

JEE-Main-21-01-2026 (Memory Based)
[MORNING SHIFT]
Maths

Question: $\operatorname{cosec} 10^\circ - \sqrt{3} \sec 10^\circ$

Options:

- (a) 1
- (b) 2
- (c) 3
- (d) 4

Answer: (d)

$$\begin{aligned}\operatorname{cosec} 10^\circ - \sqrt{3} \sec 10^\circ &= \frac{1}{\sin 10^\circ} - \frac{\sqrt{3}}{\cos 10^\circ} \\&= \frac{\cos 10^\circ - \sqrt{3} \sin 10^\circ}{\sin 10^\circ \cos 10^\circ} \\&= \frac{2\left(\frac{1}{2} \cos 10^\circ - \frac{\sqrt{3}}{2} \sin 10^\circ\right)}{\frac{1}{2} \cdot \sin 20^\circ} \\&= \frac{4 \cos 70^\circ}{\sin 20^\circ} = 4\end{aligned}$$

$$A = \begin{bmatrix} \alpha & 2 \\ 1 & 2 \end{bmatrix}, B = \begin{bmatrix} 1 & 1 \\ \beta & 1 \end{bmatrix}$$

Question: If $A^2 - 4A + 2I = 0$; $B^2 - 2B + I = 0$, then $|\operatorname{adj}(A^3 - B^3)|$ is equal to

Options:

- (a) 11
- (b) 7
- (c) -11
- (d) 121

Answer: (a)

$$\operatorname{tr}(A) = 4 \rightarrow \alpha = 2$$

$$|B| = 1 \rightarrow \beta = 0$$

$$A^3 = \begin{bmatrix} 6 & 8 \\ 4 & 6 \end{bmatrix} \begin{bmatrix} 2 & 2 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 20 & 28 \\ 14 & 20 \end{bmatrix}$$

$$B^3 = \begin{bmatrix} 1 & 3 \\ 0 & 1 \end{bmatrix}$$

$$\begin{aligned}|\operatorname{adj}(A^3 - B^3)| &= |A^3 - B^3| = \begin{vmatrix} 19 & 25 \\ 14 & 19 \end{vmatrix} \\&= 361 - 350 = 11\end{aligned}$$

Question: If α and β are the roots of the equations $x^2 + x + 1 = 0$, then find $(\alpha + \beta)^4 + (\alpha^2 + \beta^2)^4 + (\alpha^3 + \beta^3)^4 + \dots + (\alpha^{25} + \beta^{25})^4$

Options:

- (a) 145
- (b) 146
- (c) 147
- (d) 148

Answer: (a)

$$x^2 + x + 1 = 0$$

$$x = \frac{-1 \pm \sqrt{1-4}}{2}$$

$$x = \frac{-1 \pm \sqrt{3}}{2}$$

$$x^2 + x + 1 = 0 \begin{matrix} \nearrow \omega \\ \searrow \omega^2 \end{matrix}$$

$$(\alpha + \beta)^4 = (\omega + \omega^2)^4 = 1$$

$$(\alpha^2 + \beta^2)^4 = (\omega^2 + \omega)^4 = 1$$

$$(\alpha^3 + \beta^3)^4 = (\omega^3 + \omega^6)^4 = 16$$

$$16 \times 8 + 1$$

$$= 145$$

Question: The value of $\int_0^{\frac{\pi}{2}} |\sin x + \sin 2x + \sin 3x| dx$ is

Options:

- (a) $\frac{8}{3}$
- (b) $\frac{7}{3}$
- (c) $\frac{2}{3}$
- (d) 3

Answer: (b)

$$\int_0^{\frac{\pi}{2}} |2 \sin 2x \cos x + \sin 2x| dx$$

$$= \int_0^{\frac{\pi}{2}} |\sin 2x(2 \cos x + 1)|$$

$$I = \int_0^{\frac{\pi}{2}} \sin x + \sin 2x + \sin 3x dx$$

$$= -\cos x + \frac{-\cos 2x}{+2} + \frac{-\cos 3x}{+3} \Big|_0^{\frac{\pi}{2}}$$

$$= 1 + \left[\frac{1+1}{2} \right] + \left[\frac{0+1}{3} \right] = 1 + 1 + \frac{1}{3} = \frac{7}{3}$$

