Roll Number		

SET A

INDIAN SCHOOL MUSCAT
FIRST PRE-BOARD EXAMINATION
MATHEMATICS

CLASS: XII | Subject Code: 041 | Time Allotted: 3 Hrs.

02.01.2020 | Max. Marks: 80

General Instructions:

(i) All the questions are compulsory.
(ii) The question paper consists of 36 questions divided into 4 sections A, B, C, and D.
(iii) Section A comprises of 20 questions of 1 mark each. Section B comprises of 6 questions of 2 marks each. Section C comprises of 6 questions of 4 marks each. Section D comprises of 4 questions of 6 marks each.
(iv) There is no overall choice. However, an internal choice has been provided in three questions of 1 mark each, two questions of 2 marks each, two questions of 4 marks each, and two questions of 6 marks each. You have to attempt only one of the alternatives in all such questions.
(v) Use of calculators is not permitted.

SECTION A

Q1 - Q10 are multiple choice type questions. Select the correct option:

1. If a matrix A is both symmetric and skew symmetric then matrix A is — 1

(a) a scalar matrix (b) any zero matrix

(c) a zero matrix of order n × n (d) a rectangular matrix

2. If A is a square matrix such that $A^2 = A$, then write the value of $7A - (I + A)^3$, where I is an identity matrix. — 1

(a) I (b) A (c) – A (d) – I

3. The angle between the vectors $\hat{i} - \hat{j}$ and $\hat{j} - \hat{k}$ is — 1

(a) $\frac{\pi}{3}$ (b) $\frac{2\pi}{3}$ (c) $\frac{5\pi}{6}$ (d) $\frac{-\pi}{3}$

4. If A and B are any two events such that P(A) + P(B) – P(A and B) = P(A), then — 1

(a) P(B|A) = 1 (b) P(A|B) = 1 (c) P(B|A) = 0 (d) P(A|B) = 0

5. The point which lies in the solution half plane of $2x + 3y \leq 6$ is — 1

(a) (5,7) (b) (1, 2) (c) (2, 1) (d) (-1, 0)

6. If $\sin^{-1} x + \sin^{-1} y = \frac{\pi}{2}$, then value of $\cos^{-1} x + \cos^{-1} y$ is — 1

(a) $\frac{\pi}{2}$ (b) π (c) $\frac{2\pi}{3}$ (d) 0

7. If $P(A \cap B) = \frac{7}{10}$ and $P(B) = \frac{17}{20}$,then $P(A|B)$ equals 1

(a) $\frac{14}{17}$ (b) $\frac{7}{17}$ (c) $\frac{17}{20}$ (d) $\frac{14}{17}$

8. $\int_0^{\frac{\pi}{2}} \sqrt{1 + sin2x}$ dx is equal to 1

(a) $2\sqrt{2}$ (b) $2(\sqrt{2} + 1)$ (c) 2 (d) $2(\sqrt{2} - 1)$

9. The reflection of the point (α, β, γ) in the xy– plane is 1

(a) $(\alpha, \beta, 0)$ (b) $(0, 0, \gamma)$ (c) $(-\alpha, -\beta, \gamma)$ (d) $(\alpha, \beta, -\gamma)$

10. The equation of the plane parallel to the plane $4x - 3y + 2z + 1 = 0$ and passing through the point (5, 1, - 6) is 1

(a) $4x - 3y + 2z - 5 = 0$ (b) $3x - 4y + 2z - 5 = 0$

(c) $3x - 4y + 2z + 5 = 0$ (d) $4x - 3y + 2z + 5 = 0$

(Q11 - Q15) Fill in the blanks:

11. Define a relation R in **R** as aRb if $a \geq b$. R is not an equivalence relation because R is ________. 1

OR

For the function $f(x) = x^2$ *defined from* R_+ *to* R_+*, where* R_+ *is the set of all non − negative real numbers. What is* f^{-1} ?

12. The set of points where the functions f given by $f(x) = |x - 3|$ is differentiable is ________. 1

13. If $\begin{bmatrix} 2x+y & 4x \\ 5x-7 & 4x \end{bmatrix} = \begin{bmatrix} 7 & 7y-13 \\ y & x+6 \end{bmatrix}$, then value of x is ________. 1

14. The sides of an equilateral triangle are increasing at the rate of 2 cm/sec. The rate at which the area increases, when side is 10 cm is _________ **cm²/s** 1

15. The direction cosines of Z-axis are ________. 1

OR

The unit vector in the direction of the vector $2\hat{\imath} - \hat{\jmath} + 3\hat{k}$ is ____________.

