



MATHS

BOOKS - GURUKUL BOOKS & PACKAGING

MATHS (HINGLISH)

MARCH 2016

Section I

1. The negation of $p \wedge (q \rightarrow r)$ is

A. $p \vee (\sim qvr)$

B. $\sim p \wedge (q \rightarrow r)$

C. $\sim p \wedge (\sim q \rightarrow \sim r)$

D. $\sim p \vee (q \wedge \sim r)$

Answer:

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2. If $\sin^{-1}(1 - x)\sin^{-1} x = \frac{\pi}{2}$ then x equal

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

B. 1

C. 0

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

Answer:



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3. The joint equation of the pair of lines passing through (2, 3) and parallel to the coordinate axes is

A. $xy - 3x - 2y + 6 = 0$

B. $xy + 3x + 2y + 6 = 0$

C. $xy = 0$

D. $xy - 3x - 2y - 6 = 0$

Answer:



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4.

Find

$$(AB)^{-1} \text{ if } A = \begin{pmatrix} 1 & 2 & 3 \\ 1 & -2 & -3 \end{pmatrix}, B = \begin{pmatrix} 1 & -1 \\ 1 & 2 \\ 1 & -2 \end{pmatrix}$$



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5. Find the vector equation of the plane passing through a point having position vector $3\hat{i} - 3\hat{j} + \hat{k}$ and perpendicular to the vector $4\hat{i} + 3\hat{j} + 2\hat{k}$.



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6. If $\bar{p} = \hat{i} - 2\hat{j} + \hat{k}$ and $\bar{q} = \hat{i} + 4\hat{j} - 2\hat{k}$ are position vector (P.V.) of points P and Q find the position internally

in the ratio 2:1.



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7. Find k , if one of the lines given by $6x^2 + kxy + y^2 = 0$ is $2x + y = 0$.



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8. If the lines $\frac{x-1}{-3} = \frac{y-2}{2k} = \frac{z-3}{2}$ and $\frac{x-1}{3k} = \frac{y-1}{1} = \frac{z-6}{-5}$ are perpendicular, find the value of k .



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9. Examine whether the following logical statement pattern is tautology, contradiction or contingency.

$$[(p \rightarrow q) \wedge q] \rightarrow p$$



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10. Prove using vectors: Medians of a triangle are concurrent.



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11. Find the shortest distance between the lines

$$\bar{r} = (4\hat{i} - \hat{j}) + \lambda(\hat{i} + 2\hat{j} - 3\hat{k}) \quad \text{and}$$

$$\bar{r} = (\hat{i} - \hat{j} + 2\hat{k}) + \mu(\hat{i} + 4\hat{j} - 5\hat{k}).$$



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12. In any ΔABC , prove that

$$(a - b)^2 \cos^2 \frac{C}{2} + (a + b)^2 \sin^2 \frac{C}{2} = c^2.$$

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13. Minimize $Z = 4x + 5y$ subject to

$$2x + y \geq 7, 2x + 3y \leq 15, x \leq 3, x \geq 0, y \geq 0$$
 solve

using graphical method.

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14. The cost of 4 dozen pencils, 3 dozen pens and 2 dozen erasers is Rs. 60.

The cost of 2 dozen pencils, 4 dozen pens and 6 dozen erasers is Rs. 90 whereas the cost of 6 dozen pencils, 2 dozen pens and 3 dozen erasers is Rs. 70. Find the cost of each item per dozen by using matrices.

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15. Find the volume of tetrahedron whose conterminous edges are $7\hat{i} + \hat{k}$, $2\hat{i} + 5\hat{j} - 3\hat{k}$ and $4\hat{i} + 3\hat{j} + \hat{k}$.

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16. Without using truth table show that

$$\sim(p \vee q) \vee (\sim p \wedge q) \equiv \sim p$$

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17. Show that a homogeneous equations of degree two in x and y , i.e., $ax^2 + 2hxy + by^2 = 0$ represents a pair of lines passing through the origin if $h^2 - 2ab \geq 0$.



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18. Find the coordinates of the foot of the perpendicular drawn from the point $A(1, 2, 1)$ to the line joining $B(1, 4, 6)$ and $C(5, 4, 4)$.