Question: If $y = y(x)$ and $(1+x^2) dy + (1 - \tan^{-1}x)dx = 0$ and $y(0) = 1$ then $y(1)$ is

Options:

- (a) $\frac{\pi^2}{32} + \frac{\pi}{4} + 1$
 (b) $\frac{\pi^2}{32} - \frac{\pi}{4} + 1$
 (c) $\frac{\pi^2}{32} - \frac{\pi}{2} - 1$
 (d) $\frac{\pi^2}{32} - \frac{\pi}{2} + 1$

Answer: (b)

$$dy + \frac{1 + \tan^{-1}x}{1+x^2} dx = 0$$

$$y + \tan^{-1}x - \frac{1}{2}(\tan^{-1}x)^2 = c = 1$$

$$y(1) + \frac{\pi}{4} - \frac{x^2}{32} = 1$$

$$y(1) = 1 + \frac{\pi^2}{32} - \frac{\pi}{4}$$

Question: The sum of roots of the equation $|x-1|^2 - 5|x-1| + 6 = 0$ is

Options:

- (a) 4
 (b) 3
 (c) 1
 (d) 5

Answer: (a)

$$\text{Let } |x-1|^2 - 5|x-1| + 6 = 0$$

Put $|x-1| = t$. Then

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

$$(t-2)(t-3) = 0 \Rightarrow t = 2 \text{ or } t = 3$$

So,

$$|x-1| = 2 \Rightarrow x = 3, -1$$

$$|x-1| = 3 \Rightarrow x = 4, -2$$

Sum of roots:

$$3 + (-1) + 4 + (-2) = \boxed{4}$$

Question: If L_1 and L_2 are two parallel lines and $\triangle ABC$ is an equilateral triangle then area of triangle ABC is

Options:

- (a) $7\sqrt{3}$
 (b) $4\sqrt{3}$

(c) $21\sqrt{3}$

(d) 84

Answer: (c)

$$\sin \theta = \frac{6}{a}$$

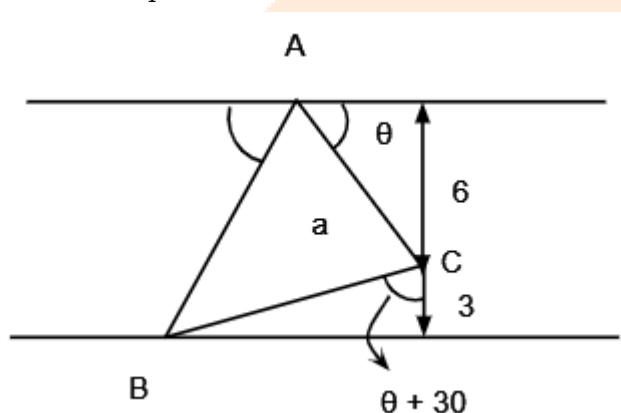
$$\rightarrow \cos. \frac{\sqrt{3}}{2} - \sin \theta. \frac{1}{2} = \frac{3}{a}$$

$$\rightarrow \sqrt{1 - \frac{6^2}{a^2}} \times \frac{\sqrt{3}}{2} = \frac{3}{a} + \frac{3}{a} = \frac{6}{a}$$

$$1 - \frac{36}{a^2} = \frac{36}{a^2} \times \frac{4}{3} = \frac{48}{a^2}$$

$$1 = \frac{84}{a^2} \rightarrow a^2 = 84$$

$$\text{Area} = \frac{\sqrt{3}}{4} \times 84 = 21\sqrt{3}$$



Question: The Hyperbola and ellipse $\frac{x^2}{36} + \frac{y^2}{16} = 1$ have same foci and eccentricity of Hyperbola is 5 then length of latus rectum of hyperbola is

Options:

(a) $\frac{96}{\sqrt{5}}$

(b) $24\sqrt{5}$

(c) $18\sqrt{5}$

(d) $12\sqrt{5}$

Answer: (a)

Ellipse:

$$\frac{x^2}{36} + \frac{y^2}{16} = 1 \Rightarrow c^2 = 36 - 16 = 20 \Rightarrow c = 2\sqrt{5}$$

