MEMORY BASED QUESTIONS JEE–MAIN EXAMINATION – APRIL 2026

(HELD ON MONDAY 06th APRIL 2026) **TIME : 9:00 AM TO 12:00 NOON**

MATHEMATICS — TEST PAPER WITH SOLUTION

1. Find $I=\int_{-\pi/4}^{\pi/4}\frac{32\cos^4\theta}{1+e^{\sin\theta}}d\theta$

(1) $3\pi+8$ (2) $3\pi+4$

(3) $4\pi+3$ (4) $8\pi+3$

Ans. **(1)**

Sol. Apply (P-5)

$$I=\int_{-\pi/4}^{\pi/4}\frac{32\cos^4\theta}{1+e^{-\sin\theta}}d\theta$$

Add $2I=\int_{-\pi/4}^{\pi/4}32\cos^4\theta\,d\theta=2\int_0^{\pi/4}32\cos^4\theta\,d\theta$

$$I=32\int_0^{\pi/4}\cos^4\theta\,d\theta$$

$$=8\int_0^{\pi/4}(2\cos^2\theta)^2d\theta=8\int_0^{\pi/4}(1+\cos2\theta)^2d\theta$$

$$=8\int_0^{\pi/4}1+2\cos2\theta+\cos^2 2\theta\,d\theta$$

$$=8\int_0^{\pi/4}1+2\cos2\theta+\frac{1+\cos4\theta}{2}d\theta$$

$$=8\left[\frac{3\theta}{2}+\frac{2\sin2\theta}{2}+\frac{\sin4\theta}{8}\right]_0^{\pi/4}$$

$$=8\left[\left(\frac{3\pi}{8}+1+0\right)\right]=3\pi+8$$

2. Let $S=\left\{\theta\in(-2\pi,2\pi):\cos\theta+1=\sqrt{3}\sin\theta\right\}$. Then $\sum_{\theta\in S}\theta$ is equal to

(1) $\frac{4\pi}{3}$ (2) $\frac{5\pi}{3}$

(3) $-\frac{4\pi}{3}$ (4) $-\frac{5\pi}{3}$

Ans. **(3)**

Sol. $\cos\theta+1=\sqrt{3}\sin\theta$

$$\frac{1-\tan^2\frac{\theta}{2}}{1+\tan^2\frac{\theta}{2}}+1=\sqrt{3}\left(\frac{2\tan\frac{\theta}{2}}{1+\tan^2\frac{\theta}{2}}\right)$$

$$2=2\sqrt{3}\tan\frac{\theta}{2}$$

$$\Rightarrow \tan\frac{\theta}{2}=\frac{1}{\sqrt{3}}\quad \theta\in(-2\pi,2\pi),\ \frac{\theta}{2}\in(-\pi,\pi)$$

$$\frac{\theta}{2}=-\frac{5\pi}{6},\frac{\pi}{6}$$

$$\theta=\frac{-5\pi}{3},\frac{\pi}{3}$$

$$\text{Sum }=-\frac{-5\pi}{3}+\frac{\pi}{3}=\frac{-4\pi}{3}$$

3. a_1, a_2, a_3 ..... a_n are in A.P. and sum of first 10 terms is 160. g_1, g_2, g_3 .... g_n are in G.P. were $g_1+g_2=8$ if the first term of A.P. is equal to common ratio of G.P. and first term of G.P. is equal to common difference of A.P. then sum of all possible values of g_1 is equal to :

(1) $\frac{34}{9}$ (2) $\frac{28}{9}$

(3) $\frac{23}{3}$ (4) $\frac{28}{5}$

Ans. **(1)**

Sol. A.P. $\frac{10}{2}[2a+9d]=160 \Rightarrow 2a+9d=32$ .... (1)

G.P. First term = A, Common ratio = R

$g_1+g_2=8$

$A+AR=8$ ... (2)

given $a=R$ & $A=d$

from (1) $\Rightarrow 2R+9A=32$

$A+AR=8$

$$A+A\left(\frac{32-9A}{2}\right)=8$$

$\Rightarrow 9A^2-34A+16=0$

$$\text{Sum}=\frac{34}{9}$$

4. If $P\left(\frac{a}{3},0,a+c\right)$ is image of Q(1, 6, a) with respect to line $L:\frac{x}{1}=\frac{y-1}{2}=\frac{z-a+1}{b}$, where a > 0, b > 0. If S (α, β, γ) is at a distance of $2\sqrt{14}$ from foot of perpendicular of Q on L, then $\alpha^2+\beta^2+\gamma^2$ is

