



MATHS

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QUESTION PAPER 2020

Exercise

1. Let R be a relation in the set N of natural numbers given by $R = \{(a, b) : a = b - 2\}$.

Choose the correct answer. a) $(2, 3) \in R$ b)

$(3, 8) \in R$ c) $(6, 8) \in R$ d) $(8, 7) \in R$

A. $(2, 3) \in R$

B. $(3, 8) \in R$

C. $(6, 8) \in R$

D. $(8, 7) \in R$

Answer:



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2. Let $*$ be a binary operation on the set Z of integers as $a * b = a + b + 1$. Then find the identity element:



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3. Write two non-zero matrices A and B for which $AB = 0$.



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4. Express $A = \begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}$ as the sum of a symmetric matrix and a skew symmetric matrix.



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5. using properties of determinants, prove

$$\text{that } \begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} = (a - b)(b - c)(c - a).$$



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6. Which among the following is not true

A. A polynomial function is always continuous

B. A continuous function is always differentiable.

C. A differentiable is always continuous

D. $\log x$ is continuous for all x greater than zero

Answer:

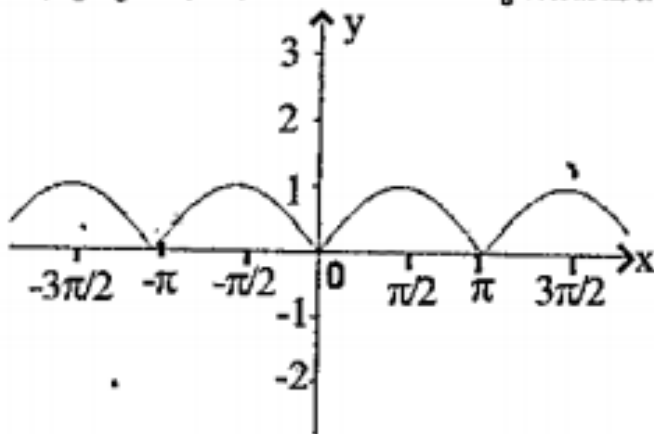


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7. Find $\frac{dy}{dx}$, if $x^2 + y^2 + xy = 100$

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8. Identify the following function



A. $\sin x$

B. $|\sin x|$

C. $\sin|x|$

D. $\cos x$

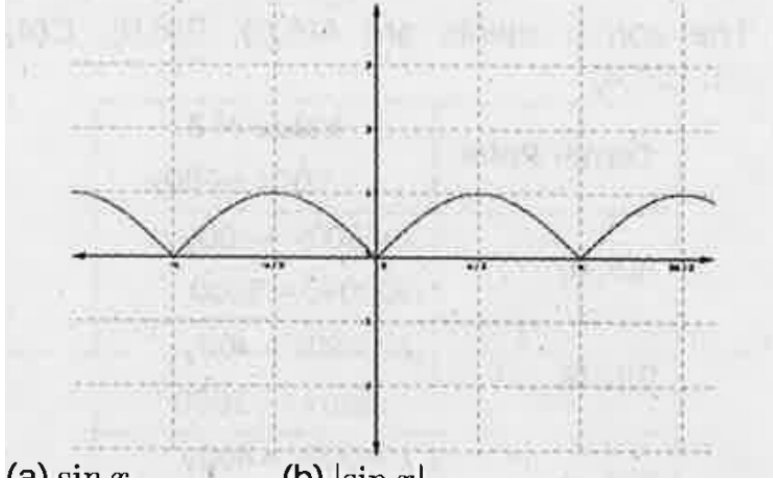
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9. Identify the following function:

Is the function differentiable? Why?



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10. Find derivative of $y = \sqrt{\tan x}$



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11. The slope of the tangent to the curve

$y = e^{2x}$ at (0,1) is....a)1 b)2 c)0 d)-1

A. 1

B. 2

C. 0

D. -1

Answer:



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12. Find the equation of a line perpendicular to the tangent to the curve $y = e^{2x}$ at $(0,1)$ and passing through $(2,3)$.



