Vedantu

JEE-Main-24-01-2026 (Memory Based)
[MORNING SHIFT]
Maths

Question: The value of $\frac{\sqrt{3}\text{cosec}20^o - \sec 20^o}{\cos 20^o \cos 40^o \cos 60^o \cos 80^o}$ **is**
Options:
(a) 12
(b) 16
(c) 64
(d) 32
Answer: (c)

$$\frac{\sqrt{3}\text{cosec} - \sec 20}{\cos 20 \cos 40 \cos 60 \cos 80} \quad \cos\theta. \ \cos ec\theta \quad \cos 2^2\theta$$

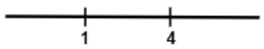
$$\frac{2\left(\frac{\sqrt{3}}{2}\cos 20 - \sin 20\right.}{\sin 20 \cos}$$

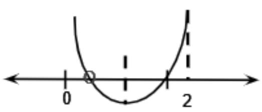
$$2 \times 2\frac{\sin(20-20)}{\frac{\sin 40 \cdot \sin 20}{2o \sin 20 \times \frac{1}{2}}}$$

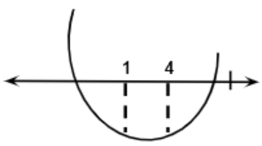
$$\frac{4}{\frac{1 \sin 2^3 \cdot 20}{2^3 \sin 20}} = 4 \times 2^4 = 64$$

Question: The number of solution for x ∈ R, x|x-4|+|x-1|-2=0
Options:
(a) 1
(b) 2
(c) 3
(d) 4
Answer: (a)

$C-I$
$-x(x-4)-(x-1)-2=0$
$-x^2+4x-x+1-2=0$
$-x^2+3x-1=0 \Rightarrow x^2-3x+1=0$
1 real root
$C-II$
$1<x<4$
$-x(x-4)+(x-1)-2=0$
$-x^2+4x+x-3=0$
$-x^2+5x-3=0$
$+x^2-5x+3=0$
No real root
$C-III$
$x>4$
$x(x-4)+x-1-2=0$
$x^2-3x-3=0$
No real root







Question: If $\cot x=\frac{5}{12}$ **for some** $x \in \left(\pi, \frac{3\pi}{2}\right)$ **then** $\sin 7x\left(\cos\frac{13x}{2}+\sin\frac{13x}{2}\right)+\cos 7x\left(\cos\frac{13x}{2}-\sin\frac{13x}{2}\right)$ **is equal to**

Answer: $\left(\frac{1}{\sqrt{13}}\right)$

$\sin 7x\left(\cos\frac{13x}{2}-\cos 7x\sin\frac{13x}{2}\right)+\sin 7x\sin\frac{13x}{2}+$
$\sin\left(7x-\frac{13x}{2}\right)+\cos\left(7x-\frac{13x}{2}\right)$
$=\sin\frac{x}{2}+\cos\frac{x}{2}=\sqrt{1+2\sin\frac{x}{2}\cos x}$
$\sqrt{1-\sin x}$
$=\sqrt{1-\frac{12}{13}}$
$=\frac{1}{\sqrt{13}}$

Question: If the function $f(x)=\frac{e^x\left(e^{\tan x-x}-1\right)+\log_e(\sec x+\tan x)-x}{\tan x-x}$ **is continuous at x = 0, then the value of f(0) is equal to**

Options:
(a) $\frac{1}{2}$
(b) 2
(c) $\frac{2}{3}$

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

Answer: (d)

$$F(0) = \lim_{x \to 0} \frac{e^x(e^{\tan x - x} - 1)}{\tan x - x} + \frac{\ln(\sec x + \tan x) - x}{\tan x - x}$$

$$= e^o(1) = \lim_{x \to 0} \frac{\ln(\sec x + \tan x) - x}{\tan x - x}$$

$$= 1(1) + \lim_{x \to 0} \frac{\sec x - 1}{\sec^2 x - 1}$$

$$= 1 + \lim_{x \to 0} \frac{(\sec x - 1)}{(\sec x - 1)(\sec x + 1)}$$

$$= 1 + \lim_{x \to 0} \frac{1}{(\sec x + 1)}$$

$$= 1 + \frac{1}{2} = \frac{3}{2}$$

Question: Consider 10 data such that their mean is 10 and variance is 2. If one of the data α is removed and new data entry β is inserted. Now new mean is 10.1 and new variance is 1.99 then (α +β) is equal to