Hyperbola has same foci and $e = 5$:

$$a = \frac{c}{e} = \frac{2\sqrt{5}}{5}, a^2 = \frac{4}{5}$$

For hyperbola:

$$c^2 = a^2 + b^2 \Rightarrow b^2 = 20 - \frac{4}{5} = \frac{96}{5}$$

Length of latus rectum:

$$\text{LLR} = \frac{2b^2}{a} = \frac{2 \cdot \frac{96}{5}}{\frac{2\sqrt{5}}{5}} = \boxed{\frac{96\sqrt{5}}{5}}$$

Question: The number of relations, defined on the set $\{a, b, c, d\}$ which are both reflexive & symmetric is equal to

Options:

- (a) 16
- (b) 1024
- (c) 64
- (d) 256

Answer: (c)

No of relations both reflexive and Symmetric = $2^6 = 64$

Question: The locus of point of intersection of tangent drawn to the circle $(x - 2)^2 + (y - 3)^2 = 16$, which subtends an angle of 120° is

Options:

- (a) $3x^2 + 3y^2 - 12x - 18y - 25 = 0$
- (b) $x^2 + y^2 - 12x - 18y - 25 = 0$
- (c) $3x^2 + 3y^2 + 12x + 18y - 25 = 0$
- (d) $x^2 + y^2 + 12x + 18y$

Answer: (a)

For the circle

$$(x - 2)^2 + (y - 3)^2 = 16$$

the centre is (2,3) and radius $r = 4$.

If tangents drawn from a point P subtend an angle of 120° , then

$$2 \sin^{-1} \left(\frac{r}{OP} \right) = 120^\circ$$

$$\sin^{-1} \left(\frac{r}{OP} \right) = 60^\circ \Rightarrow \frac{r}{OP} = \frac{\sqrt{3}}{2}$$

Hence,

$$OP = \frac{2r}{\sqrt{3}} = \frac{8}{\sqrt{3}}$$

Therefore, the locus of point P is a circle with centre (2,3) and radius $\frac{8}{\sqrt{3}}$.

$$(x - 2)^2 + (y - 3)^2 = \frac{64}{3}$$

$$3(x - 2)^2 + 3(y - 3)^2 = 64$$

$$3(x^2 - 4x + 4) + 3(y^2 - 6y + 9) = 64$$

$$3x^2 + 3y^2 - 12x - 18y - 25 = 0$$

Question: If $a_1, a_2, a_3, \dots$ are in increasing geometric progression such that

$$a_1 + a_3 + a_5 = 21,$$

$$a_1 a_3 a_5 = 64 \text{ then } a_1 + a_2 + a_3 \text{ is}$$

Options:

- (a) 5
- (b) 7
- (c) 10
- (d) 15

Answer: (b)

$$a \cdot ar^2 \cdot ar^4 = 64$$

$$(ar^2)^3 = 64$$

$$ar^2 = 4$$

$$a + ar^2 + ar^4 = 21$$

$$a + ar^4 = 17$$

$$a + a \cdot \frac{16}{a^2} = 17$$

$$a + \frac{16}{a} = 17 \Rightarrow a = 1, r = 2$$

$$a_1 + a_2 + a_3 = 1 + 2 + 4 = 7$$

Question: In the expansion $(ax^2 + bx + c)(1 - 2x)^{26}$, if coefficient of x , x^2 & x^3 are -56 , 0 , 0 respectively, then find the value of $a + b + c$.

Options:

- (a) 1500
- (b) 1403
- (c) 1300
- (d) 1483

Answer: (b)

Coeff of $x = -56$

Coeff of $x^2 = 0$

Coeff of $x^3 = 0$

By applying binomial theorem on Given expression, we have

$$b \cdot {}^{26}C_0 + c \cdot {}^{26}C_1(-2) = -56 \Rightarrow b - 52C = -56 \dots\dots(1)$$

$$a \cdot {}^{26}C_0 + {}^{26}C_1(-2)b + {}^{26}C_2(-2)^2 c = 0 \Rightarrow a - 52b + 1300c = 0 \dots\dots(2)$$

$$c \cdot {}^{26}C_3(-2)^3 + b \cdot {}^{26}C_2(-2)^2 + a \cdot {}^{26}C_1(-2) = 0 \Rightarrow a - 25b + 400C = 0 \dots\dots(3)$$