(1) 179 (2) 120

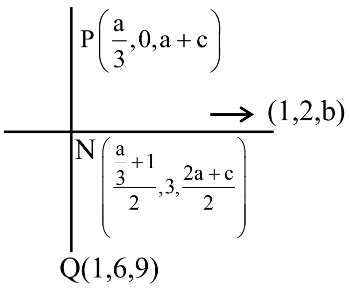
(3) 321 (4) 220

Ans. (1)

Sol. N will lie on line L

$$\frac{a+3}{6}=\frac{3-1}{2}=\frac{a+\frac{C}{2}-a+1}{b}$$

$\Rightarrow a=3$ & $\frac{c}{2}+1=b$



And $\overrightarrow{PQ}.(1,2,b)=0$

$\left(\frac{a}{3}-1\right).1+(0-6).2+c.b=0$

$-12+2b(b-1)=0$

$\Rightarrow b=3$ or $b=-2$ (reject)

$c=4$

$L:\frac{x}{1}=\frac{y-1}{2}=\frac{z-2}{3}=\lambda$

N (1, 3, 5)

Let S(λ, 2λ + 1, 3λ + 2)

$SN=2\sqrt{14}\Rightarrow(\lambda-1)^2+(2\lambda-2)^2+(3\lambda-3)^2=56$

$14(\lambda-1)^2+56\Rightarrow(\lambda-1)^2=4$

$\Rightarrow\lambda-1=\pm 2$

$\lambda=3,-1$

S (3, 7, 11) or S (– 1, – 1, – 1)

$\alpha^2+\beta^2+\gamma^2=9+49+121$

$=130+49=179$

5. Consider the circle $x^2+y^2+2gx+2fy+25=0$ having centre on line $-2x+y=+4$ and radius 6 centre lie in I[st] quadrant. If the line x = 1 cuts the circle at A and B then AB^2 is

(1) 40 (2) 60

(3) 80 (4) 100

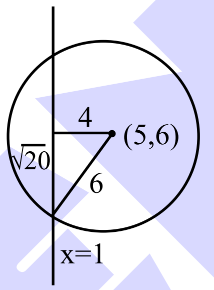
Ans. (3)

Sol. $x^2+y^2+2gx+2fy+25=0$

$2g-f=+4$ & $g^2+f^2-25=36$

solving $g=-5$, $f=-6$

$\Rightarrow x^2+y^2-10x-12y+25=0$



$AB=2\sqrt{20}$

$AB^2=80$

6. The value of $1^3-2^3+3^3-4^3+$ ------- 15^3 is equal to :

(1) 1852 (2) 1854

(3) 1856 (4) 1860

Ans. (3)

Sol. $S=1^3-2^3+3^3-4^3+$ ----- 15^3

$=(1^3+2^3+$ ------$15^3)-2\times 2^3(1^3+2^3+$ ---- $7^3)$

$=\left(\frac{15\times 16}{2}\right)^2-16\left(\frac{7\times 8}{2}\right)^2$

= 1856

7. Evaluate the limit $\lim_{x\to 0}\frac{x^2\sin^2 x}{x^2-\sin^2 x}$

(1) 2 (2) 3

(3) 4 (4) 6

Ans. (2)

Sol. $9\left(-\frac{80}{72}\right)=-10=\lim_{x\to 0}\frac{x^4}{\frac{1}{6}.2.x^4}=3$

8. If coefficients of middle terms in the expansion $(1+\alpha x)^{26}$ & $(1-\alpha x)^{28}$ are equal then α is :-

(1) $\frac{1}{4}$ (2) $\frac{8}{27}$

(3) $\frac{7}{27}$ (4) $\frac{9}{28}$

Ans. **(3)**

Sol. $^{26}C_{13}\,\alpha^{13} = {}^{28}C_{14}\,\alpha^{14}$

$$^{26}C_{13} = \frac{28}{14}.\,{}^{27}C_{13}\,\alpha$$

$$\alpha = \frac{^{26}C_{13}}{2.\,^{27}C_{13}} = \frac{\frac{26!}{13!13!}}{2.\frac{27!}{14!}} = \frac{7}{27}$$