Options:

(a) 10

(b) 20

(c) 1

(d) 2

Answer: (c)

$$\sum x = 100$$

$$\sum x - \alpha + \beta = 10.1 \times 10$$

$$\beta - \alpha = 1$$

$$\sum x^2 + = 102 \times 10$$

$$\frac{0_1^2 \sum x_1^2 - \alpha^2 + \beta^2}{10} (10.1)^2 = 1.99$$

$$\frac{1020 - \alpha^2 \beta^2}{10} = 1.99 + 1020$$

$$1020 - \alpha^2 + \beta^2 = 1040$$

$$\beta^2 - \alpha^2 = 20$$

$$(\beta - \alpha)(\beta + \alpha) = 20$$

$$1 \times \beta + \alpha = 20$$

$$\beta + \alpha = 20$$

Question: Consider an A.P a_1, a_2…a_n; $a_1 > 0$, a_2 - a_1 = $-\frac{3}{4}$, $a_n = \frac{1}{4}$ and $\sum_{i=1}^{n} a_i = \frac{525}{2}$ then $\sum_{i=1}^{17} a_i$ is equal to

Answer: (136)

$a_1 - a_1 = d = -\frac{3}{4}$

$a + (n-1)\left(-\frac{3}{4}\right) = \frac{1}{4}9$

$\Rightarrow \frac{3}{4}a = (n-1)\frac{3}{4} \Rightarrow a = n-1 \qquad n = a+1$

$\frac{n}{2}\left[2a + (n-1)\left(-\frac{3}{4}\right)\right] = \frac{525}{2}$

$(a+1)\left[2a - \frac{39}{4}\right] = 525$

$(s+1) \times \frac{59}{2} = 525$

$\left(a^2 + a\right) = (105) \times 2$

$a(a+1) = 210 \Rightarrow a = 14$

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

$\sum_{i=1}^{17} a_i = \frac{17}{2}\left[28 + 16 \times -\frac{3}{4}\right]$

$= \frac{17}{2}[28-12] = \frac{17}{2} \times 16 = 17 \times 8$

$= 136$

Question:If $F(t) = \int \frac{1 - \sin(\ell n\, t)}{1 - \cos(\ell n\, t)} dt$ and $F\left(e^{\pi/2}\right) = -e^{\pi/2}$ then $F\left(e^{\pi/4}\right)$ **is**

Options:

(a) $\left(-1-\sqrt{2}\right)e^{\frac{\pi}{4}}$

(b) $\left(1-\sqrt{2}\right)e^{\frac{\pi}{4}}$

(c) $\left(1+\sqrt{2}\right)e^{\frac{\pi}{4}}$

(d) $\left(-2-\sqrt{2}\right)e^{\frac{\pi}{4}}$

Answer: (a)

$f(t) = \int \frac{1 - \sin \ln t}{1 - \cos \ln t}$

$\int \frac{1 - \sin x}{1 - \cos x} e^x$

$\left(\frac{1}{2}\operatorname{cosec}^2 \frac{x}{2} - \cot \frac{x}{2}\right)e^x$

$f(t) = e^{\frac{x}{x}}\left(\cot \frac{x}{2}\right) + C$

$f(t) = \frac{\cot \ln t}{2} e^{\ln t} + C$

$f(t) = -e^{\ln t} \frac{\cot \ln t}{2} + C$

$f(t) = \frac{toot \ln t}{2} + C$

$C = 0$

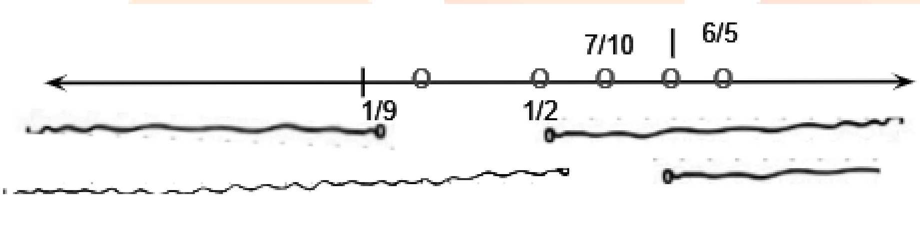
$f\left(e^{\frac{\pi}{4}}\right) - e^{\frac{\pi}{4}} \cot \frac{\pi}{8}$

