$

So Total min. 11 elements should be added to form equivalence

## Resonance Eduventures Ltd.

Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph. No.: +91-744-2777777, 2777700 | FAX No. : +91-022-39167222

To Know more : sms RESO at 56677 | Website : www.resonance.ac.in | E-mail : contact@resonance.ac.in | CIN : U80302RJ2007PLC024029

Toll Free : 1800 258 5555 | 7340010333 | facebook.com/ResonanceEdu | twitter.com/ResonanceEdu | www.youtube.com/resowatch | blog.resonance.ac.in

This solution was download from Resonance JEE (main) 2024 Solution portal

PAGE # 7

Resonance® | JEE (Main) 2024 | DATE : 31-01-2024 (SHIFT-1) | PAPER-1 | MEMORY BASED | MATHEMATICS

16. Q and R are foot of perpendicular drawn from point P (a, a, a) to the lines  $x = y, z = 1$  and  $x = -y, z = -1$  such that  $\angle QPQ$  is  $90^\circ$  then find the value of  $12a^2$

Ans. (0012)

Sol. Foot of perpendicular from P(a, a, a) on  $\frac{x}{1} = \frac{y}{1} = \frac{z-1}{0}$  is Q (a, a, 1)

Also foot of perpendicular from P(a, a, a) on  $\frac{x}{1} = \frac{y}{-1} = \frac{z+1}{0}$  is R (0, 0, -1)

D' ratios of QP are  $\langle 0, 0, 1 - a \rangle$

D' ratios of PR are  $\langle a, a, a + 1 \rangle$

Since  $\angle QPR = 90^\circ \Rightarrow 0(a) + 0(a) + (1-a)(a+1) = 0 \Rightarrow a^2 = 1 \Rightarrow 12a^2 = 12$

17. If  $f(x) = \begin{vmatrix} x^3 & 2x^2+1 & 1+3x \\ 3x^2+2 & 2x & x^3+6 \\ x^3-x & 4 & x^2-2 \end{vmatrix}$  for all  $x \in \mathbb{R}$  then  $2f(0) + f'(0)$  is equal to

- (1) 12 (2) 24 (3) 42 (4) 36

Ans. (3)

Sol.  $f(0) = \begin{vmatrix} 0 & 1 & 1 \\ 2 & 0 & 6 \\ 0 & 4 & -2 \end{vmatrix} = -2(-2-4) = 12$

$$f'(x) = \begin{vmatrix} 3x^2 & 4x & 3 \\ 3x^2+2 & 2x & x^3+6 \\ x^3-x & 4 & x^2-2 \end{vmatrix} + \begin{vmatrix} x^3 & 2x^2+1 & 1+3x \\ 6x & 2 & 3x^2 \\ x^3-x & 4 & x^2-2 \end{vmatrix} + \begin{vmatrix} x^3 & 2x^2+1 & 1+3x \\ 3x^2+2 & 2x & x^3+6 \\ 3x^2-1 & 0 & 2x \end{vmatrix}$$

$$f'(0) = \begin{vmatrix} 0 & 0 & 3 \\ 2 & 0 & 6 \\ 0 & 4 & -2 \end{vmatrix} + \begin{vmatrix} 0 & 1 & 1 \\ 0 & 2 & 0 \\ 0 & 4 & -2 \end{vmatrix} + \begin{vmatrix} 0 & 1 & 1 \\ 2 & 0 & 6 \\ -1 & 0 & 0 \end{vmatrix} = 3(8) + 0 - 1(6) = 18$$

So  $2f(0) + f'(0) = 2(12) + 18 = 24 + 18 = 42$

18.  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  has foci  $(\pm 5, 0)$  and latus rectum is  $\sqrt{50}$ , find square of eccentricity of  $\frac{x^2}{a^2} - \frac{y^2}{a^2 b^2} = 1$

Ans. (26)

Sol.  $ae = 5$

$$\frac{2b^2}{a} = \sqrt{50}$$

$$b^2 = \frac{5\sqrt{2}a}{2}$$

$$b^2 = a^2(1 - e^2) = \frac{5\sqrt{2}a}{2} \Rightarrow a(1 - e^2) = \frac{5\sqrt{2}}{2} \Rightarrow \frac{5}{e}(1 - e^2) = \frac{5}{\sqrt{2}}$$

$$\sqrt{2}(5 - 5e^2) = 5e \Rightarrow 5\sqrt{2}e^2 + 5e - 5\sqrt{2} = 0$$

$$\sqrt{2}e^2 + e - \sqrt{2} = 0 \Rightarrow e = \frac{-1 \pm \sqrt{1+8}}{2\sqrt{2}} = \frac{-1 \pm 3}{2\sqrt{2}} = \frac{1}{\sqrt{2}} \text{ (rejected) and } \frac{1}{\sqrt{2}}$$

$$\sqrt{2}e + e - \sqrt{2}e = 0 \Rightarrow e = -\sqrt{2} \text{ (rejected)} \quad \text{and } e = \sqrt{2}$$

$$\text{from } ae = 5 \Rightarrow a = 5\sqrt{2} \quad \text{and } b^2 = 25$$

$$\text{So, square of eccentricity of new curve} = 1 + \frac{a^2 b^2}{a^2} = 1 + b^2 = 26$$

