



**Maharashtra Education Society's**  
**Jr. Colleges / Higher Secondary Schools**  
**Prelim Examination (2018-19)**

Std. – XII Science

Subject - Mathematics &amp; Statics

Date - 11/01/2019

Marks -80

Time - 3 Hrs.

**Note :**

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. The question paper consist of 30 questions divided into **FOUR** sections A, B, C, D.
  - Section A contains 6 questions of 1 mark each.
  - Section B contains 8 questions of 2 marks each. (One of them has internal option)
  - Section C contains 6 questions of 3 marks each. (Two of them have internal option)
  - Section D contains 10 questions of 4 marks each. (Three of them have internal option)
4. For each MCQ, correct answer must be written along its alphabet.  
 e.g. (a)----- / (b) ----- / (c) ----- / (d) -----  
 In case of MCQ (Q 1 to Q 6) evaluation would be done for the first attempt only.
5. Start each section on new page only.
6. Use of logarithmic tables is allowed. Use of calculator is **not** allowed.
7. In L.P.P. only rough sketch of graph is expected. Graph paper is not necessary.

**SECTION – A (6 Marks)**

**Select and write the most appropriate answer from the given alternatives for each question.**

**Q. 1.** The polar co – ordinates of the point whose cartesian co – ordinates are

$$\left(-\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}\right).$$

- (a)  $\left(1, \frac{\pi}{4}\right)$       (b)  $\left(1, -\frac{\pi}{4}\right)$       (c)  $\left(1, \frac{5\pi}{4}\right)$       (d)  $\left(1, \frac{3\pi}{4}\right)$       1

**Q. 2.** If  $\hat{i} + \hat{j} + \hat{k}$ ,  $\hat{i} - \hat{j} + \hat{k}$  and  $2\hat{i} + 3\hat{j} + m\hat{k}$  are coplanar, then value of m is ... ..

- (a) 1      (b) 2      (c) 3      (d) 4      1

**Q. 3.** If a line makes angles of measure  $45^\circ$  and  $60^\circ$  with positive direction of Y and Z axes respectively, then angle made by the line with positive direction of X axis is ... ..

- (a)  $30^\circ$       (b)  $60^\circ$       (c)  $60^\circ$  or  $120^\circ$       (d) none of these      1

**Q. 4.** The order and degree of a differential equation  $\left[1 + \left(\frac{dy}{dx}\right)^3\right]^{\frac{1}{3}} = 7\frac{d^2y}{dx^2}$

is respectively ... ..

- (a) 2,1      (b) 2,3      (c) 2,7      (d) 3,7      1

- Q. 5. If  $f(x) = (\sec^2 x)^{\cot^2 x}$ , for  $x \neq 0$  and  $f(x)$  is continuous at  $x = 0$ , then  $f(0) = \dots$
- (a) 1                      (b) e                      (c)  $-e$                       (d)  $e^2$                       1
- Q. 6. If  $X \sim B(n, p)$  and  $p = 0.6$ ,  $E(X) = 6$ , then value of  $n$  is ... ..
- (a) 5                      (b) 36                      (c) 1                      (d) 10                      1

**SECTION – B (16 Marks)**

- Q. 7. Prepare the truth table for  $\sim p \rightarrow (q \leftrightarrow p)$ .                      2
- Q. 8. Find the separate equations of lines represented by  $3x^2 - 7xy + 4y^2 = 0$ .                      2
- Q. 9. Find the measure of acute angle between the lines represented by the equation  $3x^2 - 4\sqrt{3}xy + 3y^2 = 0$ .                      2
- Q. 10. If lines makes angles  $\alpha, \beta$  and  $\gamma$  with co – ordinate axes, then prove that  $\cos 2\alpha + \cos 2\beta + \cos 2\gamma + 1 = 0$ .                      2
- Q. 11. If  $x$  &  $y$  are differentiable functions of  $t$ , then prove that
- $$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}}, \frac{dx}{dt} \neq 0.$$
- 2
- Q. 12. Test whether the following function is increasing or decreasing  $f(x) = x^3 - 3x^2 + 3x - 100, x \in R$                       2

**OR**

- Q. 12. Find the approximate value of  $\sqrt{8.95}$ .                      2
- Q. 13. Evaluate  $\int_0^{\frac{\pi}{4}} \tan^2 x \, dx$ .                      2
- Q. 14. The probability of hitting a target in any shot is 0.2. If 10 shots are fired, find the probability that the target will be hit twice.                      2