9. Let f : {1,2,3,4} $\to$ {1, e, e^2, e^3} is a strictly increasing and bijective function and g : {1, e, e^2, e^3} $\to \left\{1,\frac{1}{2},\frac{1}{3},\frac{1}{4}\right\}$, strictly decreasing and bijective function. If $\phi(x) = \left[f^{-1}(g^{-1}(1/2))\right]^x$ then find $\int_0^1 (\phi(x)-x^2)dx$:

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

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

Ans. **(1)**

Sol. $f(x) = e^{x-1}$

$$g(x) = \frac{1}{\log_e x + 1}$$

$f^{-1}(g^{-1}(1/2)) = f^{-1}(e) = 2$

$\phi(x) = 2^x$

$$\therefore \int_0^1 (2^x - x^2)dx = \left(\frac{2^x}{\ln 2} - \frac{x^3}{3}\right)_0^1 = \frac{1}{\ln 2} - \frac{1}{3}$$

10. The number of four letter words which can be formed using two vowels and two consonants from the world INCONSEQUENTIAL (words can be meaningful or meaning less) is :

(1) 4092 (2) 4050

(3) 4090 (4) 4080

Ans. **(1)**

Sol. (I, I), (E, E), 0, A, U (NNN), C, S, Q, T, L

V	C	
2A	2A	$^2C_1 \times \frac{4!}{2!2!} = 12$
2A	2D	$^2C_1 \times {}^6C_2 \times \frac{4!}{2!} = 360$
2D	2A	$^5C_2 \times 1 \times \frac{4!}{2!} = 120$
2D	2D	$^5C_2 \times {}^6C_2 \times 4! = 3600$
		4092

11. If $\tan^{-1}(1-\alpha)+\tan^{-1}(1-\beta) = \frac{\pi}{4}$ & $\alpha = \frac{1}{\beta}$ then find $|\alpha+\beta|$:

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

(3) $\frac{5}{2}$ (4) 3

Ans. **(3)**

Sol. $\tan^{-1}(1-\alpha) = \frac{\pi}{4} - \tan^{-1}(1-\beta)$

$= \tan^{-1} 1 - \tan^{-1}(1-\beta)$

$$= \tan^{-1}\frac{1-(1-\beta)}{1+(1-\beta)}$$

$$\Rightarrow 1-\alpha = \frac{\beta}{2-\beta}$$

$$\because \beta = \frac{1}{\alpha}$$

$\Rightarrow 2\alpha^2 - 3\alpha - 2 = 0$

$$\Rightarrow \alpha = -\frac{1}{2} \quad \& \quad \alpha = 2$$

$$\Rightarrow \beta = -2 \quad \& \quad \beta = \frac{1}{2}$$

$$\therefore |\alpha+\beta| = \frac{5}{2}$$

12. Let the set of all values of $K \in \mathbb{R}$ such that the equation, $z(\bar{z}+2+i)+K(2+3i)=0$, $z \in C$ has atleast one solution, be the interval [α, β]. Then $9(\alpha+\beta) =$

(1) –10 (2) –8

(3) $10\sqrt{13}$ (4) $8\sqrt{13}$

Ans. **(1)**

Sol. Let $z = x + iy$ where $x, y \in \mathbb{R}$.

