Roll Number		

SET A

INDIAN SCHOOL MUSCAT
SECOND PRE-BOARD EXAMINATION
MATHEMATICS (041)
Term 2

CLASS: XII

Time Allotted: 2 hrs.

09.04.2022

Max. Marks: 40

General Instructions:

1) *The question paper consists of 14 questions divided into 4 sections A, B, C and D.*
2) *All questions are compulsory.*
3) *Section A comprises of 6 questions of 2 marks each. Internal choice has been provided in one question.*
4) *Section B comprises of 4 questions of 3 marks each. Internal choice has been provided in two questions.*
5) *Section C comprises of 3 questions of 4 marks each. Internal choice has been provided in one question.*
6) *Section D contains one case study-based question having two sub questions of 2 marks each.*

Section A

1. Evaluate : $\int \frac{dx}{x + x\log x}$ **OR** Evaluate: $\int \frac{dx}{9x^2 + 6x + 10}$ 2

2. If $\frac{dx}{x} + \frac{dy}{y} = 0$, show that the product of x and y is constant. 2

3. Find a unit vector perpendicular to each of the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$, where $\vec{a} = 3\hat{\imath} + 2\hat{\jmath} + 2\hat{k}$ and $\vec{b} = \hat{\imath} + 2\hat{\jmath} - 2\hat{k}$ 2

4. Write the vector and cartesian equation of the planes that passes through the point $(1, 0, -2)$ and the vector normal to the plane is $\hat{\imath} + \hat{\jmath} - \hat{k}$. 2

5. A coin is biased so that the head is 3 times as likely to occur as tail. If the coin is tossed twice, find the probability distribution of number of tails. 2

6. A black and a red die are rolled. Find the conditional probability of obtaining a sum greater than 9, given that the black die resulted in a 5. 2

Section B

7. Evaluate : $\int \frac{(2x-3)\,dx}{(x^2-1)(2x+3)}$ **OR** Evaluate : $\int (sin^{-1}x)^2\,dx$ 3

8. Evaluate : $\int_0^1 \frac{xe^x}{(1+x)^2}\,dx$ 3

9. If $\vec{a} = 2\hat{\imath} + \hat{\jmath} - 3\hat{k}$ and $\vec{b} = \hat{\imath} - 2\hat{\jmath}$, then find a vector $\vec{c}$, such that $\vec{a} \times \vec{c} = \vec{b}$ and $\vec{a}.\vec{c} = 4$ 3

10. If the points (1, 1, p) and (-3, 0, 1) be equidistant from the plane $\vec{r}.(3\hat{\imath} + 4\hat{\jmath} - 12\hat{k}) + 13 = 0$, then find the value of p. 3

OR

Find the shortest distance between the lines

$\vec{r} = (\hat{\imath} + 2\hat{\jmath} + 3\hat{k}) + \lambda(\hat{\imath} - 3\hat{\jmath} + 2\hat{k})$ *and* $\vec{r} = (4\hat{\imath} + 5\hat{\jmath} + 6\hat{k}) + \mu(2\hat{\imath} + 3\hat{\jmath} + \hat{k})$

Section C

11. Find the area of the smaller region bounded by the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ and the line $\frac{x}{3} + \frac{y}{2} = 1$ 4

12. Solve the differential equation $\left\{x \cos \frac{y}{x} + y \sin \frac{y}{x}\right\} y\,dx = \left\{y \sin \frac{y}{x} - x \cos \frac{y}{x}\right\} x\,dy$ 4