## Resonance Eduventures Ltd.

Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph. No.: +91-744-2777777, 2777700 | FAX No. : +91-022-39167222

To Know more : sms RESO at 56677 | Website : www.resonance.ac.in | E-mail : contact@resonance.ac.in | CIN : U80302RJ2007PLC024029

Toll Free : 1800 258 5555 | 7340010333 | [facebook.com/ResonanceEdu](https://www.facebook.com/ResonanceEdu) | [twitter.com/ResonanceEdu](https://twitter.com/ResonanceEdu) | [www.youtube.com/reswatch](https://www.youtube.com/reswatch) | [blog.resonance.ac.in](https://blog.resonance.ac.in)

This solution was download from Resonance JEE (main) 2024 Solution portal

PAGE # 8

### Resonance® Educating for better tomorrow® | JEE (Main) 2024 | DATE : 31-01-2024 (SHIFT-1) | PAPER-1 | MEMORY BASED | MATHEMATICS

19. If one of the diameter of the circle  $x^2 + y^2 - 10x + 4y + 13 = 0$  is a chord of another circle and whose centre is the point of intersection of the lines  $2x + 3y = 12$  and  $3x - 2y = 5$ , then the radius of the circle is

- (1) 6 (2)  $3\sqrt{2}$  (3)  $\sqrt{20}$  (4) 4

Ans. (1)

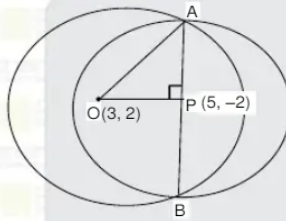
Sol. Point of intersection of lines

$$2x + 3y = 12$$

$$\& 3x - 2y = 5$$

$$x = 3$$

$$\text{and } y = 2$$



centre of required circle is (3, 2) and radius of given circle is = 4  
and centre of given circle is (5, -2)

Now from fig.

$$r = \sqrt{AP^2 + OP^2}$$

$$\Rightarrow r = \sqrt{16 + (\sqrt{4+16})^2} = 6$$

20. For any curve  $y = y(x)$ ,  $\frac{dy}{dx} = \frac{\tan x + y}{\sin x(\sec x - \sin x \tan x)}$  and  $y\left(\frac{\pi}{4}\right) = 1$  then  $y\left(\frac{\pi}{3}\right)$  is equal to

- (1)  $\frac{\sqrt{3}}{2}(1 - \sqrt{3})$  (2)  $\frac{\sqrt{3}}{2}(\sqrt{3} - 1)$  (3)  $\frac{1}{2}(\sqrt{3} - 1)$  (4)  $\sqrt{3}(\sqrt{3} + 1)$

Ans. (4)

$$\text{Sol. } \frac{dy}{dx} = \frac{\tan x}{\sin x(\sec x - \sin x \tan x)} + \frac{y}{\sin x(\sec x - \sin x \tan x)}$$

$$\frac{dy}{dx} = \frac{1}{\cos x(\sec x - \sin x \tan x)} + \frac{y}{\sin x(\sec x - \sin^2 x \sec x)}$$

$$\frac{dy}{dx} = \frac{1}{(1 - \sin^2 x)} + \frac{y}{\sin x \sec x (1 - \sin^2 x)}$$

$$\frac{dy}{dx} = \frac{1}{\cos^2 x} + \frac{y}{\sin x \cos x}$$

$$\frac{dy}{dx} - y(\sec x \operatorname{cosec} x) = \sec^2 x \quad \text{linear differential equation}$$

$$\text{I.f.} = e^{\int -\frac{1}{\sin x \cos x} dx} = e^{-2 \int \operatorname{cosec} 2x dx}$$

$$= e^{-m \tan x} = \frac{1}{\tan x} = \cot x$$

Hence solution of differential equation is

## Resonance Eduventures Ltd.

Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph. No.: +91-744-2777777, 2777700 | FAX No. : +91-022-39167222

To Know more : sms RESO at 56677 | Website : www.resonance.ac.in | E-mail : contact@resonance.ac.in | CIN : U80302RJ2007PLC024029

Toll Free : 1800 258 5555 | 7340010333 | [facebook.com/ResonanceEdu](https://www.facebook.com/ResonanceEdu) | [twitter.com/ResonanceEdu](https://twitter.com/ResonanceEdu) | [www.youtube.com/reswatch](https://www.youtube.com/reswatch) | [blog.resonance.ac.in](https://blog.resonance.ac.in)