$\therefore$ The equation becomes

$(x^2 + y^2 + 2x - y + 2k) + i(x + 2y + 3k) = 0 = 0 + i0$

$\therefore x^2 + y^2 + 2x - y + 2k = 0$ .....(1)

& $x + 2y + 3k = 0$ ....(2)

So, on putting $x = -(2y + 3k)$ from

(2) in (1), we get

$5y^2 + (12k - 5)y + (9k^2 - 4k) = 0$

As y is real, so its

Discriminate ≥ 0

$\Rightarrow 36k^2 + 40k - 25 = 0$

$$\therefore \frac{-40 - 20\sqrt{13}}{72} \leq k \leq \frac{-40 + 20\sqrt{13}}{72}$$

$$\text{So, } 9(\alpha + \beta) = 9\left(-\frac{80}{72}\right) = -10$$

13. If x_1, x_2, x_3............x_{25} be 25 observations such that $\sum_{i=1}^{25}(x_i + 5)^2 = 2500$ and $\sum_{i=1}^{25}(x_i - 5)^2 = 1000$. Then the ratio of mean and standard deviation of the given observation, is

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

(3) $\frac{1}{4}$ (4) $\frac{1}{5}$

Ans. (2)

Sol. $\sum x_i^2 + 10\sum x_i + 625 = 2500$

$\sum x_i^2 - 10\sum x_i + 625 = 1000$

$\Rightarrow \sum x_i^2 = 1125$

$\sum x_i = 75$

$$\text{Mean } \bar{x} = \frac{\sum x_i}{25} = \frac{75}{25} = 3$$

$$\text{Standard deviation} = \sqrt{\frac{\sum x_i^2}{25} - \left(\frac{\sum x_i}{25}\right)^2}$$

$$= \sqrt{\frac{1125}{25} - 9} = 6$$

Ratio $\frac{1}{2}$

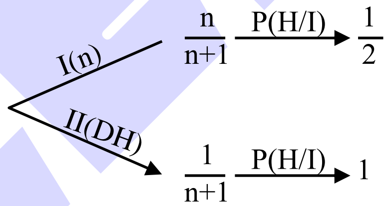
14. If there are (n + 1) coins of which n coins are fair and one is double headed coin. A coin is randomly selected and tossed, if probability that head occurs is $\frac{9}{16}$ then n is :

(1) 7 (2) 8

(3) 9 (4) 10

Ans. (1)

Sol.



$$\therefore \frac{n}{n+1}\cdot\frac{1}{2} + \frac{1}{n+1}\cdot 1 = \frac{9}{16}$$

$$\frac{n+2}{2(n+1)} = \frac{9}{16} \Rightarrow n = 7$$

15. Given point $P(6,4\sqrt{3})$ satisfy hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ where eccentricity is root of equation $9e^2-21e+10=0$. Then find the length of latus rectum of hyperbola $\frac{x^2}{a^2}-\frac{y^2}{2(1+b^2)}=1$.

(1) $\frac{56}{3}$ (2) $\frac{68}{3}$

(3) $\frac{52}{3}$ (4) $\frac{70}{3}$

Ans. **(2)**

Sol. $9e^2 - 15e - 6e + 10 = 0$

$3e(3e-5) - 2(3e-5) = 0$

$e = \frac{2}{3}, \frac{5}{3}; \boxed{e = \frac{5}{3}}$

$\frac{25}{9} = 1 + \frac{b^2}{a^2} \Rightarrow \frac{b^2}{a^2} = \frac{16}{9}$

$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1 \xrightarrow[(6,4\sqrt{3})]{} \frac{36}{a^2} - \frac{48}{b^2} = 1$

$\frac{36}{9\lambda} - \frac{48}{16\lambda} = 1 \Rightarrow \frac{4}{\lambda} - \frac{3}{\lambda} = 1 \Rightarrow \lambda = 1$

$b^2 = 16, a^2 = 9$

$\frac{x^2}{9} - \frac{y^2}{34} = 1$

$\frac{2b^2}{a} = \frac{2\times 34}{3} = \frac{68}{3}$

16. Given two lines

$L_1 : \frac{x-1}{3} = \frac{y-2}{2} = \frac{z+1}{1}$

$L_2 : \frac{x+2}{1} = \frac{y-1}{1} = \frac{z}{1}$

Third lines L_3 is perpendicular to both lines L_1 & L_2. Find acute angle between lines L_3 & $\vec{v} = 2\hat{i} - \hat{j} - \hat{k}$

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

(3) $\frac{\pi}{6}$ (4) $\frac{\pi}{3}$

Ans. **(4)**

Sol. DR of $L_3 = \vec{a}$

$$\vec{a} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & 2 & 1 \\ 1 & 1 & 1 \end{vmatrix} = \hat{i} - 2\hat{i} + \hat{k}$$

