



MATHS

BOOKS - UNITED BOOK HOUSE

QUESTION PAPER 2015

Exercise

1. The value of m for which the planes $2x+3y-z=5$ and $3x-my+3z=6$ are perpendicular to each other is

A. -1

B. $\frac{1}{2}$

C. $\frac{1}{2}$

D. $\frac{1}{2}$

Answer:



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2. $f(x) = \mu x - \sin x, x > 0$ is a monotonic increasing function then

A. $\mu > -1$

B. $\mu < 1$

C. $\mu > 1$

D. $\mu < 1$

Answer:



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3. The probability distribution $P(x)$ of a random variable X is given by

$$p(X = x) = \begin{cases} K & \text{when } x = 0 \\ 2K & \text{when } x = 1 \\ 3K & \text{when } x = 2 \\ 0 & \text{elsewhere} \end{cases}, \text{ where } K \text{ is a}$$

constant. The value of K is

A. $\frac{1}{2}$

B. $\frac{1}{4}$

C. $\frac{1}{5}$

D. $\frac{1}{6}$

Answer:



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4. IF $P(A \cap B) = \frac{5}{13}$ then the value of

$P(A^C \cup B^C)$ is

A. $\frac{4}{13}$

B. $\frac{5}{13}$

C. $\frac{7}{13}$

D. $\frac{8}{13}$

Answer:



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5. The value of λ for which the vectors

$\vec{a} = \hat{i} + 3\hat{j} - \hat{k}$ and $\vec{b} = 2\hat{i} + 6\hat{j} + \lambda\hat{k}$ are

parallel is

A. 2

B. $-\frac{1}{2}$

C. $\frac{1}{2}$

D. -2

Answer:



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6. The value of $\int_{-1}^1 x|x|dx$ is

A. 2

B. 0

C. $\frac{1}{2}$

D. $-\frac{1}{2}$

Answer:



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7. answer any three questions:5. if $f(2)=4, f'(2)=4$, then

evaluate $\lim_{x \rightarrow 2} \frac{x f(2) - 2 f(x)}{x - 2}$

A. 2

B. -4

C. $\frac{1}{2}$

D. -2

Answer:





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8. If A is a 2×2 invertible matrix, then value of \det

A^{-1} is

A. $-\det A$

B. $-\frac{1}{\det A}$

C. $\det A$

D. $\frac{1}{\det A}$

Answer:



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9. The value of $\sin^{-1}\left(-\frac{\sqrt{3}}{2}\right) + \cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$ is

A. $\frac{\pi}{6}$

B. $-\frac{\pi}{6}$

C. $\frac{\pi}{4}$

D. $-\frac{\pi}{4}$

Answer:



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10. The relation $R \{(1,1),(2,2),(4,4),(1,2),(1,3),(2,3)\}$ on the set $A = \{1,2,3,4\}$ is

A. reflexive

B. symmetric

C. transitive

D. equivalence

Answer:



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11. A binary operation $*$ is defined on the set of all integers Z by $a * b = a + b + 5, a, b \in Z$ Find whether $*$ is associative on Z .



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12. Find the value of $\tan^{-1} \left\{ 2 \cos \left(2 \frac{\sin^{-1} 1}{2} \right) \right\}$.

(Consider principal values only).

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13. If $A = \begin{pmatrix} 3 & 1 \\ 7 & 5 \end{pmatrix}$ and $A^2 = -xI + yA$. Find x

and y where I is a unit matrix of order 2.

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14. Without expanding, show that $\begin{vmatrix} 9 & 9 & 12 \\ 1 & -3 & -4 \\ 1 & 9 & 12 \end{vmatrix} = 0$



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15. Verify Rolle's theorem for function $f(x) = 4^{\sin x}$ in the interval $[0, \pi]$.



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16. Evaluate the limit $\lim_{x \rightarrow 0} \frac{e^{2x} + e^{-x} - 2}{x}$



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17. If the function $f(x) = \begin{cases} \frac{\sin x}{kx} + k & x \neq 0 \\ 2 & x = 0 \end{cases}$ is

continuous at $x = 0$, find k .

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18. If $\sin^{-1} \left(\frac{x^2 - y^2}{x^2 + y^2} \right) = k$, k is a constant, then
prove that $\frac{dy}{dx} = \frac{y}{x}$.

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19. Evaluate the $\int \sin \sqrt{x} dx$

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20. Find the differential equation of the curves given by $y = Ae^{2x} + Be^{-2x}$ where A and B are parameters.

