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Previous Year Paper

Mathematics - 2015

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Short Answer Type

1. Find the value of k if $M = 1223$ and $M^2 - kM - I_2 = 0$

[Answer](#)

2. Find the equation of an ellipse whose latus rectum is 8 and eccentricity is $\frac{1}{3}$

[Answer](#)

3. Using L' Hospital rule, evaluate: $\lim_{x \rightarrow 0} x - \sin x x^2 \sin x$

[Answer](#)

4. Solve: $\cos^{-1} \sin \cos^{-1} x = \frac{\pi}{6}$

[Answer](#)

5. evaluate: $\int 2y^2 y^2 + 4 dy$

[Answer](#)

6. Evaluate: $\int_0^3 f(x) dx$, where $f(x) = \cos(2x)$, $0 \leq x \leq \frac{\pi}{2}$, $\frac{\pi}{2} \leq x \leq \pi$

[Answer](#)

7. The two lines of regression are $4x + 2y - 3 = 0$ and $3x + 6y + 5 = 0$. Find the correlation coefficient between x and y .

[Answer](#)

8. A card is drawn from a well shuffled pack of playing cards. What is the probability that it is either a space or an ace or both ?

[Answer](#)

9. If $1, w$ and w^2 are the cube roots of unity, prove that $a + bw + cw^2 + aw + bw^2 = w^2$

[Answer](#)

10. Solve the differential equation: $\sin^{-1} dy/dx = x + y$

[Answer](#)

11. Given two matrices A and B

$$A = \begin{bmatrix} 1 & 2 & 3 & 1 & 1 \\ 1 & 3 & 2 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix} \text{ and } B = \begin{bmatrix} 1 & 1 & 5 & 1 & 4 \\ 1 & 1 & 2 & 7 & 1 \\ 6 & 1 & 2 & 2 & 1 \end{bmatrix}$$

Find AB and use this result to solve the following system of equation:

$$x - 2y + 3z = 6, x + 4y + z = 12, x - 3y + 2z = 1$$

[Answer](#)

12. Using properties of determinants, prove that:

$$1 + a^2 + b^2 + c^2 - 2ab - 2bc - 2ca = (1 + a^2 + b^2 + c^2 - 2ab - 2bc - 2ca)$$

[Answer](#)

13. Solve the equation for x : $\sin^{-1} 5x + \sin^{-1} 12x = \frac{\pi}{2}, x \neq 0$

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14. If A, B and C represent switches in 'on' position and A', B' and C' represent them in 'off' position. Construct a switching circuit representing the polynomial $ABC + AB'C + A'B'C$. Using Boolean algebra, prove that the given polynomial can be simplified to $C(A + B')$. Construct an equivalent switching circuit.

Answer

15. If $y = em\cos^{-1}x$, prove that:
 $1 - x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} = m^2y$

Answer

16. Find the smaller area enclosed by the circle $x^2 + y^2 = 4$ and the line $x + y = 2$.

Answer

17. Given that the observations are:

(9, - 4), (10, - 3), (11, - 1), (12, 0), (13, 1), (14, 3), (15, 5), (16, 8).

Find the two lines of regression and estimate the value of y when $x = 13.5$.

Answer

18. In a contest the competitions are awarded marks out of 20 by two judges. the scores of the 10 competitors are given below. Calculate Spearman's rank correlation.

Competitors	A	B	C	D	E	F	G	H	I	J
Judge A	2	11	11	18	6	5	8	16	13	15
Judge B	6	11	16	9	14	20	4	3	13	17

Answer

19. An urn contains 2 white and 2 black balls. A ball is drawn at random. If it is white, it is not replaced into the urn. Otherwise it is replaced with another ball of the same colour. The process is repeated. Find the probability that the third ball drawn is black.