OR

Find the particular solution of the following differential equation,

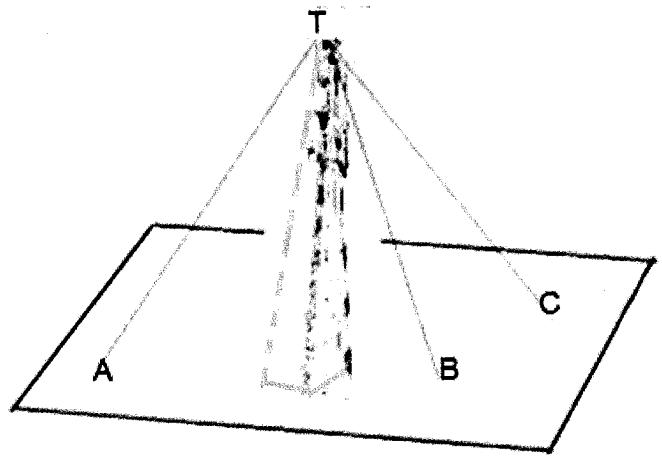
$\frac{dy}{dx} + y\cot x = 3x \operatorname{cosec} x$, given that y = 0 when $x = \frac{\pi}{2}$

13. A manufacturer has three machine operators A, B and C. The first operator A produces 1 % of defective items, whereas the other two operators B and C produce 5% and 7% defective items respectively. A is on the job for 50% of the time, B on the job 30% of the time and C on the job for 20% of the time. All the items are put into one stockpile and then one item is chosen at random from this and is found to be defective. What is the probability that it was produced by A? 4

Section D

14. Read the paragraph and answer the following questions:

A mobile tower stands on the top of a hill. Consider the surface on which the tower stands as a plane having points A(1, 0, 2), B(3, -1, 1) and C(1, 2, 1) on it. The mobile tower is tied with three cables from the point A, B and C such that it stands vertically on the ground. The top of the tower is at the point T(2, 3, 1) as shown in the figure.



i) Find the equation of the plane passing through the points A, B and C? 2

ii) Find the coordinates of the foot of the tower drawn from the top to the ground, given tower stands perpendicular to the ground(plane)? 2

End of the Question Paper

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SET B

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6) *Section D contains one case study-based question having two sub questions of 2 marks each.*

Section A

1. Evaluate: $\int sin^2\frac{x}{2}\,dx$ **OR** Evaluate: $\int \frac{dx}{x^2 - 6x + 13}$ 2

2. Find the vector and Cartesian equation of the planes that passes through the point (1, 0, −2) and the vector normal to the plane is $\hat{\imath} + \hat{\jmath} - \hat{k}$. 2

3. A coin is biased so that the head is 3 times as likely to occur as tail. If the coin is tossed twice, find the probability distribution of number of tails. 2

4. A yellow and a green die are rolled. Find the conditional probability of obtaining a sum greater than 9, given that the yellow die resulted in a 5. 2

5. Find a unit vector perpendicular to each of the vectors $\vec{a} + \vec{b}$ *and* $\vec{a} - \vec{b}$, *where* $\vec{a} = 3\hat{\imath} + 2\hat{\jmath} + 2\hat{k}$ and $\vec{b} = \hat{\imath} + 2\hat{\jmath} - 2\hat{k}$ 2

6. If $\frac{dx}{x} + \frac{dy}{y} = 0$, show that the product of x and y is constant 2

Section B

7. If the points (1, 1, p) and (-3, 0, 1) be equidistant from the plane $\vec{r}.(3\hat{\imath} + 4\hat{\jmath} - 12\hat{k}) + 13 = 0$, then find the value of p. 3

OR

Find the shortest distance between the lines

$\vec{r} = (\hat{\imath} + 2\hat{\jmath} + 3\hat{k}) + \lambda(\hat{\imath} - 3\hat{\jmath} + 2\hat{k})$ *and* $\vec{r} = (4\hat{\imath} + 5\hat{\jmath} + 6\hat{k}) + \mu(2\hat{\imath} + 3\hat{\jmath} + \hat{k})$

8. Show that the vectors $2\hat{\imath} - \hat{\jmath} + \hat{k}, \hat{\imath} - 3\hat{\jmath} - 5\hat{k}$ and $3\hat{\imath} - \hat{4j} - 4\hat{k}$ form the vertices of a right-angled triangle. 3