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13. The general solution of a differential equation contains 3 arbitrary constants. Then what is the order of the differential equation?

A)2 B)3 C)0 D)1

A. 2

B. 3

C. 0

D. 1

Answer:



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14. Check whether $y = e^{-3x}$ is a solution of

the differential equation

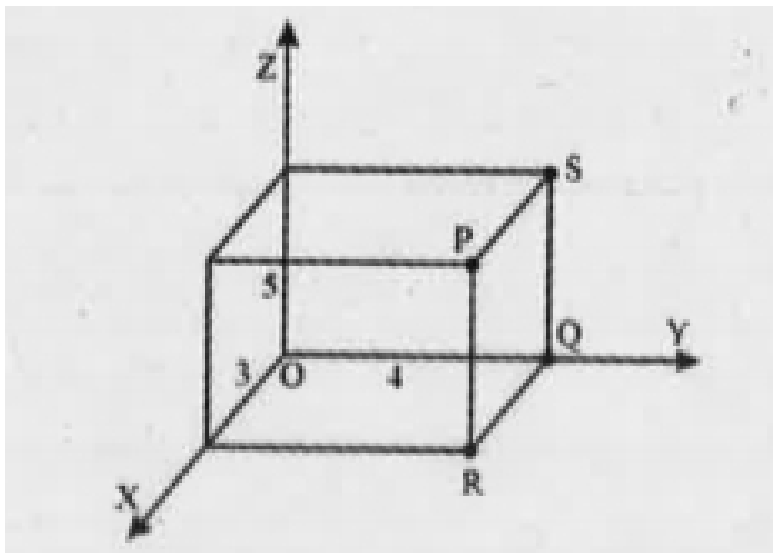
$$\frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y = 0$$



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15. Consider the following figure:

Find the distance of PQ.



A. $y=0$

B. $y=2$

C. $z=4$

D. $x=3$

Answer:



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16. Let $A = \mathbb{R} - \{3\}$ and $B = \mathbb{R} - \{1\}$

consider the function $f: A \rightarrow B$ defined by

$f(x) = \frac{x - 2}{x - 3}$. Is f one-one and onto? Justify

your answer.



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17. Let $A = \mathbb{R} - \{3\}$ and $B = \mathbb{R} - \{1\}$

consider the function $f: A \rightarrow B$ defined by

$$f(x) = \frac{x - 2}{x - 3}. \text{ Is it invertible? Why?}$$



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18. Let $A = \mathbb{R} - \{3\}$ and $B = \mathbb{R} - \{1\}$

consider the function $f: A \rightarrow B$ defined by

$$f(x) = \frac{x - 2}{x - 3}. \text{ If invertible, find inverse of } f(x).$$



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19. If $xy < 1$, $\tan^{-1} x + \tan^{-1} y = \dots\dots\dots$ a)

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

b) $\tan^{-1} \left(\frac{x + y}{1 - xy} \right)$ c) $\frac{\tan x + \tan y}{1 - \tan x \tan y}$ d)

$$\frac{\tan x - \tan y}{1 - \tan x \tan y}$$

A. $\tan^{-1} \left(\frac{x - y}{1 + xy} \right)$

B. $\tan^{-1} \left(\frac{x + y}{1 - xy} \right)$

C. $\frac{\tan x + \tan y}{1 - \tan x \cdot \tan y}$

D. $\frac{\tan x - \tan y}{1 + \tan x \cdot \tan y}$

Answer:



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20. Solve $\tan^{-1} 2x + \tan^{-1} 3x = \frac{\pi}{4}$



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21. Find $\frac{dy}{dx}$ if $y = x^x + x^{\sin x}$.