(Q16 - Q20) Answer the following questions:

16. Let A be a square matrix of order 3×3 and k a scalar, then find the value of $|kA|$. 1

17. Evaluate: $\int \frac{dx}{\sin^2 x \cos^2 x}$ 1

18. Evaluate: $\int_0^{\frac{\pi}{2}} \frac{1}{secx} dx$ 1

19. Evaluate: $\int_a^{-a} (sin^5 x) dx$ 1

20. What is the order of the differential equation of all circles of given radius 5 units? 1

OR

What is the integrating factor of the differential equation $x\frac{dy}{dx} - 2y = e^{2x}$?

SECTION – B

21. Find the principal value of $cos^{-1}\left(cos\ \frac{7\pi}{6}\right) + sin^{-1}\left(sin\ \frac{5\pi}{6}\right)$ 2

22. Find $\frac{dy}{dx}$,if y = $sin^{-1}\left(\frac{1-x^2}{1+x^2}\right)$,0< $x < 1$ 2

OR

Differentiate log (cos e^x) with respect to e^x.

23. Find the value of c in Mean value theorem for the function f (x) = x (x – 2), x ∈ [1, 2] 2

24. Find the angle between the two planes 3x – 6y + 2z = 7 and 2x + 2y - 2z = 5 2

25. Find the vector and Cartesian equation of the line through the point (5, 2,-4) and which is parallel to the vector $3\hat{\imath} + 2\hat{\jmath} - 8\,\hat{k}$. 2

OR

Show that the points A ($-2\hat{\imath} + 3\hat{\jmath} + 5\hat{k}$), B ($\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$) and C ($7\hat{\imath} - \hat{k}$) are collinear.

26. A die is thrown twice and the sum of the numbers appearing is observed to be 6. What is the conditional probability that the number 4 has appeared at least once? 2

SECTION – C

27. Let T be the set of all triangles in a plane with R, a relation in T given by R = {(T1, T2): T1 is similar to T2}.Show that R is an equivalence relation. Are the two right angled triangles with sides T_1 : 3, 4, 5 and T_2 : 1, 1, $\sqrt{2}$ related? Justify. 4

28. If y = 3 cos (log x) + 4 sin (log x). Show that $x^2y_2 + xy_1 + y = 0$ 4

OR

$If\ \sqrt{1-x^2} + \sqrt{1-y^2} = a(x-y)\ then\ prove\ that\ \frac{dy}{dx} = -\frac{\sqrt{1-y^2}}{\sqrt{1-x^2}}$

29. Find the particular solution of differential equation $(1 + x^2)$ dy +2xy dx = cot x dx, given that y = 1 when x = $\frac{\pi}{2}$. 4

30. Evaluate : $\int \frac{6x+7}{\sqrt{(x-5)(x-4)}}$ dx 4

31. There are 2 boxes I and II .Box I contains 3 red and 6 black balls. Box II contains 5 red and 'n' black balls. One of the two boxes, box I and box II is selected at random and a ball is drawn at random. The ball drawn is found to be red. If the probability that this red ball comes out from box II is $\frac{3}{5}$, find the value of 'n'. 4

OR

From a lot of 30 bulbs which include 6 defectives, a sample of 4 bulbs is drawn at random with replacement. Find the probability distribution of the number of defective bulbs.

32. A dealer wishes to purchase a number of fans and sewing machines. He has only ₹ 5760 to invest and has space for at most 20 items. A fan costs him ₹ 360 and a sewing machine ₹ 240. His expectation is that he can sell a fan at a profit of ₹ 22 and a sewing machine at a profit of ₹ 18. Assuming that he can sell all the items that he can buy, how should he invest his money in order to maximize the profit? Formulate this as a linear programming problem and solve it graphically. 4

SECTION D

33. If A = $\begin{pmatrix} 1 & 1 & 1 \\ 1 & 0 & 2 \\ 3 & 1 & 1 \end{pmatrix}$.Find A^{-1},hence solve the system of equations, x + 2z =7 , 3x + y + z =12 and x + y + z =6 6

OR

Find the inverse of the following matrix using column operations

A = $\begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$

34. Using integration, find the area of Δ ABC ,whose vertices are A(2,5) ,B(4,7) and C(6,2) 6

35. A given quantity of metal is to be cast into a solid half circular cylinder with a rectangular base and semi-circular ends. Show that in order that total surface area is minimum, the ratio of length of cylinder to the diameter of semi-circular ends is π : π + 2. 6

OR

Find the equation of the normal at a point on the curve $x^2 = 4y$ which passes through the point (1, 2). Also find the equation of the corresponding tangent.