$= -e^{\frac{\pi}{4}}\left(1+\sqrt{2}\right)$

Question: Find domain of $\log_{(10x^2 - 17x - 7)}\left(18x^2 - 11x + 1\right)$ **is**

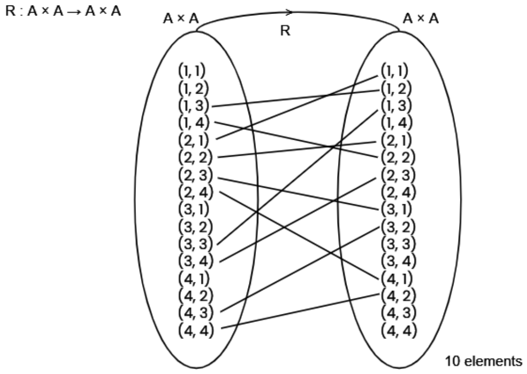
Answer: $(-\left\{\frac{6}{5}\right\})$

$18x^2 - 11x + 1 > 0$
$(2x-1)(9x-1) > 0$
$x \in \left(-\infty, \frac{1}{9}\right) v \left(\frac{1}{2}, \infty\right)$
$10x^2 - 17x + 7 > 0$
$10x^2 - 10x - 7x + 7 > 0$
$10x(x-1) - 7(x-1) > 0$
$(x-1)(10x-7) > 0$
$x \in \left(-\infty, \frac{7}{10}\right) v (1, \infty)$
and $10x^2 - 17x + 7 \neq 1$
$10x^2 - 17x + 6 \neq 0$
$10x^2 - 12x - 5x + 6 \neq 0$
$2x(5x-6) - 1(5x-6) \neq 0$
$(5x-6)(2x-1) \neq 0$
$x \neq \frac{1}{2}, \frac{6}{5}$
$\left(-\infty, \frac{1}{9}\right) v \left(\frac{1}{2}, \frac{7}{10}\right) v (1, \infty) - \left\{\frac{6}{5}\right\}$



Question: $\frac{1}{25!} + \frac{1}{3!23!} + \ldots$ **upto 13 terms = ?**
Answer: $\left(\frac{1}{26!} \times 2^{25}\right)$
$\frac{1}{25!x!} + \frac{1}{8!23!} - - - - - - - - - - - \text{upto} 13$
$T_n = \frac{1}{(2n-1)!(27-2n)!}$
$T_n = \frac{(26!)}{26! \times 2! \times \{(2n-1)1 \times (27-2n)!\}}$
$= \frac{1}{26!}\,{}^{26}C_{2n-1}$
$\frac{1}{26!}\left[{}^{26}C_1 + {}^{26}C_3 - - - - - -\right]$
$\frac{1}{26!} \times 2^{25}$

Question: If A $\in$ {1, 2, 3, 4}; A relation defined on A × A such that 2a + 3b = 3c +4d then number of elements in relation
Answer: (10 elements)



Question: Number of 4 - digit number by using digits 0, 1, 2, 5, 9 divisible by 3 & number lies between 5000 to 9000 (Repetition is allowed)
Answer: (42)

____ [0, 1, 2, 3, and 9]   ____ [   ]   ____ [   ]

$= \text{ Sum of coefficient of } x^{3k} \text{in } x^5\left(x^0+x^1+x^2+x^5+x^9\right)^3$

$= \frac{5^3+\omega^5(-\omega)^3+\left(-\omega^2\right)^3\omega^{10}}{3} = 42$

Question: $\left|\frac{z-6i}{Z-2i}\right| = 1 \ \& \ \left|\frac{z-8+2i}{z+2i}\right| = \frac{3}{5}$ **If Z is complex no satisfying then find ∑ |2|²**

Answer: (385)

$\left|\frac{z-6i}{z-2i}\right| = 1$

$\left|\frac{z-(-2i)}{z-(8-2i)}\right| = \frac{5}{3}$

This is equal of circle

$\text{Radins} = \frac{\frac{5}{3}}{\left(\frac{5}{3}\right)^2-1} AB$

$= \frac{\frac{5}{3}\times 9}{25-9} \times 8 = \frac{15}{16} \times 8 = \frac{15}{2}$

