MATHS

BOOKS - GURUKUL BOOKS & PACKAGING MATHS (HINGLISH)

JULY 2016

Section I

1. Inverse of statement pattern $(p \vee q) \rightarrow (p \wedge q)$ is

A. $(p \wedge q) \rightarrow (p \vee q)$

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

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

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

Answer: D

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2. If the vectors $2\hat{i} - q\hat{j} + 3\hat{k}$ and $4\hat{i} - 5\hat{j} + 6\hat{k}$ are collinear, then of q is

A. 5

B. 10

C. $\frac{5}{2}$

D. $\frac{5}{4}$

Answer: C

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3. If in $\triangle ABC$, with usual notations, $a = 18, b = 24, c = 30$, then $\sin. \frac{A}{2}$ is equal to

A. $\frac{1}{\sqrt{5}}$

B. $\frac{1}{\sqrt{10}}$

C. $\frac{1}{\sqrt{15}}$

D. $\frac{1}{2\sqrt{5}}$

Answer: B

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4. Find the angle between the pair of lines given by

$\rightarrow r = 3\hat{i} + 2\hat{j} - 4\hat{k} + \lambda\left(\hat{i} + 2\hat{j} + 2\hat{k}\right)$ and

$\rightarrow r = 5\hat{i} - 2\hat{j} + \mu\left(3\hat{i} + 2\hat{j} + 6\hat{k}\right)$.

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5. If p, q,r are the statements with truth values T, F, T respectively then find the truth value of $(r \wedge q) \leftrightarrow (\sim p)$

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6. If $A = \begin{bmatrix} 2 & -3 \\ 3 & 5 \end{bmatrix}$ then find A^{-1} by adjoint method.

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7. By method, show that the quadrilateral with vertices A(1,2,-1), B(8,-3,-4), C(5,-1,1),D(-2,1,4) is a parallelogram.

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8. Find the general solution of the equation $\sin x = \tan x$.

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9. The combined equation of the pair of lines through the origin and perpendicular to the pair of lines given by $ax^2 + 2hxy + by^2 = 0$, is

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10. Find the principal value of $\sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$

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11. Find the cartesian form of the equation of the plane .

$$\bar{r} = \left(\hat{i} + \hat{j}\right) + s\left(\hat{i} - \hat{j} + 2\hat{k}\right) + t\left(\hat{i} + 2\hat{j} + \hat{k}\right)$$

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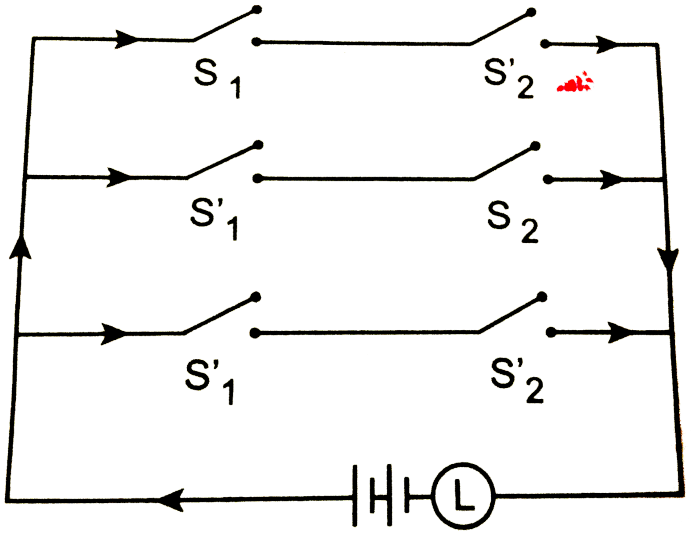
12. Simplify the following circuit so that new circuit has minimum number of switches. Also draw simplified circuit.



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13. A line makes angles of measures 45° and 60° with positive directions of Y-and Z-axes respectively. Find the d.c.s. of the line and also find the vector of magnitude 5 along the direction of line.

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14. Maximize :

$z = 3x + 5y$

Subject to : $x + 4y \leq 24$

$3x + y \leq 21$

$x + y \leq 9$

$x \geq 0, y \geq 0$

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15. Find the shortest distance between the lines $\frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}$ and $\frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1}$

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16. Show that the points $(1, -1, 3)$ and $(3, 4, 3)$ are equidistant from the plane $5x + 2y + -7z + 8 = 0$.

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17. If any triangle ABC with usual notations prove $c = a\cos B + b\cos A$.

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18. Find P and k if the equation

$$px^2 - 8xy + 3y^2 + 14x + 2y + k = 0$$

represents a pair of perpendicular lines.