36. Show that the lines with vector equations $\vec{r} = \hat{\imath} + \hat{\jmath} + \hat{k} + \mu(\hat{\imath} - \hat{\jmath} + \hat{k})$ *and* $\vec{r} = 4\hat{\jmath} + 2\hat{k} + \beta(2\hat{\imath} - \hat{\jmath} + 3\hat{k})$ are coplanar. Also find the equation of the plane containing the lines. 6

End of the Question Paper

Roll Number		

SET B

INDIAN SCHOOL MUSCAT
FIRST PRE-BOARD EXAMINATION
MATHEMATICS

CLASS: XII　　Subject Code: 041　　Time Allotted: 3 Hrs.

02.01.2020　　Max. Marks: 80

General Instructions:

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(v) Use of calculators is not permitted.

SECTION A

Q1 – Q10 are multiple choice type questions. Select the correct option.

1. The angle between the vectors $\hat{\imath} - \hat{\jmath}$ and $\hat{\jmath} - \hat{k}$ is　1
(a) $\frac{\pi}{3}$　(b) $\frac{2\pi}{3}$　(c) $\frac{5\pi}{6}$　(d) $\frac{-\pi}{3}$

2. If $P(A \cap B) = \frac{7}{10}$ and $P(B) = \frac{17}{20}$,then P(A|B) equals　1
(a) $\frac{14}{17}$　(b) $\frac{7}{17}$　(c) $\frac{17}{20}$　(d) $\frac{14}{17}$

3. If A and B are any two events such that P(A) + P(B) – P(A and B) = P(A), then　1
(a) P(B|A) = 1　(b) P(A|B) = 1　(c) P(B|A) = 0　(d) P(A|B) = 0

4. $\int_0^{\frac{\pi}{2}} \sqrt{1 + sin2x}$ dx is equal to　1
(a) $2\sqrt{2}$　(b) $2(\sqrt{2}+1)$　(c) 2　(d) $2(\sqrt{2}-1)$

5. If a matrix A is both symmetric and skew symmetric then matrix A is　1

(a) a scalar matrix　(b) any zero matrix

(c) a zero matrix of order $n \times n$　(d) a rectangular matrix.

6. The reflection of the point (α, β, γ) in the xy– plane is　1
(a) $(\alpha, \beta, 0)$　(b) $(0, 0, \gamma)$　(c) $(-\alpha, -\beta, \gamma)$　(d) $(\alpha, \beta, -\gamma)$

7. If A is a square matrix such that $A^2 = A$, then write the value of $7A - (I + A)^3$, where I is an identity matrix. 1

(a) I (b) A (c) – A (d) – I

8. The point which lies in the solution half plane of $2x + 3y \le 6$ is 1

(a) (5,7) (b) (1, 2) (c) (2, 1) (d) (-1, 0)

9. The equation of the plane parallel to the plane 4x - 3y + 2z + 1 = 0 and passing through the point (5, 1, - 6) is 1

(a) 4x – 3y + 2z – 5 = 0 (b) 3x – 4y + 2z – 5 = 0

(c) 3x – 4y + 2z + 5 = 0 (d) 4x – 3y + 2z + 5 = 0

10. If $\sin^{-1} x + \sin^{-1} y = \frac{\pi}{2}$, then value of $\cos^{-1} x + \cos^{-1} y$ is 1

(a) $\frac{\pi}{2}$ (b) π (c) $\frac{2\pi}{3}$ (d) 0

(Q11 - Q15) Fill in the blanks.

11. If $\begin{bmatrix} 2x+y & 4x \\ 5x-7 & 4x \end{bmatrix} = \begin{bmatrix} 7 & 7y-13 \\ y & x+6 \end{bmatrix}$, then value of x is _________. 1

12. The direction cosines of Z-axis are ________. 1

OR

The unit vector in the direction of the vector $2\hat{i} - \hat{j} + 3\hat{k}$ is ____________.

13. The sides of an equilateral triangle are increasing at the rate of 2 cm/sec. The rate at which the area increases, when side is 10 cm is _________ **cm^2/s** 1

14. The set of points where the functions f given by f (x) = |x – 3| is differentiable is _________. 1

15. Define a relation R in **R** as aRb if a ≥ b. R is not an equivalence relation because R is ________. 1

OR

For the function $f(x) = x^2$ *defined from* R_+ *to* R_+, *where* R_+ *is the set of all non – negative real numbers. What is* f^{-1} ?