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21. Find the vector equation of the line whose Cartesian equation is given by $x+y+z=0$.

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22. If \vec{a} and \vec{b} are two vectors such that $|\vec{a}| = 2$, $|\vec{b}| = 3$ and $\vec{a} \cdot \vec{b} = 4$, then find the value of $|\vec{a} - \vec{b}|$



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23. Find out the mean and variance of the following probability distribution:

$X = x_j$	0.	1.
P_i	$\frac{1}{2}$	$\frac{1}{2}$

where

$$p_i = P(X = x_1)$$



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24. Find the probability that birthdays of any two members out of five members in a family fall on Sunday.



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25. Prove that

$$\tan^{-1}\left(\frac{1}{x+y}\right) + \tan^{-1}\left(\frac{y}{x^2+xy+1}\right) = \cot^{-1} x$$

.



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26. If $A = \begin{pmatrix} 1 & 4 \\ 2 & 3 \end{pmatrix}$ then show that

$A^2 - 4A - 5I = \theta$ and using this find A^{-1} . Where

$$I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \text{ and } \theta = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}.$$



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27. Solve the following equations by Cramer's

method: $x+y=1, y+z=2, x+z=3$.



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28.

Show

that

$$\begin{vmatrix} a + b + 2c & a & b \\ c & b + c + 2a & b \\ c & a & c + a + 2b \end{vmatrix} = 2(a + b + c)^3$$

.



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29. Solve for x :

$$\begin{vmatrix} x & c + x & b + x \\ c + x & x & a + x \\ b + x & a + x & x \end{vmatrix} = 0$$



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30. Find $\frac{dy}{dx}$ where

$$x = \cos^{-1}(8t^4 - 8t^2 + 1)$$

$$y = \sin^{-1}(3t - 4t^3)$$



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31. Evaluate: $\int \frac{2^x dx}{\sqrt{4^x - 2^{x+2} + 5}}$



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32. Evaluate: $\int \frac{3x + 5}{x^3 - x^2 - x + 1} dx$



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33. Solve $(1 + y)^2 dx = (\tan^{-1} y - x) dy$, given that $y = 0$ when $x = -1$.



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34. If the rate of increase of population is 5% per year, then in how many years the population will be doubled?



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35. Find \vec{c} , when $\vec{a} \times \vec{c} = \vec{b}$ and $\vec{a} \cdot \vec{c} = 3$
where $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{j} - \hat{k}$.

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36. Find the value of λ if three vectors
 $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} - 3\hat{k}$ and
 $\vec{c} = 3\hat{i} + \lambda\hat{j} + 5\hat{k}$ are coplanar.

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37. Evaluate (with the help of definite integral)

$$\lim_{n \rightarrow \infty} \left[\frac{1}{\sqrt{n}} + \frac{1}{\sqrt{2n}} + \frac{1}{\sqrt{3n}} + \dots + \frac{1}{n} \right]$$



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38. Find the value of $\int_0^{\frac{\pi}{2}} \frac{x \sin x \cos x}{a^2 \cos^2 x + b^2 \sin^2 x} dx$.



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39. Sum and product of mean and standard deviation of a binomial distribution are 24 and 128 respectively. Find the distribution.



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40. The probability distribution of a random variable X is given as follows:

$X = x_i$	0	1	2
P_i	$3k^3$	$4k - 10k^2$	$5k - 1$

Find the

value of k .



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41. A lamp is on the top of a lamp post of height $2a$ metres situated on a straight road. A boy of height a metre walks towards the post at the speed of c

metre/minute. Find the rate of decrease of the length of his shadow.



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42. If the line $x \cos \alpha + y \sin \alpha = p$ touches the curve $x^m y^n = a^{m+n}$ prove that

$$p^{m+n} \cdot m^m \cdot n^n = a^{m+n} (m+n)^{m+n} \cdot \cos^m \alpha \cdot \sin^n \alpha.$$



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43. The total surface area of a right circular cone is given. Show that the volume of that cone will be

maximum if the semivertical angle is $\frac{\sin^{-1} 1}{3}$.



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44. Find the image of the point (1,6,3) with respect to the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$ and also find the equation of the line passing through the point and its image.



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45. Find the equation of a plane through the intersection of the planes $\vec{r} \cdot (\hat{i} + 3\hat{j} - \hat{k}) = 5$ and

$\vec{r} \cdot (2\hat{i} - \hat{j} + \hat{k}) = 3$ and passing through the point (2,1,-2)



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