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HIGHER MATHEMATICS - 2012

Time : 3 Hours] **Class : 12th** **[M. M. : 100**

Note - **(1) All questions are compulsory.**

(2) Marks have been indicated against each question.

(3) There are two Sections-Section A and Section B in the question paper.

(4) In Section A question Nos. 1 to 5 are of objective type questions containing fill in the blanks, True/False, match the columns and choose the correct answers.

(5) Internal options are given in question Nos. 6 to 21 of Section B.

Section -A (Objective Type Questions)

Q. 1. Write the correct answer from the given options provided in every objective type question: 5

(i) Partial fraction of $\frac{2}{x^2-1}$ is:

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

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

(ii) The value of $\tan^{-1}x + \cot^{-1}x$ is :

(a) π (b) zero

(c) $\frac{\pi}{2}$ (d) 1

(iii) The equation of X-axis is :

(a) $\frac{X}{1}=\frac{Y}{0}=\frac{Z}{0}$ (b) $\frac{X}{0}=\frac{Y}{1}=\frac{Z}{1}$

(c) $\frac{X}{1}=\frac{Y}{1}=\frac{Z}{1}$ (d) None of these

(iv) If $\hat{i}, \hat{j}, \hat{k}$ are the unit vectors along the axis X, Y and Z respectively, then the value of $\hat{i} \times (\hat{j} \times \hat{k})$ is:

(a) zero (b) 1

(c) -1 (d) None of these

(v) The centre of the sphere $x^2 + y^2 + z^2 - ax - by - cz = 0$ is.

(a) (a, b, c) (b) (-a, -b, -c)

(c) $\left(\frac{a}{2}, \frac{b}{2}, \frac{c}{2}\right)$ (d) $\left(-\frac{a}{2}, -\frac{b}{2}, -\frac{c}{2}\right)$

Q.2. Write True/False in the following state/ments: 1×5

(i) The value of $\bar{a} . (\bar{a} \times \bar{b})$ is zero

(ii) The differential coefficient of cos 2x is sin 2x

(iii) The value of correlation coefficient is always 2.

(iv) If two regression coefficients are 0.8 and 0.2 respectively, then correlation coefficient is equal to zero.

(v) The root of the equation $x^3 - 2x - 5 = 0$ lie in the interval (2 3)

Q.3. Fill in the blanks: 1×5

(i) The shortest distance between two intersecting lines is always equal to .....

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(ii) If vectors $\vec{a} = \hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + \hat{j} + \hat{k}$, then the value of $\vec{a} \cdot \vec{b}$ is .....

(iii) The velocity of any particle at maximum height is equal to.....

(iv) The nth derivative of sin x is equal to .....

(v) The equation of a plane which intercept unit length from the co-ordinate axes is .....

Q.4. Write the answer of each question in one word/sentence of the following: 1×5

(i) Write the value of 0.2642E05 + 0.3781E05

(ii) In trapezoidal rule

$$\int_a^b f(x)dx = \frac{h}{2}[y_o + 2(y_1 + y_2 + ...y_{n-1}) + y_n]$$

Write the value of h.

(iii) In Newton-Raphson's method, what is the formula, after first iteration.

(iv) In numerical methods, write the formula for Simpson's one-third rule.

(v) If $\vec{a} = \hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = -\hat{i} + \hat{j} - \hat{k}$, then find the value of $|\vec{a} + \vec{b}|$

Q.5. Match the columns by choosing the correct answer from B for A: 5

'A'	'B'
(i) $\int \cot x \, dx$	(a) $\frac{1}{2}\log x + c$
(ii) $\int \tan x \, dx$	(b) $\frac{1}{2}\tan x + c$
(iii) $\int \frac{1}{1+\cos 2x} dx$	(c) $\log(\sin x) + c$
(iv) $\int (1 + \tan^2 x) dx$	(d) $\log(\sec x) + c$
(v) $\int \text{cosec } x \, dx$	(e) $\tan x + c$
	(f) $\log\left(\tan\frac{x}{2}\right) + c$

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(Section - B) (Very Short Answer Type Questions)

Q. 6. Resolve $\frac{x}{1-x^3}$ into partial fraction. 4

(Or) Resolve $\frac{x^2-5x-1}{(x-1)^2(x-2)}$ into partial fraction.