(Q16 - Q20) Answer the following questions

16. Evaluate: $\int_a^{-a} (\sin^5 x)dx$ 1

17. Evaluate: $\int_0^{\frac{\pi}{2}} \frac{1}{\sec x} dx$ 1

18. What is the order of the differential equation of all circles of given radius 5 units? 1

OR

What is the integrating factor of the differential equation $x\frac{dy}{dx} - 2y = e^{2x}$?

19. Evaluate: $\int \frac{dx}{\sin^2x \cos^2x}$ 1

20. Let A be a square matrix of order 3 × 3 and k a scalar, then find the value of | kA |. 1

SECTION – B

21. A die is thrown twice and the sum of the numbers appearing is observed to be 6. What is the conditional probability that the number 4 has appeared at least once? 2

22. Find the value of c in Mean value theorem for the function f (x) = x (x – 2), x ∈ [1, 2] 2

23. Find the principal value of $\cos^{-1}\left(\cos \frac{7\pi}{6}\right) + \sin^{-1}\left(\sin \frac{5\pi}{6}\right)$ 2

24. Find $\frac{dy}{dx}$,if y = $\sin^{-1}\left(\frac{1-x^2}{1+x^2}\right)$,0< $x < 1$ 2

OR

Differentiate log (cos e^x) with respect to e^x.

25. Find the angle between the two planes 3x – 6y + 2z = 7 and 2x + 2y - 2z = 5 2

26. Find the vector and Cartesian equation of the line through the point (5, 2,-4) and which is parallel to the vector $3\hat{\imath} + 2\hat{\jmath} - 8\,\hat{k}$. 2

OR

Show that the points A ($-2\hat{\imath} + 3\hat{\jmath} + 5\hat{k}$), B ($\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$) and C ($7\hat{\imath} - \hat{k}$) are collinear.

SECTION – C

27. Evaluate : $\int \frac{6x+7}{\sqrt{(x-5)(x-4)}}$ dx 4

28. A dealer wishes to purchase a number of fans and sewing machines. He has only ₹ 5760 to invest and has space for at most 20 items. A fan costs him ₹ 360 and a sewing machine ₹ 240. His expectation is that he can sell a fan at a profit of ₹ 22 and a sewing machine at a profit of ₹ 18. Assuming that he can sell all the items that he can buy, how should he invest his money in order to maximize the profit? Formulate this as a linear programming problem and solve it graphically. 4

29. Let T be the set of all triangles in a plane with R, a relation in T given by R = {(T1, T2): T1 is similar to T2}.Show that R is an equivalence relation. Are the two right angled triangles with sides T_1 : 3, 4, 5 and T_2 : 1, 1, $\sqrt{2}$ related? Justify. 4

30. Find the particular solution of differential equation $(1 + x^2)$ dy +2xy dx = cot x dx, given that y = 1 when x = $\frac{\pi}{2}$. 4

31. There are 2 boxes I and II .Box I contains 3 red and 6 black balls. Box II contains 5 red and 'n' black balls. One of the two boxes, box I and box II is selected at random and a ball is drawn at random. The ball drawn is found to be red. If the probability that this red ball comes out from box II is $\frac{3}{5}$, find the value of 'n'. 4

OR

From a lot of 30 bulbs which include 6 defectives, a sample of 4 bulbs is drawn at random with replacement. Find the probability distribution of the number of defective bulbs.

32. If $y = 3\cos(\log x) + 4\sin(\log x)$. Show that $x^2y_2 + xy_1 + y = 0$ 4

OR

$If\ \sqrt{1-x^2} + \sqrt{1-y^2} = a(x-y)\ then\ prove\ that\ \frac{dy}{dx} = -\frac{\sqrt{1-y^2}}{\sqrt{1-x^2}}$

SECTION D

33. Show that the lines with vector equations $\vec{r} = \hat{\imath} + \hat{\jmath} + \hat{k} + \mu(\hat{\imath} - \hat{\jmath} + \hat{k})$ *and* $\vec{r} = 4\hat{\jmath} + 2\hat{k} + \beta(2\hat{\imath} - \hat{\jmath} + 3\hat{k})$ are coplanar. Also find the equation of the plane containing the lines. 6

34. A given quantity of metal is to be cast into a solid half circular cylinder with a rectangular base and semi-circular ends. Show that in order that total surface area is minimum, the ratio of length of cylinder to the diameter of semi-circular ends is $\pi : \pi + 2$. 6

OR

Find the equation of the normal at a point on the curve $x^2 = 4y$ which passes through the point (1, 2). Also find the equation of the corresponding tangent.