$\text{Create} \rightarrow mid \text{ point of I and E}$

$\left(\frac{29}{2}, -2\right)$

$eq^n \text{of circle}$

$\left(x-\frac{25}{2}\right)^2 + (y+2)^2 = \frac{225}{4}$

$z_i = 8+4i$

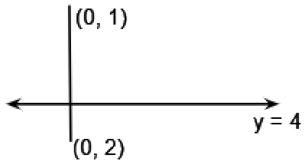
$z_2 = 17+4i$

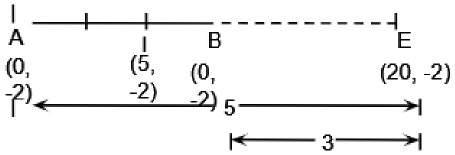
$|z_i|^2 + |z_2|^2$

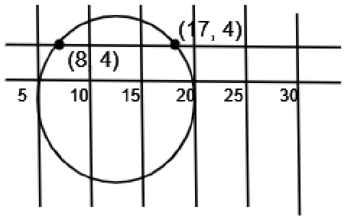
$64+16+289+16$

$80+305$

$= 385$







Question: Consider a sequence 729, 81, 9, 1… Let Pn = product of first n terms of the given sequence $\sum_{n=1}^{40}(P_n)^{\frac{1}{n}} = \frac{3\alpha - 1}{2 \times 3^{\beta}}$ **and Then the value of $\alpha + \beta$ is**

Options:

(a) 73

(b) 75

(c) 76

(d) 81

Answer: (a)

$p_n = a_1, a_2, a_3 - - - - - - - - a_{27}$

$= 3^{8-2\times1} \cdot 3^{8-2\times2} 3 \cdot^{8-2\times3} - - - - - e2^{8-2n}$

$p_n = 3^{8-8+8-4------8-2n}$

$= 3^{6+4+2------8-2n}$

$3\frac{n}{2}(6 + 8 - 2n)$

$pn\frac{1}{n}3\frac{n}{2}(7 - n) = 3^{n(7-n)}$

$= 3^{n-n}$

$$\sum_{n}^{40} 37n = 3^6 + 3^5 - - - - 3^7 - 40$$

$= 36\frac{\left(1-(1/3)^{40}\right)}{\left(1-\frac{1}{3}\right)}$

$= 36 \times \frac{3}{2} \cdot \left(1 - 3^{-40}\right)$

$729, 81, 9, 1$

$a = 36$

$r = \frac{34}{36} = 3^{-2}$

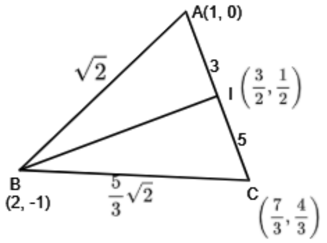
$ak = 729 \cdot \left(3^{-1}\right)k - 1$

$= 729\ 3^{-2k+2}$

$= 3^6 \cdot 3^{-2k+2}$

$= 3^{-2k+8}$

Question: (1,0), (2,-1), $\left(\frac{7}{3}, \frac{4}{3}\right)$ are vertices of a δ. Find e^n of internal angle bisector through (2, -1),
Answer: (3x + y = 5)



$$BC = \sqrt{\left(\frac{7}{3} - 2\right)^2 + \left(\frac{4}{3} + 1\right)^2}$$

$$= \sqrt{\frac{1}{9} + \frac{49}{9}}$$

$$I\left(\frac{7+5}{8}, \frac{4+0}{8}\right) = \left(\frac{3}{2}, \frac{1}{2}\right)$$

$$mAI = \frac{\frac{1}{2}+1}{\frac{3}{2}-2} = \frac{3}{-1} = -3$$

$$Eq^n \text{of } BI \Rightarrow y + 1 = -3(x - 2)$$

$$y + 1 = -3x + 6$$

$$3x + y = 5$$

Question: Number of matrices A of order 3 × 2 such that all of its elements are from the set {-2, -1, 0, 1, 2} such that trace of AA^T is 5, is equal to
Options:
(a) 120
(b) 312
(c) 192
(d) 126
Answer: (a)

$$\begin{bmatrix} a_1 & a_2 \\ b_1 & b_2 \\ c_1 & c_2 \end{bmatrix} \begin{bmatrix} a_1 & b_1 & c_1 \\ a_1 & b_2 & c_2 \end{bmatrix} = \begin{matrix} a_1^2 + a_2^2 & & \\ & b_1^2 + b_2^2 & \\ & & c_1^2 + c_2^2 \end{matrix}$$

$$\left[a_1^2 + a_2^2 + b_1^2 + b_2^2 + c_1^2 + c_2^2\right] = 5$$

$$^6C_2 \times 2!(2)(-2) = 120$$

Question: Out of 100 bulbs, 10 are defective and 90 are non defective. If the probability of finding 7 defective bulbs out of 8 draws, with replacement, is $\frac{K}{10^8}$ then the value of K is
Options:
(a) 69
(b) 72