9. Evaluate : $\int_0^1 \frac{te^t}{(1+t)^2} dt$ 3

10. Evaluate: $\int \frac{(2x-3)\,dx}{(x^2-1)(2x+3)}$ **OR** Evaluate : $\int (cos^{-1}x)^2\, dx$ 3

Section C

11. Solve the differential equation 4

$$\left\{x \cos \frac{y}{x} + y \sin \frac{y}{x}\right\} y\, dx = \left\{y \sin \frac{y}{x} - x \cos \frac{y}{x}\right\} x\, dy$$

OR

Find the particular solution of the following differential equation

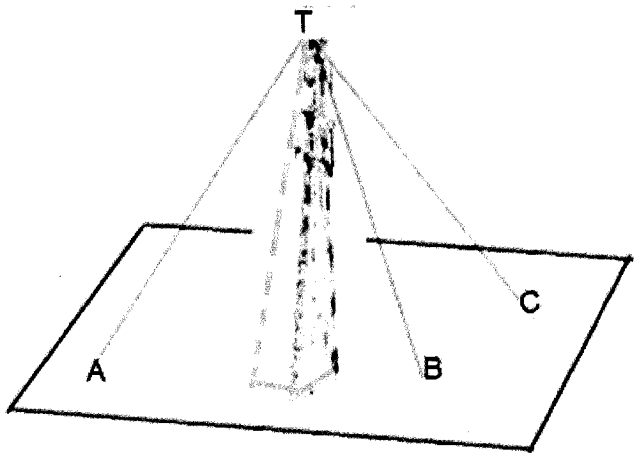
$\frac{dy}{dx} + ycotx = 4x\ cosecx$, given that y = 0 when $x = \frac{\pi}{2}$.

12. Three persons *A*, *B* and *C* apply for a job of Manager in a Private Company. Chances of their selection (*A*, *B* and *C*) are in the ratio 1 : 2 : 4. The probabilities that *A*, *B* and *C* can introduce changes to improve profits of the company are 0.8, 0.5 and 0.3 respectively. If the change does not take place, find the probability that it is due to the appointment of *C*. 4

13. Find the area of the region bounded by the lines 2x + y = 4, 3x – 2y = 6 and x – 3y + 5 = 0. 4

Section D

14. Read the paragraph and answer the following questions:
A mobile tower stands on the top of a hill. Consider the surface on which the tower stands as a plane having points A (1, 0, 2), B (3, -1, 1) and C (1, 2, 1) on it. The mobile tower is tied with three cables from the point A, B and C such that it stands vertically on the ground. The top of the tower is at the point T(2, 3, 1) as shown in the figure.



i) Find the equation of the plane passing through the points A, B and C? 2

ii) Find the coordinates of the foot of the perpendicular drawn from the top(T) to the plane? 2

End of the Question Paper

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SET C

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6) *Section D contains one case study-based question having two sub questions of 2 marks each.*

Section A

1. A black and a red die are rolled. Find the conditional probability of obtaining a sum greater than 9, given that the black die resulted in a 5. 2

2. Find the vector and cartesian equation of the planes that passes through the point (1, 0, −2) and the vector normal to the plane is $\hat{\imath} + \hat{\jmath} - \hat{k}$. 2

3. Evaluate: $\int \frac{\sin^3 x + \cos^3 x}{\sin^2 x \cos^2 x}$ **OR** Evaluate: $\int \frac{dx}{3x^2 + 13x - 10}$ 2

4. If $\frac{dx}{x} + \frac{dy}{y} = 0$, show that the product of x and y is constant. 2

5. A coin is biased so that the head is 3 times as likely to occur as tail. If the coin is tossed twice, find the probability distribution of number of tails. 2

6. Find a unit vector perpendicular to each of the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$, where $\vec{a} = 3\hat{\imath} + 2\hat{\jmath} + 2\hat{k}$ and $\vec{b} = \hat{\imath} + 2\hat{\jmath} - 2\hat{k}$ 2