$\cos\theta = \frac{\vec{a}.\vec{v}}{|\vec{a}||\vec{v}|}$

$= \left(\frac{2+2-1}{\sqrt{6}\sqrt{6}}\right)$

$= \frac{1}{2}$

$\theta = \frac{\pi}{3}$

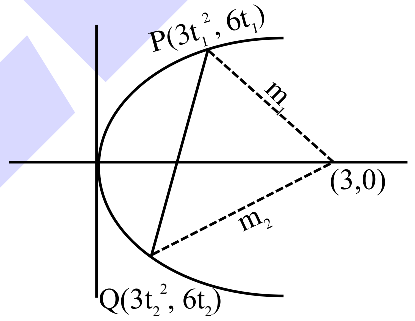
17. If ratio of 2-ordinates of points on the parabola $y^2 = 12x$ is 1 : 2 and length of chord joining these points is $3\sqrt{13}$, then find angle subtend by the chord at the focus of the parabola

(1) $\tan^{-1}\frac{1}{2}$ (2) $\tan^{-1}\frac{3}{4}$

(3) $\tan^{-1}\frac{2}{3}$ (4) $\tan^{-1}\frac{1}{4}$

Ans. **(2)**

Sol.



$\frac{6t_1}{6t_2} = \frac{1}{2}$

$t_2 = 2t_1$

$m_1 = \frac{6t_1}{3t_1^2 - 3} = \frac{2t_1}{t_1^2 - 1} = \text{not defined}$

$m_2 = \frac{2t_2}{t_2^2 - 1} = \frac{4t_1}{4t_1^2 - 1} = \frac{4}{3}$

$9\times 13 = 9\left(t_1^2 - t_2^2\right)^2 + 36\left(t_1 - t_2\right)^2$

$13 = \left(t_1^2 - 4t_1^2\right)^2 + 4\left(t_1 - 2t_1\right)^2$

$13 = 9t_1^4 + 4t_1^2 \Rightarrow t_1^2 = 1$

$t_1 = 1, -1$ $\boxed{\tan\theta = 3/4}$

18. If domain of $f(x)=\sin^{-1}\left(\frac{x+[x]}{3}\right)$ where $[\bullet]$ denotes greatest integer function, is $[\alpha, \beta)$ then $(\alpha^2+\beta^2)$ is :

(1) 5 (2) 7

(3) 3 (4) 9

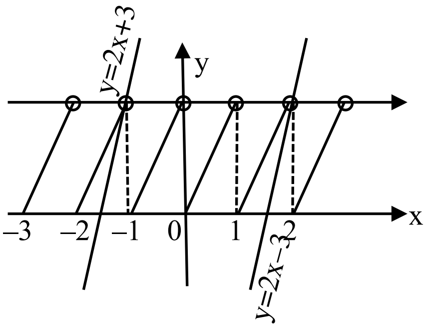
Ans. **(1)**

Sol. $-1 \le \frac{x+[x]}{3} \le 1$

$x+[x] \ge -3$ $x+[x] \le 3$

$2x-\{x\} \ge -3$ $2x-\{x\} \le 3$

$\{x\} \le 2x+3$ $\{x\} \ge 2x-3$



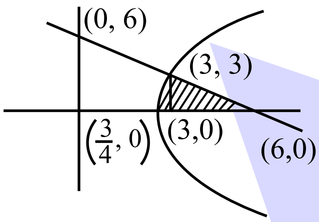
$x \in [-1, 2) \Rightarrow \alpha = -1, \beta = 2$

$\therefore \alpha^2 + \beta^2 = 5$

19. Find the area bounded by $0 \le y \le 6-x$, $y^2+3 \le 4x$ & $x > 0$, is

Ans. **(9)**

Sol. $A = \int_0^3 \left(6-y-\frac{y^2+3}{4}\right)dy = 9$



20. Solution of differential equation

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

Satisfy condition $y(1) = 1$, then find $\left[y\left(\sqrt{5}\right)\right]$.

