

**E-445(H/E) HIGHER MATHEMATICS 2016****Time : 3 Hours ]****Class : 12th****[ M. M. : 100****Instructions-**

- (i) All questions are compulsory.
- (ii) Read instructions carefully of the question paper and then answers of the questions.
- (iii) Question paper has two sections-Section 'A' and Section 'B'.
- (iv) In the section- 'A' Question Nos. 1 to 5 are objective type. Each question carries 5 marks.
- v) In the section 'B' Question Nos. 6 to 24 has Internal option.
- vi) Q. Nos. 6 to 10 carry 2 marks each.
- vii) Q. Nos. 11 to 17 carry 4 marks each.
- viii) Q. Nos. 18 to 22 carry 5 marks each.
- x) Q. Nos. 23 to 24 carry 6 marks each.

**Section 'A'****Q. 1. Choose the correct options:****5 × 1 = 5****(i) The value of  $2\cos^{-1}x$  is:**

- |                         |                                 |
|-------------------------|---------------------------------|
| (a) $\cos^{-1}(2x^2+1)$ | (b) $\cos^{-1}\frac{2x}{1+x^2}$ |
| (c) $\cos^{-1}(2x^2-1)$ | (d) $\tan^{-1}\frac{2x}{1-x^2}$ |

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(ii) The partial fraction form of  $\frac{1}{x^2 + 2x}$  is:

(a)  $\frac{1}{2} \left[ \frac{1}{x} - \frac{1}{x+2} \right]$       (b)  $\frac{1}{2} \left[ \frac{1}{x} + \frac{1}{x+2} \right]$

(c)  $\frac{1}{2} \left[ \frac{1}{x+2} - \frac{1}{x} \right]$       (d)  $\frac{1}{x} - \frac{1}{x+2}$

(iii) The value of  $\int_a^b \cos x \, dx$  is:

(a)  $-\sin b + \sin a$       (b)  $\sin b + \sin a$   
(c)  $\cos b - \cos a$       (d)  $\sin b - \sin a$

(iv) Projection of vector  $\vec{a}$  on  $\vec{b}$

(a)  $\frac{\vec{a} \cdot \vec{b}}{|\vec{b}|}$       (b)  $\frac{\vec{a}}{|\vec{a}|}$

(c)  $\frac{\vec{a}}{|\vec{a}|}$       (d)  $\frac{\vec{a} \times \vec{b}}{|\vec{b}|}$

(v) The value of  $\frac{d}{dx} \sin x^2$  is:

(a)  $\cos x^2$       (b)  $x \sin x^2$   
(c)  $2x \cos x^2$       (d)  $x \cos x^2$

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- Q.2. Answer in one word/sentence:** **5 × 1**
- Write Simpson's one-third rule formula in numerical meth
  - In Newton-Raphson's method write the formula for find cube root of the number N.
  - In which interval does the root of equation  $x^3 - 2x - 5 = 0$
  - If  $x_n$  is a nearer root of equation  $f(x) = 0$ , then write the value  $x_{n+1}$  by Newton-Raphson's method.
  - On which principle is Simpson's rule based?

- Q.3. Match the correct pair:** **5 × 1 = 5**
- | <b>'A'</b>                        | <b>'B'</b>                                    |
|-----------------------------------|---|
| (a) $\int \tan x dx$              | 1. $\frac{1}{2a} \log \frac{x-a}{x+a}, x > a$ |
| (b) $\int \cot x dx$              | 2. $\frac{1}{2a} \log \frac{a+x}{a-x}, x < a$ |
| (c) $\int \sec x dx$              | 3. $\log \sin x$                              |
| (d) $\int \frac{1}{x^2 - a^2} dx$ | 4. $-\log \cos x$                             |
| (5) $\int \frac{1}{a^2 - x^2} dx$ | 5. $\log (\sec x + \tan x)$                   |

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- Q.4. Fill in the blanks:**  $5 \times 1 = 5$
- (i) Equation of the plane which intercepts unit length from coordinate axes is .....
  - (ii) The acute angle between the planes  $2x - y + z = 6$  and  $x + y + 2z = 3$  is .....
  - (iii) The equation of plane parallel to x - axis is .....
  - (iv) The perpendicular distance of point (18, 5, 12) from x- axis is .....
  - (v) Differential coefficient of  $\sin x^3$  with respect to  $x^3$  is .....

- Q.5. Write True/False in the following statements:**  $5 \times 1 = 5$
- (i) The value of coefficient of correlation is greater than 1.
  - (ii) The coefficient of correlation is the geometric mean of the regression co-efficients
  - (iii) When a body is thrown up, the sign of g is positive when it goes up.
  - (iv) In vector Algebra displacement is a vector quantity.
  - (v) Square of a vector is equal to square of its modulus.