This solution was download from Resonance JEE (main) 2024 Solution portal

PAGE # 9



$$y \cdot \cot x = \int \sec^2 x \cdot \cot x dx + c$$

$$y \cdot \cot x = \int \frac{\sec^2 x}{\tan x} dx + c$$

$$y \cdot \cot x = \int 2 \operatorname{cosec} 2x + c$$

$$y \cdot \cot x = \ln \tan x + c$$

$$\text{now } y\left(\frac{\pi}{4}\right) = 1$$

$$1 = 0 + c$$

$$y \cdot \cot x = \ln \tan x + 1$$

$$y\left(\frac{\pi}{3}\right) = (\ln \sqrt{3} + 1)\sqrt{3}$$

21. 3 rotten apples are mixed with 15 good apples. Two apples are drawn from basket at random. Let  $x$  be the variable representing number of rotten apples drawn, then variance of probability distribution of number of rotten apples drawn is

- (1)  $\frac{1024}{2601}$       (2)  $\frac{40}{153}$       (3)  $\frac{70}{153}$       (4)  $\frac{641}{2501}$

Ans. (2)

Sol.

| $X_i$ | 0   | 1   | 2   |
|-------|---|---|---|
| $P_i$ | $\frac{{}^{15}C_2}{{}^{18}C_2} = \frac{35}{51}$ | $\frac{{}^{15}C_1 \times {}^3C_1}{{}^{18}C_2} = \frac{5}{17}$ | $\frac{{}^3C_2}{{}^{18}C_2} = \frac{1}{51}$ |

$$\begin{aligned} \text{Var}(x) &= \text{Var}(x) = \sum p_i x_i^2 - \left( \sum p_i x_i \right)^2 \\ &= \frac{35}{51} \times (0)^2 + \frac{5}{17} (1)^2 + \frac{1}{51} (2)^2 - \left( 0 + \frac{5}{17} + \frac{2}{51} \right)^2 \\ &= \frac{19}{51} - \left( \frac{17}{51} \right)^2 \\ &= \frac{680}{2601} = \frac{40}{153} \end{aligned}$$

22. If A ( $\alpha, \beta$ ), B (1, 0), C( $\gamma, \delta$ ) and D (1, 2) are vertices of a parallelogram ABCD. If line  $2x - 3y + 1 = 0$  passes through vertices A and C then value of  $2(\alpha + \beta + \gamma + \delta)$  is equal to

Ans. (0008)

Sol. ABCD is a parallelogram so mid point of A, C = mid point of B, D

$$\Rightarrow \left( \frac{\alpha + \gamma}{2}, \frac{\beta + \delta}{2} \right) = \left( \frac{1+1}{2}, \frac{0+2}{2} \right)$$

$$\Rightarrow \left( \frac{\alpha + \gamma}{2}, \frac{\beta + \delta}{2} \right) = (1, 1)$$

$$\Rightarrow \alpha + \gamma = 2 \quad \& \quad \beta + \delta = 2$$

$$\text{So } 2(\alpha + \beta + \gamma + \delta) = 2(2+2) = 8$$

## Resonance Eduventures Ltd.

Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph. No.: +91-744-2777777, 2777700 | FAX No.: +91-022-39167222

To Know more : sms RESO at 56677 | Website : www.resonance.ac.in | E-mail : contact@resonance.ac.in | CIN : U80302RJ2007PLC024029

Toll Free : 1800 258 5555 | 7340010333 | facebook.com/ResonanceEdu | twitter.com/ResonanceEdu | www.youtube.com/resonance | blog.resonance.ac.in

This solution was download from Resonance JEE (main) 2024 Solution portal

PAGE # 10

23. Let  $S = \left\{ y^2 \leq 4x, x < 4, \frac{xy(x-1)(x-2)}{(x-3)(x-4)} < 0, x \neq 3 \right\}$  then area of region S is

- (1)  $\frac{32}{3}$       (2)  $\frac{16}{2}$       (3)  $\frac{64}{3}$       (4)  $\frac{8}{3}$

Ans. (1)

Sol. Case-1:

when  $y \geq 0$

$$\text{Then } \frac{xy(x-1)(x-2)}{(x-3)(x-4)} < 0$$

$$x(x-1)(x-2) < 0$$

Case-2:

$$(x-3)(x-4)$$

|   |   |   |   |   |
|---|---|---|---|---|
| + | - | + | - | + |
| 0 | 1 | 2 | 3 | 4 |

$$x \in (1, 2) \cup (3, 4)$$

$$y < 0$$

$$\frac{xy(x-1)(x-2)}{(x-3)(x-4)} < 0$$

$$\frac{x(x-1)(x-2)}{(x-3)(x-4)} > 0$$

|   |   |   |   |   |
|---|---|---|---|---|
| + | - | + | - | + |
| 0 | 1 | 2 | 3 | 4 |