(Here $[\cdot]$ denotes greatest integer function)

Ans. **(3)**

Sol. $\frac{dy}{dx}+\frac{y}{x}=\frac{1}{x-\sqrt{x^2-1}}$

$\frac{dy}{dx}+\frac{y}{x}=x+\sqrt{x^2-1}$

$I.f = e^{\ln x} = x$

$y.x=\int\left(x+\sqrt{x^2-1}\right)x\,dx$

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

Given $y(1) = 1$

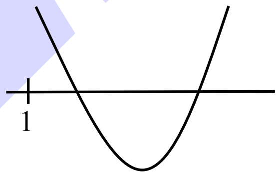
$1=\frac{1}{2}+C \Rightarrow C=\frac{1}{2}$

$\left[y\left(\sqrt{5}\right)\right]=\left[\frac{\sqrt{5}}{2}+\frac{8}{3}+\frac{1}{2\sqrt{5}}\right]=3$

21. Consider e_1 and e_2 be roots of the equal $x^2-ax+2=0$ set of exhaustive values of 'a' for which e_1 and e_2 are eccentricities of hyperbolas then $a \in [\alpha,\beta)$ and set of values of 'a' for which e_1 and e_2 are eccentricity of the parabola and ellipse is (γ, ∞) then $(\alpha^2+\beta^2+\gamma^2)$ equal :

Ans. **(26)**

Sol.



$f(x) = x^2 - ax + 2$

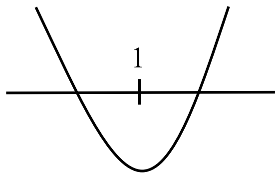
$f(1) = 3-a > 0 \Rightarrow a < 3$

$-\frac{b}{2a} > 1 \Rightarrow \frac{a}{2} > 1 \Rightarrow a > 2$

$D \ge 0 \Rightarrow a^2 - 8 \ge 0$

$a \in (-\infty,-2\sqrt{2}]\cup[2\sqrt{2},\infty)$

$a \in [2\sqrt{2},3)$



$f(1) < 0$

$3 - a < 0$

$a \in (3, \infty)$

$\alpha = 2\sqrt{2},\ \beta = 3,\ \gamma = 3$

$\alpha^2 + \beta^2 + \gamma^2 = 8 + 9 + 9 = 26$

22. Given vectors

$\vec{a} = \hat{i} + \hat{j} + \hat{k}$ & $\vec{b} = \hat{j} - \hat{k}$. Another vector $\vec{c}$ satisfy equation $\vec{a}.\vec{c} = 3$ & $\vec{a} \times \vec{c} = \vec{b}$ then find $\vec{a}.(\vec{c} - 2\vec{b})$

Ans. **(3)**

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

$3\vec{a} - 3\vec{c} = \vec{a} \times \vec{b}$

$\vec{c} = \dfrac{3\vec{a} - \vec{a} \times \vec{b}}{3}$

$\vec{a}.\left(\dfrac{3\vec{a} - \vec{a} \times \vec{b}}{3} - 2\vec{b}\right)$

$\Rightarrow |\vec{a}|^2 - 2\vec{a}.\vec{b} = 3 - 2(0) = 3$

23. Given that quadratic equation $(k^2 - 15k + 27)\ x^2 + 9(k-1) + 18 = 0$ has one root twice of other. Then find length of latus rectum of parabola $y^2 = 6kx$

Ans. **(12)**

Sol. $(k^2 - 15k + 27)\ x^2 + 9\ (k - 1)\ x + 18 = 0$ ⟨ α, 2α

$\alpha + 2\alpha = -\dfrac{9(k-1)}{k^2 - 15k + 27} \Rightarrow \alpha = \dfrac{-3(k-1)}{k^2 - 15k + 27}$

$\alpha(2\alpha) = \dfrac{18}{k^2 - 15k + 27}$

$\Rightarrow 2\alpha^2 = \dfrac{18}{k^2 - 15k + 27} \Rightarrow \dfrac{2 \cdot 9(k-1)^2}{(k^2 - 15k + 27)^2} = \dfrac{18}{(k^2 - 15k + 27)}$

$\Rightarrow (k-1)^2 = k^2 - 15k + 27 \Rightarrow k = 2$

$LR = 6k = 12$


PHYSICS