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22. if $y = x \cos x$, find $\frac{d^2y}{dx^2}$



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23. $\int \frac{f(x)}{\tan x} dx = \log|\tan x| + c$, then $f(x)$ is

A. $\cot x$

B. $\sec^2 x$

C. $\operatorname{cosec}^2 x$

D. $\cot^2 x$

Answer:



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24. If $\frac{d}{dx}f(x) = 4x^3 - \frac{3}{x^4}$ such that $f(2) = 0$, then $f(x)$ is

a) $x^4 + \frac{1}{x^3} - \frac{129}{8}$ b) $x^3 + \frac{1}{x^4} + \frac{129}{8}$

c) $x^4 + \frac{1}{x^3} + \frac{129}{8}$ d) $x^3 + \frac{1}{x^4} - \frac{129}{8}$



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25. The area bounded by the curve $y=f(x)$, x-axis and the line $x=a$ and $x=b$ is ?

A. $\int_a^b x dy$

B. $\int_a^b y dx$

C. $\int_a^b x^2 dy$

D. $\int_a^b y^2 dx$

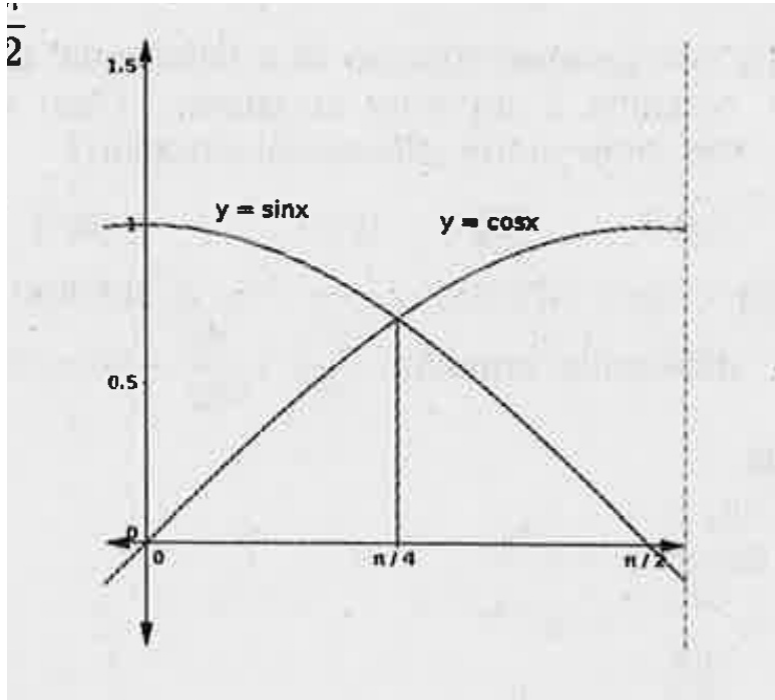
Answer:



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26. From the following figure, find the area of the region bounded by the curves $y = \sin x$,

$y = \cos x$ and x axis as x varies from 0 to $\frac{\pi}{2}$



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27. Form the differential equation corresponding to the curve $y = mx$



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28. Consider the D.E $\frac{dy}{dx} + \frac{y}{x} = x^2$

Solve the D.E.



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29. Find a unit vector perpendicular to the plane ABC where A,B,C are point (1,1,2),(2,3,5) and (1,5,5).



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30. The Cartesian equation of two lines are

$$\frac{x + 1}{7} = \frac{y + 1}{-6} = \frac{z + 1}{1} \quad \text{and}$$
$$\frac{x - 3}{1} = \frac{y - 5}{-2} = \frac{z - 7}{1} \quad \text{.Write the vector}$$

equations.



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31. Find the shortest distance between the

lines

$$\frac{x + 1}{7} = \frac{y + 1}{-6} = \frac{z + 1}{1} \quad \text{and}$$
$$\frac{x - 3}{1} = \frac{y - 5}{-2} = \frac{z - 7}{1}$$



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32. If a plane intersects the co-ordinate axes at a, b, c respectively, write the equation of the plane.



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33. Find the vector and cartesian equations of the plane that passes through

the point $(1, 0, -2)$ and normal to the plane is

$$\hat{i} + \hat{j} - \hat{k}$$



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34. Let two independent events A and B such that $P(A)=0.3, P(B)=0.6$. Find

$P(A \text{ and } B)$



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35. Let two independent events A and B such that $P(A)=0.3, P(B)=0.6$

Find $P(A \text{ and not } B)$



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36. Let two independent events A and B such that $P(A)=0.3, P(B)=0.6$

Find $P(A \text{ or } B)$



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37. Given two independent events A and B such that $P(A) = 0.3, P(B)=0.6$. find $P(\text{neither A nor B})$



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38. Let $A = [a_{ij}]_{2 \times 3}$ where $a_{ij} = i + j$. construct
A.