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19. Find the vector equation of the plane passing through the point $\hat{i} + \hat{j} - 2\hat{k}$ and $\hat{i} + 2\hat{j} + \hat{k}$, $2\hat{i} - \hat{j} + \hat{k}$.



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20. Find the general solution for each of the following equation: $\sin x + \sin 3x + \sin 5x = 0$



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Section II

1. If the function

$$f(x) = \begin{cases} k + x & \text{for } x < 1 \\ 4x + 3 & \text{for } x \geq 1 \end{cases}$$

is continuous at $x = 1$ then $k =$

A. 7

B. 8

C. 6

D. -6

Answer:



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2. The equation of tangent to the curve $y = x^2 + 4x + 1$ at $(-1, -2)$ is

A. $2x - y = 0$

B. $2x + y - 5 = 0$

C. $2x - y - 1 = 0$

D. $x + y - 1 = 0$

Answer:



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3. Given that $X \sim B(n=10, p)$. If $E(x) = 8$, find the value of p .

A. 0.6

B. 0.7

C. 0.8

D. 0.4

Answer:



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4. If $y = x^x$, find $\frac{dy}{dx}$.



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5. The displacement s of a moving particle at a time t is given by $s = 5 + 20t - 2t^2$. Find its acceleration when the velocity is zero.



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6. Find the area bounded by the curve $y^2 = 4ax$, X - axis and the lines $x = 0$ and $x = a$.

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7. The probability distribution of a discrete random variable X is :

$X = x$	1	2	3	4	5
$P(X = x)$	k	$2k$	$3k$	$4k$	$5k$

Find $P(X \leq 4)$.

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8. Evaluate: $\int \frac{\sin x}{\sqrt{36 - \cos^2 x}} dx$

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9. If $y = f(u)$ is differentiable function of u , and $u = g(x)$ is a differentiable function of x , then proven that $y = f [g(x)]$ is a differentiable function of x and $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$.

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10. The probability that a person who undergoes kidney operation will recover is 0.5. Find the probability that of six patients who undergo similar operations. (a) Non will recover. (b) Half of them will recover.

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11. Evaluate : $\int_0^{\pi} \frac{x}{a^2 \cos^2 x + b \cdot 2 \sin^2 x} dx$

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12. Discuss the continuity of the functions at the points shown against them. If a function is discontinuous, determine whether the discontinuity is removable. In this case, redefine the function, so that it becomes continuous

:

$$\left. \begin{aligned} F(x) &= \frac{4^x - e^x}{6^x - 1}, \text{ for } x \neq 0 \\ &= \log\left(\frac{2}{3}\right), \text{ for } x = 0 \end{aligned} \right\} \text{ at } x = 0.$$

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13. Prove that :

$$\int \sqrt{a^2 - x^2} dx = \frac{x}{2} \sqrt{a^2 - x^2} + \frac{a^2}{2} \sin^{-1} \left(\frac{x}{a} \right) + c$$

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14. A body is heated to $110^\circ C$ and placed in air at $10^\circ C$. After 1 hour its temperature is $60^\circ C$. How much additional time is required for it to cool to $35^\circ C$?

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15. Prove that :

$$\int_0^{2a} f(x) dx = \int_0^a f(x) dx + \int_0^a f(x) dx + \int_0^a f(2a - x) dx$$

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16. $\int \frac{1 + \log x}{x(2x + \log x)(3 + \log x)} dx$ (March '16)

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17. $\cos^{-1} \left(2x \sqrt{1 - x^2} \right)$

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18. Solve the differential equation $\cos(x + y)dy = dx$.

Hence find the particular solution for $x = 0$ and $y = 0$.

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19. A wire of length l is cut into two parts. One part is bent into a circle and the other into a square. Prove that the sum of the areas of the circle and the square is the least, if the radius of the circle is half of the side of the square.

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20. The following is the p.d.g. (Probability Density Function) of a continuous random variable X :

$$f(x) = \frac{x}{32}, 0 < x < 8 = 0, \text{ otherwise}$$

(a) Find following the expression for c.d.f. (Cumulative Distribution Function) of X .

(b) Also find its value at $x = 0.5$ and 9 .

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