**SECTION – C (18 Marks)**

- Q. 15. In any  $\Delta ABC$ , prove that  $\frac{a-b}{a+b} = \frac{\tan\left(\frac{A-B}{2}\right)}{\tan\left(\frac{A+B}{2}\right)}$ .                      3
- OR**
- Q. 15. Prove that  $\sin^{-1}\left(\frac{3}{5}\right) + \cos^{-1}\left(\frac{12}{13}\right) = \sin^{-1}\left(\frac{56}{65}\right)$ .                      3
- Q. 16. Find the length of the perpendicular from the point  $P(3,2,1)$  to the line  $\frac{x-7}{2} = \frac{y-7}{2} = \frac{z-6}{3}$ .                      3

Q. 17. Find the equation of the plane in vector form passing through the points (1,0,1), (1, -1,1) and (4, -3,2). 3

Q. 18. If the function  $f(x) = \frac{x^4 - 64x}{\sqrt{x^2 + 9} - 5}$ , for  $x \neq 4$   
 $= k$ , for  $x = 4$   
 is continuous at  $x = 4$ , then find the value of  $k$ . 3

Q. 19. Prove that  $\int \sqrt{x^2 + a^2} dx = \frac{x}{2} \sqrt{x^2 + a^2} + \frac{a^2}{2} \log |x + \sqrt{x^2 + a^2}| + c$ . 3

**OR**

Q. 19. Prove that  $\int e^x [f(x) + f'(x)] dx = e^x \cdot f(x) + c$ .  
 Hence evaluate  $\int e^x (1 + \tan x + \tan^2 x) dx$ . 3

Q. 20. Let the p. m. f. of a random variable  $X$  is  $P(X) = \begin{cases} \frac{3-X}{10}, & X = -1, 0, 1, 2 \\ 0, & \text{Otherwise} \end{cases}$ .  
 Calculate  $E(X)$  and variance( $X$ ). 3

**SECTION - D (40 Marks)**

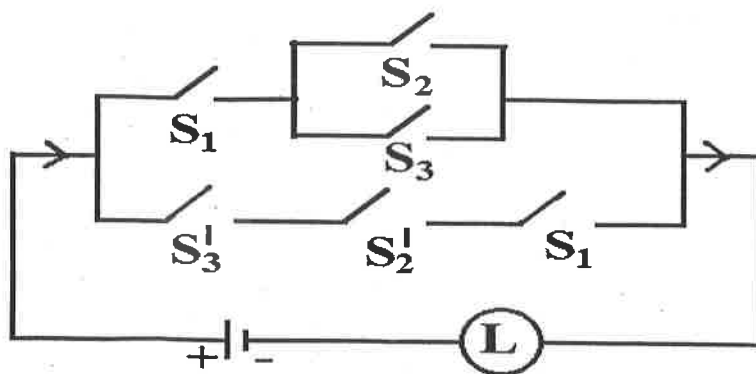
Q. 21. In  $\Delta ABC$ , prove that  $\cot\left(\frac{A}{2}\right) + \cot\left(\frac{B}{2}\right) + \cot\left(\frac{C}{2}\right) = \frac{a+b+c}{b+c-a} \cot\left(\frac{A}{2}\right)$ . 4

**OR**

Q. 21. Find the general solution of  $\cos x - \sin x = 1$ . 4

Q. 22. Find inverse of the matrix  $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ , by adjoint method. 4

Q. 23. Construct the new switching circuit for the following circuit with only one switch by simplifying the given circuit. 4



Q. 24. Prove that the altitudes of a triangle are concurrent, by vector method. 4

Q. 25. Solve the following L. P. P. using graphical method.

Minimize  $Z = 8x + 10y$ ,

subject to  $2x + y \geq 7; 2x + 3y \geq 15; y \geq 2$ ,

$x \geq 0, y \geq 0$ .

4

Q. 26. Prove that  $\int_{-a}^a f(x) dx = \begin{cases} 0, & \text{if } f(x) \text{ is an odd function.} \\ 2 \int_0^a f(x) dx, & \text{if } f(x) \text{ is an even function.} \end{cases}$

4

Q. 27. If  $\sqrt{1-x^2} + \sqrt{1-y^2} = a(x-y)$ , then show that  $\frac{dy}{dx} = \sqrt{\frac{1-y^2}{1-x^2}}$ .

4

OR

Q. 27. If  $x = \log(1+t^2), y = t - \tan^{-1} t$ , then show that  $\frac{dy}{dx} = \frac{\sqrt{e^x - 1}}{2}$ .

4

Q. 28. Find the co-ordinates of the point on the curve  $4y = x^2$ , which are nearest to the point (0,5).

4

Q. 29. Evaluate  $\int \sec^3 x dx$ .

4

Q. 30. Solve the differential equation  $\frac{dy}{dx} = \frac{y + \sqrt{x^2 + y^2}}{x}$ .

4

OR

Q. 30. Find the particular solution of the differential equation

$y(1 + \log x) \frac{dx}{dy} - x \log x = 0$ , when  $y = e^2$  and  $x = e$ .

4

\*\*\*\*\*