By (1), (2) & (3)

$$\begin{bmatrix} 0 & 1 & -52 \\ 1 & -52 & 1300 \\ 1 & -25 & 400 \end{bmatrix}$$

$$\left[\begin{array}{ccc|c} 0 & 1 & -52 & -56 \\ 1 & -52 & 1300 & 0 \\ 1 & -25 & 400 & 0 \end{array} \right]$$

By applying row operations

$$(1) R_1 \leftrightarrow R_2$$

$$(2) R_3 \leftrightarrow R_3 - R_1$$

$$(3) R_3 \rightarrow R_3 - 27R_2$$

$$\rightarrow \left[\begin{array}{ccc|c} 1 & -52 & 1300 & 0 \\ 0 & 1 & -52 & -56 \\ 0 & 0 & 504 & 1512 \end{array} \right]$$

$$a = 1300$$

$$b = 100$$

$$c = 3$$

$$a+b+c = 1403$$

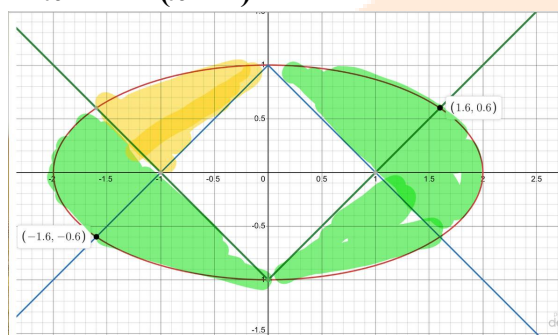
Question: Find the area inside the ellipse $x^2 + 4y^2 = 4$ and outside the area inclosed by the curves $y = |x| - 1$ & $y = 1 - |x|$.

Options:

- (a) $2(\pi - 1)$
- (b) $3(\pi - 1)$
- (c) $\pi - 1$
- (d) $\frac{\pi - 1}{4}$

Answer: (a)

$$\text{Shaded Area} = \pi(2)(1) - (\sqrt{2})^2 \\ = 2\pi - 2 = 2(\pi - 1)$$



Question: The value of the integral $\int_{-\frac{\pi}{6}}^{\frac{\pi}{6}} \frac{2\pi + 4x^{11}}{1 - \sin(|x| + \frac{\pi}{6})} dx$

Options:

- (a) π
- (b) 2π
- (c) 4π
- (d) 8π

Answer: (d)

$$\int_{-\frac{\pi}{6}}^{\frac{\pi}{6}} \frac{2\pi + 4x^{11}}{1 - \sin(|x| + \frac{\pi}{6})} dx$$

$$I = 2 \int_0^{\frac{\pi}{6}} \frac{2\pi dx}{1 - \sin(|x| + \frac{\pi}{6})} \quad (\text{second part is odd})$$

$$t = x + \frac{\pi}{6}$$

$$I = 4\pi \int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dt \times (1 + \sin t)}{(1 - \sin t)(1 + \sin t)}$$

$$I = 4\pi \int_{\frac{\pi}{6}}^{\frac{\pi}{3}} (\sec^2 t + \sec t \tan t) dt$$

$$I = 4\pi [\tan t + \sec t]_{\frac{\pi}{6}}^{\frac{\pi}{3}}$$

$$I = 4\pi \times 2 = 8\pi$$

Question: If $A = \{1, 2, 3, 4, 5, 6\}$, $B = \{1, 2, 3, \dots, 8, 9\}$. Then the number of strictly increasing functions from $A \rightarrow B$ such that $f(i) \neq i \forall i = 1, 2, 3, 4, 5, 6$ are

Options:

- (a) 25
- (b) 27
- (c) 28
- (d) 29

Answer: (c)

Case I : $f(1) = 2$

$$\begin{aligned} \text{No. of functions} &= {}^7C_5 \\ &= 21 \end{aligned}$$

Case II : If $f(1) = 3$

$$\text{No of functions} = {}^6C_5 = 6$$

Case III : If $f(1) = 4$

$$\text{No of functions} = {}^6C_6 = 1$$

$$\text{Total} = 21 + 6 + 1 = 28$$

Question: If the mean and variance of observations $x, y, 12, 14, 4, 10, 2$ is 8 and 16 respectively where $x > y$. Then, the value of $3x - y$ is

Options:

- (a) 18
- (b) 20
- (c) 22
- (d) 24

Answer: (a)

$$\bar{X} = \frac{x+y+12+14+4+10+2}{7}$$

$$8 = \frac{x+y+42}{7}$$

$$x + y = 56 - 42$$

$$x + y = 14$$

$$a^2 = \overline{x^2} - (\bar{x})^2$$

$$16 = \frac{x^2+y^2+144+196+16+100+4}{7} - (8)^2$$

$$(16 + 64) \times 7 = x^2 + y^2 + 460$$

$$560 - 460 = x^2 + y^2$$

$$x^2 + y^2 = 100$$

$$(x + y)^2 = 2xy = 100$$

$$(14)^2 - 2xy = 100$$

$$xy = 48$$

$$x + y = 14 \quad xy = 48$$

$$x + \frac{48}{x} = 14$$

$$x^2 - 14x + 48 = 0$$

$$x = 8, 6$$

$$y = 8, 6$$

$$x > y = 1, \quad x = 8_1, \quad y = 6$$

$$3x - y = 3 \times 8 - 6 = 18$$

Question: If O is the vertex of the parabola $x^2 = 4y$, Q is the point on the parabola. If C is the locus of a point which divides OQ ratio 2:3. The equation of the chord of C which bisected at point (1, 2).

Options:

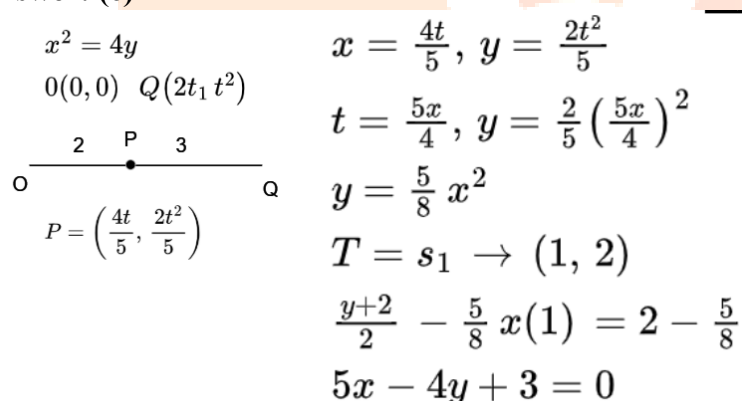
(a) $5x + 4y + 3 = 0$

(b) $5x - 4y - 3 = 0$

(c) $5x - 4y + 3 = 0$

(d) $5x + 4y - 3 = 0$

Answer: (c)



$$x^2 = 4y$$

$$O(0,0) \quad Q(2t^2, 4t)$$

$$\frac{2}{3} \quad P \quad \frac{3}{2}$$

$$O \quad P \quad Q$$

$$P = \left(\frac{4t}{5}, \frac{2t^2}{5} \right)$$

$$x = \frac{4t}{5}, \quad y = \frac{2t^2}{5}$$

$$t = \frac{5x}{4}, \quad y = \frac{2}{5} \left(\frac{5x}{4} \right)^2$$

$$y = \frac{5}{8} x^2$$

$$T = s_1 \rightarrow (1, 2)$$

$$\frac{y+2}{2} - \frac{5}{8} x(1) = 2 - \frac{5}{8}$$

$$5x - 4y + 3 = 0$$

Question: If $f(3) = 18$, $f'(3) = 0$ and $f''(3) = 4$. Then, the value of

$$\lim_{x \rightarrow 1} \ln \left(\frac{f(x+2)}{f(3)} \right)^{\frac{18}{(x-1)^2}}$$

is equal to

Options:

(a) 2

(b) 4

(c) 6

(d) 8

Answer: (a)

$$L = \log_e \left(\lim_{x \rightarrow 1} \left(\frac{f(x+2)}{f(3)} \right)^{\frac{18}{(x-1)^2}} \right)$$