(c) 75
(d) 96
Answer: (b)

$$P=\frac{10}{100}=\frac{1}{10} \quad q=\frac{9}{10}$$

$$p(x=r)={ }^n C_r p^r q^{n-r}$$

$$P(x=7)={ }^8 C_7\left(\frac{1}{10}\right)^7\left(\frac{9}{10}\right)^1$$

$$=\frac{8 \times 1}{10^8} \times 9=\frac{72}{10^8}$$

$$k=72$$

Question: Let the lines $L_i: \overrightarrow{r}=\hat{i}+2\hat{j}+3\widehat{k}+\lambda\left(2\hat{i}+3\hat{j}+4\widehat{k}\right), \lambda \in R$
Intersect at the point R. Let P and Q be the points lying on liens L_1 & L_2 respectively such that $|PR|=\sqrt{29}$ **and** $|PQ|=\sqrt{\frac{47}{3}}$. **If the point P lies in the first octant, then $27(QR)^2$ is equal to**
Options:
(a) 340
(b) 360
(c) 320
(d) 348
Answer: (b)

$$L_1: \vec{r}=\hat{i}+2\hat{j}+3\hat{k}+\lambda(2\hat{i}+3\hat{j}+4\hat{k})$$

$$L_2: \vec{r}=(4\hat{i}+\hat{j})+\mu(5\hat{i}+2\hat{j}+\hat{k})$$

$$P(1+2d,\ 2+3d+3+4\lambda)$$

$$Q(4+5\mu, 1+2\mu+D+\mu)$$

$$R(-1,-1,-1)$$

$$(2\lambda+2)^2+(3+3\lambda)^2+(4\lambda+\gamma)^2$$

$$R(1+2\lambda+9+5\mu)$$

$$3\pi 5\mu-2\lambda=-3$$

$$(2\lambda+2)^2+(3+3\lambda)^2+(4\lambda+\lambda)^2$$

$$=2\times 2\mu-3\lambda=1-11$$

$29(d+1)^2 = 29$

$\lambda = -12 + 1 = 21$

$\lambda = 0, \lambda = ?$

$P(1,2,3)$

$PQ = (5+3)^2(24-1)^2 + (\mu-3)^2 = \frac{47}{3}$

$P(1,2,3)\, Q\left(\frac{7}{3}, \frac{1}{3}, \frac{1}{3}\right) - \mu^2 - 6\mu + 9$

$30\mu^2 + 20\mu + 19 = \frac{47}{3}$

$(QR)^2 = \frac{100}{9} + \frac{16}{9} + \frac{4}{9} = \frac{120}{9}\, 9\mu^2 + 6\mu + 1 = 0$

$= \frac{40}{3} \Rightarrow 27(QR)^2 = \cancel{27} \times \frac{40}{\cancel{3}} = 360$

Question: If $\int_0^{36} \left(\frac{tx}{36}\right) dt = 4\alpha f(x), y = f(x)$ **is standard parabola passing through (2, 1) & (-4,** β**). Find the value of** β^α **=**

Answer: (64)

$y = kx^2 \Rightarrow 1 = k(2)^2 \Rightarrow k = \frac{1}{4}$

$f(x) = y = \frac{1}{4}x^2 \quad \beta = \frac{1}{4}(-4)^2 = 4$

$$\int_0^{36} \frac{1}{4}\left(\frac{tx}{36}\right)^2 dt = 4\alpha \times \frac{1}{4}x^2$$

$\frac{1}{3} \times \frac{x^2}{(36)^2 \times 4}\left(t^3\right)_0^{36} = \alpha x^2$