**Section 'B'**

- Q.6. Find the direction cosiness of the vector  $6\hat{i} + 2\hat{j} - 3\hat{k}$**  **2**
- (OR)** If  $\vec{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$  and  $\vec{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$  then find the value of  $\vec{a} \times \vec{b}$
- Q.7. If  $\vec{a} = 2\hat{i} + \lambda\hat{j} + \hat{k}$  and  $\vec{b} = 4\hat{i} - 3\hat{j} - 2\hat{k}$  are perpendicular to each other then find the value of scalar  $\lambda$**  **2**

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(OR) Find the angle between two vectors  $\vec{a} = 2\hat{i} + \hat{j} - 3\hat{k}$  and  $\vec{b} = 3\hat{i} - 2\hat{j} - 2\hat{k}$

Q. 8. Find the vector equation of the sphere with centre  $(\hat{i} + 2\hat{j} - 3\hat{k})$  and radius 5 units. 2

(OR) Write the condition for intersecting the two lines  $\vec{r} = \vec{a}_1 + \lambda \vec{b}_1$  and  $\vec{r} = \vec{a}_2 + \lambda \vec{b}_2$

Q. 9. Find the value of  $\int \sec^2 x \tan^3 x \, dx$  , 2

(OR) Find the value of  $\int \frac{1}{e^x + 1} \, dx$

Q. 10. Find the value of  $\int x \sin x \, dx$  2

(OR) Find the value of  $\int \frac{2x+1}{\sqrt{x^2+x+1}} \, dx$

Q. 11. Prove that: 4

$$\tan^{-1} \frac{1}{4} + \tan^{-1} \frac{2}{9} = \frac{1}{2} \cos^{-1} 3/5$$

(OR) Prove that:

$$\sin^{-1} 3/5 + \sin^{-1} 8/17 = \sin^{-1} \frac{77}{85}$$

Q. 12. Resolve  $\frac{11-2x}{x^2+9x+14}$  into partial fractions. 4



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Simplifying 16

(OR) Resolve  $\frac{x}{1+x^3}$  into partial fractions.

Q. 13. Differentiate  $\tan^{-1} \frac{x}{\sqrt{a^2 - x^2}}$  with respect to  $x$ . 4

(OR) If  $y = \frac{1 - \cos x}{1 + \cos x}$ , then find the value of  $\frac{dy}{dx}$

Q. 14. If  $y = \tan x + \sec x$ , then prove that  $\frac{d^2y}{dx^2} = \frac{\cos x}{(1 - \sin x)^2}$  4

(OR) Find the differential coefficient of  $\sin^{-1} \left( \frac{2x}{1+x^2} \right)$  with respect to  $\tan^{-1}x$ .

Q. 15. The edge of a cube is increasing at the rate of 7 cm/sec. How fast is the volume of the cube increasing when the edge is 10 cm long? 4

(OR) Find two positive numbers whose product is 64 and the sum is minimum.

Q. 16. Calculate the correlation coefficient between  $x$  and  $y$  for the following data: 4

$x$	5	9	13	17	21
$y$	12	20	25	33	35

(OR) Find correlation coefficient  $f(x, y)$ , where

$$\text{cov}(x, y) = -2.25,$$

$$\text{var}(x) = 6.25,$$

$$\text{and var}(y) = 20.25$$

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- Q. 17.** An article costs Rs. 75 at Gwalior. Find the corresponding most appropriate value at Bhopal using the following data: 4

	Gwalior	Bhopal
Mean value	65	67
Standard Deviation	2.5	3.5

Three Telation coefficient between the values of the two cities is 0.8

- (OR)** If the regression line of  $y$  on  $x$  is  $ax + by + c = 0$  and that of  $x$  on  $y$  is  $a_1x + b_1y + c_1 = 0$ , then prove that  $ab_1 \leq a_1b$ .

- Q. 18.** Find the equation to the plane through the point  $(-1, 3, 2)$  and perpendicular to the planes  $x + 2y + 2z = 11$  and  $3x + 3y + 2z = 15$ . 5

- (OR)** Prove that the angle between any two diagonals of a cube is  $\tan^{-1}(2\sqrt{2})$

- Q. 19.** Find the value of  $\lim_{x \rightarrow 0} \frac{x^3 \cot x}{1 - \cos x}$  5

- (OR)** 
$$f(x) = \begin{cases} \frac{\sin ax}{\sin bx}, & x \neq 0 \\ a/b, & x = 0 \end{cases}$$
 Test the continuity of function at  $x = 0$ .

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- Q. 20. Find the value of  $\int \frac{dx}{3+2\cos^2 x}$  5
- (OR) Find the area included between the two curves  $y^2 = 9x$  and  $x^2 = 9y$ .
- Q. 21. Solve the differential equation  $x + y \frac{dy}{dx} = 2y$ . 5
- (OR) Solve the differential equation  $\frac{dy}{dx} + 2y = \sin x$ .
- Q. 22. Tickets are marked from 1 to 16 and mixed up. One ticket is taken out at random. Find the probability of its being a multiple of 2 or 3. 5
- (OR) A dice is thrown twice. A success is an even number on each throw. Find the probability distribution of the number of successes.
- Q. 23. Prove that the points (1, 2, 3), (3, 0, 3), (-2, -3, -3) and (3, 4, 6) are coplanar. 6
- (OR) The coordinates of ends of one diameter of a sphere are (1, 0, 1) and (5, 4, 5). Find the equation, centre and diameter of sphere.
- Q. 24. If  $\vec{a} = 3\hat{i} + 2\hat{j} + 2\hat{k}$ ,  $\vec{b} = -\hat{i} + 3\hat{j} - \hat{k}$  and  $\vec{c} = \hat{i} + \hat{j} + \hat{k}$  then find the value of  $\vec{a} \times (\vec{b} \times \vec{c})$  and  $(\vec{a} \times \vec{b}) \times \vec{c}$  6
- (OR) Prove that the triangle, whose position vectors of the vertices are  $2\hat{i} + 4\hat{j} - \hat{k}$ ,  $4\hat{i} + 5\hat{j} + \hat{k}$  and  $3\hat{i} + 6\hat{j} - 3\hat{k}$  respectively, is an isosceles right angled triangle.