Section B

7. Show that the vectors $2\hat{\imath} - \hat{\jmath} + \hat{k}, \hat{\imath} - 3\hat{\jmath} - 5\hat{k}$ and $3\hat{\imath} - 4\hat{\jmath} - 4\hat{k}$ form the vertices of a right-angled triangle. 3

8. Find: $\int \frac{(2x-3)\,dx}{(x^2-1)(2x+3)}$ **OR** Find: $\int (\log x)^2\,dx$ 3

9. If the points (1, 1, p) and (-3, 0, 1) be equidistant from the plane $\vec{r} \cdot (3\hat{\imath} + 4\hat{\jmath} - 12\hat{k}) + 13 = 0$, then find the value of p. 3

OR

Find the shortest distance between the lines
$\vec{r} = (\hat{\imath} + 2\hat{\jmath} + 3\hat{k}) + \lambda(\hat{\imath} - 3\hat{\jmath} + 2\hat{k})$ *and* $\vec{r} = (4\hat{\imath} + 5\hat{\jmath} + 6\hat{k}) + \mu(2\hat{\imath} + 3\hat{\jmath} + \hat{k})$

10. Evaluate: $\int_0^1 \frac{xe^x}{(1+x)^2} dx$ 3

Section C

11. *P*, *Q* and *R* apply for a job of a Regional Manager in a Private Company. Chances of their selection are in the ratio 1 : 2 : 4 respectively. The probabilities that *P*, *Q* and *R* can introduce changes to improve profits of the company are 0.8, 0.5 and 0.3 respectively. If the change does not take place, find the probability that it is due to the appointment of *R*. 4

12. Find the area of the smaller region bounded by the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ and the line $\frac{x}{4} + \frac{y}{3} = 1$ 4

13. Solve the differential equation $\left\{x \cos \frac{y}{x} + y \sin \frac{y}{x}\right\} y\, dx = \left\{y \sin \frac{y}{x} - x \cos \frac{y}{x}\right\} x\, dy$ 4

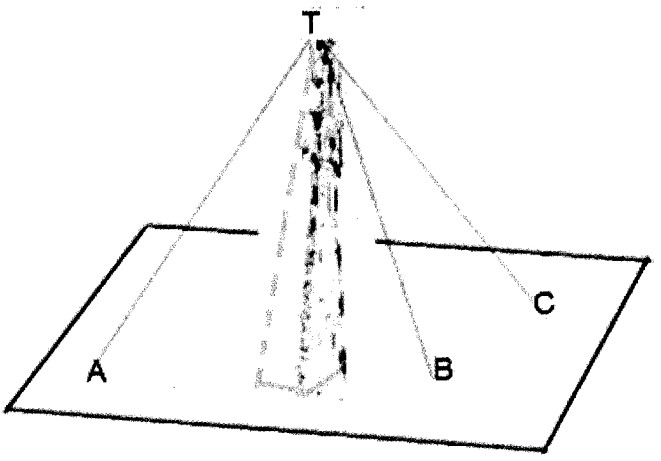
OR

Find the particular solution of the following differential equation
$\frac{dy}{dx} + y\cot x = 5x \operatorname{cosec} x$, given that y = 0 when $x = \frac{\pi}{2}$

Section D

14. Read the paragraph and answer the following questions:

A mobile tower stands on the top of a hill. Consider the surface on which the tower stands as a plane having points A (1, 0, 2), B (3, -1, 1) and C (1, 2, 1) on it. The mobile tower is tied with three cables from the point A, B and C such that it stands vertically on the ground. The top of the tower is at the point T(2, 3, 1) as shown in the figure.



i) Find the equation of the plane passing through the points A, B and C? 2

ii) Find the coordinates of the foot of the perpendicular drawn from the top(T) to the plane? 2

End of the Question Paper