35. Using integration, find the area of Δ ABC ,whose vertices are A(2,5) ,B(4,7) and C(6,2) 6

36. If A = $\begin{pmatrix} 1 & 1 & 1 \\ 1 & 0 & 2 \\ 3 & 1 & 1 \end{pmatrix}$.Find A^{-1},hence solve the system of equations, x + 2z =7 , 3x + y + z =12 and x + y + z =6 6

OR

Find the inverse of the following matrix using column operations

A = $\begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$

End of the Question Paper

Roll Number		

SET C

INDIAN SCHOOL MUSCAT
FIRST PRE-BOARD EXAMINATION
MATHEMATICS

CLASS: XII | Subject Code: 041 | Time Allotted: 3 Hrs.

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(v) Use of calculators is not permitted.

SECTION A

Q1 – Q10 are multiple choice type questions. Select the correct option.

1. $\int_0^{\frac{\pi}{2}} \sqrt{1 + sin2x}\ dx$ is equal to 1

(a) $2\sqrt{2}$ (b) $2(\sqrt{2}+1)$ (c) 2 (d) $2(\sqrt{2}-1)$

2. If $\sin^{-1} x + \sin^{-1} y = \frac{\pi}{2}$, then value of $\cos^{-1} x + \cos^{-1} y$ is 1

(a) $\frac{\pi}{2}$ (b) π (c) $\frac{2\pi}{3}$ (d) 0

3. The point which lies in the solution half plane of $2x + 3y \leq 6$ is 1

(a) (5,7) (b) (1, 2) (c) (2, 1) (d) (-1, 0)

4. If $P(A \cap B) = \frac{7}{10}$ and $P(B) = \frac{17}{20}$,then $P(A|B)$ equals 1

(a) $\frac{14}{17}$ (b) $\frac{7}{17}$ (c) $\frac{17}{20}$ (d) $\frac{14}{17}$

5. The angle between the vectors $\hat{\imath} - \hat{\jmath}$ and $\hat{\jmath} - \hat{k}$ is 1

(a) $\frac{\pi}{3}$ (b) $\frac{2\pi}{3}$ (c) $\frac{5\pi}{6}$ (d) $\frac{-\pi}{3}$

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(a) $4x - 3y + 2z - 5 = 0$ (b) $3x - 4y + 2z - 5 = 0$

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OR

The unit vector in the direction of the vector $2\hat{\imath} - \hat{\jmath} + 3\hat{k}$ is ____________.

13. The sides of an equilateral triangle are increasing at the rate of 2 cm/sec. The rate at which the area increases, when side is 10 cm is __________ **cm²/s** 1

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SECTION – B

21. Find the value of c in Mean value theorem for the function f (x) = x (x – 2), x ∈ [1, 2] 2

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Show that the points A $(-2\hat{\imath} + 3\hat{\jmath} + 5\hat{k})$, B $(\hat{\imath} + 2\hat{\jmath} + 3\hat{k})$ and C $(7\hat{\imath} - \hat{k})$ are collinear.

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Differentiate log (cos e^x) with respect to e^x.

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SECTION – C

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OR

$If\ \sqrt{1-x^2} + \sqrt{1-y^2} = a(x-y)\ then\ prove\ that\ \frac{dy}{dx} = -\frac{\sqrt{1-y^2}}{\sqrt{1-x^2}}$

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SECTION D

33. A given quantity of metal is to be cast into a solid half circular cylinder with a rectangular base and semi-circular ends. Show that in order that total surface area is minimum, the ratio of length of cylinder to the diameter of semi-circular ends is $\pi : \pi + 2$. 6

OR

Find the equation of the normal at a point on the curve $x^2 = 4y$ which passes through the point (1, 2). Also find the equation of the corresponding tangent.

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OR

Find the inverse of the following matrix using column operations.

A = $\begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$

35. Show that the lines with vector equations $\vec{r} = \hat{\imath} + \hat{\jmath} + \hat{k} + \mu(\hat{\imath} - \hat{\jmath} + \hat{k})$ *and* $\vec{r} = 4\hat{\jmath} + 2\hat{k} + \beta(2\hat{\imath} - \hat{\jmath} + 3\hat{k})$ are coplanar. Also find the equation of the plane containing the lines. 6

36. Using integration, find the area of Δ ABC ,whose vertices are A(2,5) ,B(4,7) and C(6,2) 6

End of the Question Paper