$\frac{1}{3} \times \frac{1}{4 \times (36)^2}(36)^3 = \alpha$

$\frac{1}{3} \times \frac{36}{4} = \alpha \Rightarrow \alpha = 3$

$\beta^\alpha = 4^3 = 64$

Question: A1 is the area bounded by y = x^2 + 1, x + y = 8, y-axis in the 1[st] quadrant and A_2 is the area bounded by y = x^2 + 2, y^2 = x, x = 0 and x = 2 in the 1st quadrant find (A_1 - A_2)

Options:

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

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

(c) $\frac{3}{5} + \frac{4\sqrt{2}}{3}$

(d) None of these

Answer: (a)

$$A = \int_0^2 (8-x) - (x^2+2)$$
$$= \int_0^2 (8 - x - x^2)$$
$$= \left\{6x - \tfrac{x^2}{2} - \tfrac{x^3}{3}\right\}_{-3}^2 = \left(12 - 2 - \tfrac{8}{3}\right) = \left(\tfrac{22}{3}\right)$$
$$= 1$$
$$\int_0^2 (x^2 + 2 - \sqrt{x}) = \left[\frac{x^3}{3} + 2x - \frac{2}{3}x\frac{3}{2}\right]_0^2$$
$$= \left(\tfrac{8}{3} + 4 - \tfrac{2}{3}2\sqrt{2}\right)$$
$$A_1 - A_2 = \tfrac{22}{3} - \left(\tfrac{20}{3} - \tfrac{4\sqrt{2}}{3}\right)$$
$$\left(\tfrac{20}{3} - \tfrac{4\sqrt{2}}{3}\right)$$
$$= \tfrac{2}{3} + \tfrac{4\sqrt{2}}{3}$$

Question: Let a circle pass through points $A\left(-\sqrt{2}\alpha, 0\right), B\left(0, \sqrt{3}\beta\right)$ **And O (0,0) such that its radius is 4. Then the radius of locus of centroid of triangle OAB is**

Options:

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

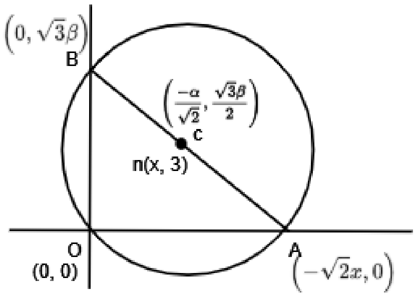
(b) $\frac{8}{3}$

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

(d) $\frac{11}{3}$

Answer: (b)

$$OC = R\sqrt{\tfrac{\alpha^2}{2} + \tfrac{3}{4}\beta^2} = 4$$
$$2\alpha^2 + 3\beta^2 = 64$$
$$x = -\frac{\sqrt{2}\alpha}{3}, \qquad y = \frac{\sqrt{3}\beta}{3}$$
$$3x = -\sqrt{2}\alpha \qquad ay^2 = 3\beta^2$$
$$\Rightarrow 9x^2 = 2\alpha^2$$
$$9x^2 + 9y^2 = 64$$
$$x^2 + y^2 = \tfrac{64}{9}$$
$$\text{Radius} = \tfrac{8}{3}$$



$\vec{a} = 2\hat{i} + 2\hat{j} - \hat{k}$

$\vec{b} = \hat{i} - \hat{j}$

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

Question: $\vec{d}$ **makes an angle** $\frac{\pi}{4}$ **with** $\vec{c}$ **and** $\left|\vec{c} \times \vec{d}\right| = 3, \left|\vec{a} - \vec{d}\right| = \sqrt{11}.$ **Find the value of**

Answer: (-$\frac{1}{2}$)

$\vec{a} = 2\hat{i} + 2\hat{j} - \hat{k}$

$b = \hat{i} - \hat{j}$

$$c = a \times b = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 2 & -1 \\ 1 & -1 & 0 \end{vmatrix} = -\hat{i} - \hat{j} - 4\hat{k}$$

$|c| = \sqrt{18} = 3\sqrt{2}$

$|c \times d| = |c||d| \sin \frac{2}{4}$

$3 = \left(\frac{3}{\sqrt{2}}\right)|d| \times \frac{1}{\sqrt{2}} \Rightarrow |d| = 1$

$|a - d| = \sqrt{11} \Rightarrow |a|^2 + |d|^2 - 2(a \cdot d) = 11$

$= 9 + 1 - 2(cd) = 11$

$= a \cdot d = -\frac{1}{2}$