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39. Let $A = [a_{ij}]_{2 \times 3}$ where $a_{ij} = i + j$. construct
A. Find AA' and hence prove that AA' is
symmetric.



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40. For any square matrix A , prove that $A+A'$ is symmetric.



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41. If A is a skew symmetric matrix of order 3. Then prove that its determinant is zero. (without using examples).



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42. Given $\begin{vmatrix} 2 + x & 3 & 4 \\ 1 & -1 & 2 \\ x & 1 & 5 \end{vmatrix}$ is a singular matrix.

Find the value of x



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43. Given A and B are square matrices of order 2 such that $|A| = -1$, $|B| = 3$. Find $|3AB|$.



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44. Find the intervals in which the function $f(x) = x^2 + 2x - 5$ strictly increasing or decreasing.



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45. Find the equation of tangents and normals to the given curves $y = x^3$ at $(1, 1)$



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46. Find local maximum and local minimum if any for the function. $h(x) = \sin x + \cos x$.

$$0 < x < \left(\frac{\pi}{2}\right)$$



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47. Integrate the following

$$\int \frac{dx}{1 + \frac{x^2}{4}}$$



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48. Integrate the following

$$\int \frac{x}{(x-1)(x-2)} dx$$



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49. Integrate the following $\int_0^{\frac{\pi}{2}} x \cos x dx$



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50. If \vec{a} , \vec{b} , \vec{c} are three coplanar vectors,

then $\left[\vec{a} \vec{b} \vec{c} \right]$ is

A. 1

B. 0

C. -1

D. not defined

Answer:



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51. If $|\vec{a}| = 2$, $|\vec{b}| = 3$ and θ is the angle between \vec{a} and \vec{b} . Then the maximum value of $\vec{a} \cdot \vec{b}$ occurs when $\theta = \dots$ a) $\frac{\pi}{2}$ b) π c) 0 d) $\frac{\pi}{4}$

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

B. π

C. 0

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

Answer:



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52. If $\vec{b} = 2\hat{i} + \hat{j} - \hat{k}$, $\vec{c} = \hat{i} + 3\hat{k}$ and \vec{a} is a unit vector. Find the maximum value of

scalar triple product $\left[\begin{array}{ccc} \vec{a} & \vec{b} & \vec{c} \end{array} \right]$



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53. Solve the linear programming problem graphically:

$$\text{Max: } z = 3x + 2y$$

Subject to:

$$x + 2y \leq 10, 3x + y \leq 15, x \geq 0, y \geq 0$$



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54. The probability distribution of a random variable X is given in the following table:

Find k .

| | | | | | |
|--------|-----|-----|------|------|-----|
| X | 0 | 1 | 2 | 3 | 4 |
| $P(X)$ | 0.1 | k | $2k$ | $2k$ | k |



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55. The probability distribution of a random variable X is given in the following table: Find

the probability that X lies between 1 and 4.

| | | | | | |
|--------|-----|-----|------|------|-----|
| X | 0 | 1 | 2 | 3 | 4 |
| $P(X)$ | 0.1 | k | $2k$ | $2k$ | k |



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56. The probability distribution of a random variable X is given in the following table:

Find the mean of X .

| | | | | | |
|--------|-----|-----|------|------|-----|
| X | 0 | 1 | 2 | 3 | 4 |
| $P(X)$ | 0.1 | k | $2k$ | $2k$ | k |



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57. The probability distribution of a random variable X is given in the following table: find variance of X

| | | | | | |
|--------|-----|-----|------|------|-----|
| X | 0 | 1 | 2 | 3 | 4 |
| $P(X)$ | 0.1 | k | $2k$ | $2k$ | k |



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