Q. 7. Prove that: 4

$$\cos^{-1}\frac{4}{5}+\sin^{-1}\frac{5}{13}=\cos^{-1}\frac{33}{65}$$

(Or) If $\tan^{-1} a + \tan^{-1} b + \tan^{-1} c = \pi$ then prove that:
$a + b + c = abc$

Q. 8. Find the differential coefficient of $x^{\sin x}$. 4

(Or) If $x = a\sin^3\theta$ and $y = a\cos^3\theta$ then find the value of $\frac{dy}{dx}$

Q. 9. If $y = \sqrt{\cos x+\sqrt{\cos x+\sqrt{\cos x+....\infty}}}$ then prove that: 4

$$\frac{dy}{dx}=\frac{-\sin x}{(2y-1)}$$

(Or) If $y = (\sin^{-1} x)^2$, then prove that $(1-x^2)\frac{d^2y}{dx^2}-x\frac{dy}{dx}=2$

Q. 10. Find the maximum value of $\sin x + \cos x$ (using differentiation). 4

(Or) A spherical ball of a ice melts uniformly. When the radius of the ball is 5 cm, find the rate of change of its volume with respect ot its radius.

Q. 11. Find the coefficient of correlation from the following data: 4

x	y
2	15
3	17
5	4
7	5
3	4

(Or) Find the coefficient of correlation from the following data:

x	y
-10	5
-5	9
0	7
5	11
10	13

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Q. 12. If regression lines are $3x + 12y - 19 = 0$ and $9x + 3y - 46 = 0$, then find the coefficient of correlation. 4

(Or) If the regression line of y on x is $ax + by + c = 0$ and the regression line of x on y is $a_1x + b_1y + c_1 = 0$, then prove that:

$$ab_1 \leq a_1b.$$

(Short Answer Type Questions)

Q. 13. Find the equation of the plane passes through the point (-1, 3, 2) and is perpendicular to plane $x + 2y + 2z = 5$ and $3x + 3y + 2z = 8$. 5

(Or) Find the distance from a point (-1, -5, -10) to the point of intersection of the line $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$ and the plane $x - y + z = 5$

Q. 14. Show that the sum of three vectors determined by the medians of a triangle, directed from the vertices is zero. 5

(Or) If $\vec{a} + \vec{b} + \vec{c} = 0$, then prove that:

$\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$

where $\vec{a}, \vec{b}, \vec{c}$ are non- zero vectors

Q. 15. If $f(x) = \begin{cases} \frac{x^2 - 1}{x+1} & x \neq -1 \\ -2 & x = -1 \end{cases}$ 5

so verify whether the function $f(x)$ is continuous at x = -1

(Or) Find the value of $\lim_{x \to 0} \frac{\sqrt{2+x} - \sqrt{2-x}}{x}$

Q. 16. Evaluate : $\int \frac{xe^x}{(x+1)^2} dx$ 5

(Or) Evaluate : $\int \frac{1}{5 + 4\sin x} dx$

Q. 17. Prove that : $\int_0^{\pi/2} \frac{dx}{1 + \tan x} = \frac{\pi}{4}$ 5

(Or) Find the area of the circle $x^2 + y^2 = a^2$ by integration.

Q. 18. Solve the differential equation : 5

$(1 + x^2)dy = (1 + y^2)dx$

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(Or) Find the solution of the differential equation:

$$\frac{dy}{dx} + y \tan x = \sec x .$$

Q. 19. If two cubical dice are thrown simultaneously, then find the probability of getting the sum of numbers 'more then 7' or 'less than 7'. 5

(Or) The odds in favour of winning a race for three horses A,B and c respectively 1:2, 1: 3 and 1:4 Find the probability for winning of any one of them

(Long Answer Type Questions)

Q. 20. Prove that the plane passes through the points (1, 0, 1), (1, 1, 1) and (-7, -3, -5) is perpendicular to xz plane. 6

(Or) Find the equation of the sphere which passes through points (0, 0, 2), (0, 2, 0) and (2, 0, 0) and whose centre lies on the plane x + y + z=2.

Q. 21. Prove by vector method: 6

$\sin(\alpha + \beta) = \sin\alpha \cos\beta + \cos\alpha \sin\beta$.

(Or) Find the shortest distance between the given lines by vector method:

$$\vec{r} = 3\hat{i} + 8\hat{j} + 3\hat{k} + \lambda(3\hat{i} - \hat{j} + \hat{k})$$

and $\vec{r} = -3\hat{i} - 7\hat{j} + 6\hat{k} + \mu(-3\hat{i} + 2\hat{j} + 4\hat{k})$.

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