1^∞ form

$$L = \log_e \left(e^{\lim_{x \rightarrow 1} \frac{18}{(x-1)^2} \left(\frac{f(x+2)}{f(3)} - 1 \right)} \right)$$

$$L = \log_e \left(e^{\lim_{x \rightarrow 1} \frac{18}{(x-1)^2} \left(\frac{f(x+2) - f(3)}{f(3)} \right)} \right)$$

$$L = \log_e \left(e^{\lim_{x \rightarrow 1} \left[\frac{18(f(x+2) - 18)}{(x-1)^2 \cdot 18} \right]} \right)$$

$$L = \log_e \left(e^{\lim_{x \rightarrow 1} \left[\frac{f(x+2) - 18}{(x-1)^2} \right]} \right)$$

$$L = \log_e \left(e^{\lim_{x \rightarrow 1} \frac{f'(x+2)}{2(x-1)}} \right)$$

$$L = \log_e \left(e^{\lim_{x \rightarrow 1} \frac{f''(x+2)}{2}} \right)$$

$$L = \log_e (e^2) = 2$$

Question: If $a_1 = 1$ and for $n \geq 1$,

Options:

- (a) 4
- (b) 2
- (c) 1
- (d) 5

Answer: (b)

$$a_{n+1} = \frac{1}{2} a_n \frac{n^2 - 2n - 1}{n^2(n+1)^2} \quad \text{then} \quad \left| \sum_{n=1}^{\infty} \left(a_n - \frac{2}{n^2} \right) \right|$$

$$a_{n+1} = \frac{a_n}{2} + \frac{1}{(n+1)^2} - \left[\frac{(n+1)^2 - n^2}{n^2(n+1)^2} \right]$$

$$a_{n+1} = \frac{a_n}{2} + \frac{1}{(n+1)^2} - \left[\frac{1}{n^2} - \frac{1}{(n+1)^2} \right]$$

$$a_{n+1} - \frac{2}{(n+1)^2} = \frac{a_n}{2} - \frac{1}{n^2}$$

$$a_{n+1} - \frac{2}{(n+1)^2} = \frac{1}{2} \left(a_n - \frac{2}{n^2} \right)$$

$$b_{n+1} = \frac{1}{2} b_n$$

$$b_n = a_n - \frac{2}{n^2}$$

$$b_2 = \frac{1}{2}(-1) = -\frac{1}{2} \quad b_1 = 1 - \frac{2}{1} = -1$$

$$b_3 = \frac{1}{2} \left(-\frac{1}{2} \right) = -\frac{1}{4}$$

$$b_n = (-1) \left(\frac{1}{2} \right)^{n-1} = - \left(\frac{1}{2} \right)^{n-1}$$

$$a_n - \frac{2}{n^2} = - \left(\frac{1}{2} \right)^{n-1}$$

$$\begin{aligned} \left| \sum_{n=1}^{\infty} \left(a_n - \frac{2}{n^2} \right) \right| &= \sum_{n=1}^{\infty} \left(\frac{1}{2} \right)^{n-1} \\ &= 1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots + \infty \\ &= \frac{1}{1-\frac{1}{2}} = 2 \end{aligned}$$

Question: If the domain of the function

$$\cos^{-1} \left(\frac{2x-5}{11x-7} \right) + \sin^{-1} (2x^2 - 3x + 1) \text{ is } [0, a], \left[\frac{12}{13}, b \right] \text{ then } \frac{1}{ab}$$

is equal to

Options:

(a) -3

(b) 3

(c) 2

(d) 4

Answer: (b)

$$-1 \leq \frac{2x-5}{11x-7} \leq 1, \quad -1 \leq 2x^2 - 3x + 1 \leq 1$$

$$\frac{2x-5}{11x-7} + 1 \geq 0, \quad \frac{2x-5}{11x-7} - 1 \leq 0, \quad 2x^2 - 3x + 2 \geq 0,$$

$$2x^2 - 3x \leq 0$$

$$\frac{13x-12}{11x-7} \geq 0, \quad \frac{-9x+2}{11x-7} \leq 0, \quad x(2x-3) \leq 0$$

$$x \in \left(-\infty, \frac{7}{11} \right) \cup \left[\frac{12}{13}, \infty \right), \quad x \in \left(-\infty, \frac{2}{9} \right] \cup \left(\frac{7}{11}, \infty \right), \quad x \in \left[0, \frac{3}{2} \right]$$

$$\Rightarrow x \in \left[\frac{12}{13}, \frac{3}{2} \right] \cup \left[0, \frac{2}{9} \right]$$

$$a = \frac{2}{9}, \quad b = \frac{3}{2} \Rightarrow ab = \frac{1}{3} \Rightarrow \frac{1}{ab} = 3$$