,  $x \in (0, 1) \cup (2, 3)$

Required region

So required area

$$= \int_0^4 \sqrt{4x} dx = \left( 2(x^{\frac{3}{2}}) \frac{2}{3} \right)_0^4 = \frac{4}{3} (4 \times 2 - 0) = \frac{32}{3}$$

## Resonance Eduventures Ltd.

Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph. No.: +91-744-2777777, 2777700 | FAX No. : +91-022-39167222

To Know more : sms RESO at 56677 | Website : www.resonance.ac.in | E-mail : contact@resonance.ac.in | CIN : U80302RJ2007PLC024029

Toll Free : 1800 258 5555 7340010333 facebook.com/ResonanceEdu twitter.com/ResonanceEdu www.youtube.com/resowatch blog.resonance.ac.in

This solution was download from Resonance JEE (main) 2024 Solution portal

PAGE # 11



Boost your Percentile with

# PERCENTILE BOOSTER COURSE

COURSE COMMENCEMENT: 5<sup>th</sup> FEBRUARY 2024

TARGET

**JEE (Main) 2024**  
April Attempt

MODE:  
OFFLINE/  
ONLINE

## COURSE Concept

Percentile Booster Course (PBC) is for those students who want to boost their percentile in JEE-Main 2024 through a systematic complete course revision & practice plan.

In this course, daily chapter wise tests, Full Syllabus Test, JEE Preparatory Test will be conducted and each test will be followed by proper offline/online discussion class

## COURSE FEATURES

- Complete Course Coverage
- Chapter wise Test
- Regular Practice through Daily Online Practice Test
- Joint Preparatory Test
- Full Syllabus Test
- Back up support of recorded



COURSE FEE

Offline: ₹4999 | Online: ₹2499



Approx 2500 practice Qns.



Regular Test discussion classes for concept clearance

JEE (Main) 2024 April Attempt में

अधिकतम %ile प्राप्त करने के लिए आज ही Join करें।

SCAN TO APPLY



18 & Apply

# ADMISSIONS OPEN FOR CLASS 12+

ACADEMIC SESSION 2024-25



TARGET: JEE (ADV.) 2024

For Class XII Passed Student

## VISHESH COURSE

MODE: OFFLINE/ONLINE



CLASS STARTS 08<sup>TH</sup> APRIL, 2024



TARGET: JEE (MAIN) 2024

For Class XII Passed Student

## ABHYAAS COURSE

MODE: OFFLINE/ONLINE



CLASS STARTS 08<sup>TH</sup> APRIL, 2024

SCHOLARSHIP ON THE BASIS OF JEE (MAIN) 2024 %ILE/AIR



# Resonance®

Educating for better tomorrow

## JEE (Advanced) 2023 RESULT

AIR 7



**BIKKINA A. CHOWDARY**

All India Ranks (AIR-CRL) in  
Top 50 : 8 Top 100 : 15

All Students are from Our  
Offline/Online Classroom Programs

AIR 22



DESHANK P. SINGH

AIR 26



MAYANK SONI

AIR 29



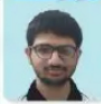
TANISHQ M. MANDHANE

AIR 32



KRITIN GUPTA

AIR 33



NAMAN GOVAL

AIR 37



S S SUMEDH

AIR 44



KAUSHAL VIJAYVERGIYA

## JEE (Main) 2023 RESULT

22 वर्षों से लगातार... श्रेष्ठ शिक्षण, श्रेष्ठ परिणाम...

6 AIRs in TOP-50

AIR 5

300/300 Marks



KAUSHAL VIJAYVERGIYA

AIR 26

100%ile



SOHAN DAS

AIR 29

100%ile



ASHIK STENNY

AIR 31

100%ile



KRISH GUPTA

AIR 34

100%ile



MAYANK SONI

AIR 50

100%ile (Maths)



HARSHAL LASOD

ADMISSIONS OPEN

SCHOLARSHIP UPTO

Academic Session 2024-25

**Class: V to XII & XII+**



**JEE**  
(Advanced)



**JEE**  
(Main)



**NEET**  
(UG)



**100%**

Based on ResoNET (Scholarship Test)

REGISTERED & CORPORATE OFFICE (CIN: U80302RJ2007PLC024029)

CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Rajasthan) - 324005

0744-2777777 | 73400 10345 | [contact@resonance.ac.in](mailto:contact@resonance.ac.in) | [www.resonance.ac.in](http://www.resonance.ac.in) | Follow Us: [@ResonanceEdu](#) | [@Resonance\\_Edu](#)