Answer

20. Three persons A, B and C shoot to hit a target. If A hits the target four times in five trials, B hits it three times in four trials and C hits it two times in three trials, find the probability that:

- (i) Exactly two persons
- (ii) At least two persons hit the target
- (iii) None hit the target

Answer

21. If $z = x + iy$, $w = 2 - iz$ and $|w| = 1$, find the locus of z and illustrate it in the Argand plane.

Answer

22. Find the volume of a parallelepiped whose edges are represented by the vectors:
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Answer

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23. Find the equation of the plane passing through the intersection of the planes:

$$x + y + z + 1 = 0 \text{ and } 2x - 3y + 5z - 2 = 0 \text{ and the point } (-1, 2, 1)$$

Answer

24. Find the shortest distance between the

$$\text{lines } r_1 = i^{\wedge} + 2j^{\wedge} + 3k^{\wedge} + \lambda(2i^{\wedge} + 3j^{\wedge} + 4k^{\wedge}) \text{ and } r_2 = 2i^{\wedge} + 4j^{\wedge} + 5k^{\wedge} + \mu(4i^{\wedge} + 6j^{\wedge} + 8k^{\wedge})$$

Answer

25. Mr. Nirav borrowed Rs. 50,000 from the bank for 5 years. The rate of interest is 9 % per annum compounded monthly. Find the payment he makes monthly if he pays back at the beginning of each month.

Answer

26. A dietician wishes to mix two kinds of food X and Y in such a way that the mixture contains atleast 10 units of vitamin A, 12 units of vitamin B and 8 units of vitamin C. The vitamin contents of one kg food is given below:

Food	Vitamin A	Vitamin B	Vitamin C
X	1 unit	2 units	3 units
Y	2 units	2 units	1 unit

One kg of food X costs Rs.24 and one kg of food Y costs Rs.36. Using Linear Programming, find the least cost of the total mixture which will contain the required vitamins.

Answer

27. A bill for Rs. 7650 was drawn on 8th March, 2013, at 7 months. It was discounted on 18th May, 2013 and the holder of bill received Rs. 7497. What is the rate of interest charged by bank?

Answer

28. The average cost function, AC for a commodity is given by $AC = x + 5 + \frac{36}{x}$, in terms of output x. Find:

- (i) The total cost, C and marginal cost, MC as a function of x.
(ii) The outputs for which AC increases.

Answer

29. Calculate the index number for the year 2014, with 2010 as the base year by the weighted aggregate method from the following data:

Commodity	Price in Rs. for 2010	Price in Rs. for 2014	Weight
A	2	4	8

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Answer

30. The quarterly profits of a small scale industry (in thousands of rupees) is as follows:

Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2012	39	47	20	56
2013	68	59	66	72
2014	88	60	60	67

Calculate four quarterly moving averages. Display these and the original figures graphically on the same graph sheet.

Answer



Long Answer Type

31. Verify Lagrange's Mean Value Theorem for the following function:

$$f(x) = 2\sin x + \sin 2x \text{ on } 0, \pi$$

Answer

32. Find the equation of hyperbola whose foci are $(0, \pm 10)$ and passing through the point $(2, 3)$.

Answer

33. Show that the rectangle of maximum perimeter which can be inscribed in a circle of radius 10 cm is a square of side 10 $\sqrt{2}$ cm.

Answer

34. Evaluate: $\int \sec x + \csc x dx$

Answer

35. Solve the differential equation:

$$xy^2 - xy + 1 + xy dx dy = 0, \text{ when } x = 0, y = 1$$

Answer

36. Using vectors, prove that angle in a semicircle is a right angle.

Answer

37. Box I contains two white and three black balls. Box II contains four white and one black balls and box III contains three white and four black balls. A dice having three red, two yellow, and one blue face, is thrown. To select the box, red face turns up, white pick up box I, if yellow face turns up, pick up box II, and if blue face turns up, pick up box III.

up, we pick up box II, otherwise we pick up box III. Then, we draw a ball from the selected box. If

the ball drawn is white, what is the probability that the dice had turned up with a red face?

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38. Five dice are thrown simultaneously. If the occurrence of an odd number in a single dice is considered a success, find the probability of maximum three successes.

[Answer](#)