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19. 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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20. Prove that the volume of the parallelopiped with coterminus edges as $\bar{a}, \bar{b}, \bar{c}$ is $\left[\bar{a}, \bar{b}, \bar{c}\right]$ and hence find the volume of the parallelopiped with its coterminus edges $\hat{i} + 5\hat{j} - 4\hat{k}, 5\hat{i} + 7\hat{j} + 5\hat{k}$ and $4\hat{i} + 5\hat{j} - 2\hat{k}$.

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Section Ii

1. Select and write the correct answer from the given alternatives in each of the following sub-questions :

The order and degree of the differential equation $\left[1+\left(\frac{dy}{dx}\right)^3\right]^{7/3} = 7\left(\frac{d^2y}{dx^2}\right)$ are respectively.

A. 2,3

B. 3,2

C. 2,2

D. 3,3

Answer: A

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2. Select and write the correct answer from the given alternatives in each of the following sub-questions :

$$\int_4^9 \frac{1}{\sqrt{x}} dx = \ldots\ldots$$

A. 1

B. -2

C. 2

D. -1

Answer: C

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3. Thep.d.f of a continous random variable X is

$$f(x) = \frac{x^2}{3}, \ -1 < 1 < 2$$

0 = otherwise

Then the c.d.f of X is

A. $\frac{x^3}{9} + \frac{1}{9}$

B. $\frac{x^3}{9} - \frac{1}{9}$

C. $\frac{x^2}{4} + \frac{1}{4}$

D. $\frac{1}{9x^3} + \frac{1}{9}$

Answer: A

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4. $\sec \sqrt{x}$

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5. Evaluate : $\int \frac{x+1}{(x+2)(x+3)} \cdot dx$

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6. Find the area of the region lying in the first quadrant bounded by the curve $y^2 = 4x$, X axis and the lines $x = 1, x = 4$.

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7. Solve the differential equation :

$\sec^2 x \tan y dx + \sec^2 y \tan x dy = 0$

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8. Given $X \sim B(n, p)$ if E(X) = 6, Var (X) = 4.2 , find the value of n and p.

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9. If the function $f(x) = \dfrac{\left(4^{\sin x} - 1\right)^2}{x \cdot \log(1 + 2x)}$, for $x \neq 0$ is continuous at $x = 0$, find $f(0)$.

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10. Evaluate : $\int \dfrac{1}{3 + 2\sin x + \cos x} dx$.

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11. If $y = f(x)$ is a differentiable function x such that invrse function $x = f^{-1}$ y exists,

then prove that x is a differentiable function of y and $\frac{dx}{dy} = \frac{1}{\frac{dy}{dx}}$ where $\frac{dy}{dx} \neq 0$

Hence, find $\frac{d}{dx}\left(\tan^{-1} x\right)$.

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12. A point source of light is hung 30 feet directly above a straight horizontal path on which a man of 6 feet in height is walking. How fast is the man's shadow lengthening and how fast the tip of shadow is moving when he is

walking away from the light at the rate of 100 ft/min.

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13. The p.m.f. for X = number of major defects in a randomly selected appliance of a certain type is

$X = x$	0	1	2	3	4
$P(x)$	0·01	0·15	0·45	0·27	0·05

Find the expected value and variance of X.

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14. Prove that : $\int_0^a f(x)dx = \int_0^a f(a-x)dx$

hence evaluate : $\int_0^{\pi/2} \frac{\sin x}{\sin x + \cos x} dx$

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15. If $y = e^{\tan x} + (\log x)^{\tan x}$ then find $\frac{dy}{dx}$

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16. If the probability that a fulurorescent light has a useful life of a least 800 hours is 0.9 find

the probability that among 20 such lights at least 2 will not have a useful life of at least 800 hours. [Given $(0.9) = 0.1348]$

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17. Find α and β, so the function f (x) defined by

$$f(x) = -2\sin x, \text{for} -\pi \leq x \leq -\frac{\pi}{2}$$

$$= \alpha \sin x + \beta \text{for} -\frac{\pi}{2} < x < \frac{\pi}{2}$$

$$= \cos x, \text{for} \frac{\pi}{2} \leq x \leq \pi,$$

is continuous on $[-\pi, \pi]$.

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18. Find the equation of a curve passing through the point (0, 2) given that the sum of the coordinates of any point on the curve exceeds the magnitude of the slope of the tangent to the curve at that point by 5.

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19. If u and v are two functions of x then prove that :

$$\int uvdx = u\int vdx - \int\left[\frac{du}{dx}\int vdx\right]dx$$

Hence, evaluate $\int xe^x dx$

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20. Find the approximate value of $\log_{10}(1016)$

given $\log_{10} e = 0.4343$

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