

# QUESTIONS BASED ON 'VALUES'

FOR CLASS XII [2012 - 2013]

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[ *Electronics & Communications Engineering, Indira Award Winner* ]

- Q01. Two schools A and B decided to award prizes to their students for three values honesty (x), punctuality (y) and obedience (z). School A decided to award a total of ₹11000 for the three values to 5, 4 and 3 students respectively while school B decided to award ₹10700 for the three values to 4, 3 and 5 students respectively. If all the three prizes together amount to ₹2700, then:
- Represent the above situation by a matrix equation and form linear equations using matrix multiplication.
  - Is it possible to solve the system of equations so obtained using matrices?
  - Which value you prefer to be rewarded most and why?
- Q02. There is a group of 50 people who are patriotic out of which 20 believe in non-violence. Two persons are selected at random out of them, write the probability distribution for the selected persons who are non-violent. Also find the mean of the distribution. Explain the importance of Non-violence in patriotism.
- Q03. A dealer in rural area wishes to purchase a number of sewing machines. He has only ₹5760.00 to invest and has space for at most 20 items. An electronic sewing machine costs him ₹360.00 and a manually operated sewing machine ₹240.00. He can sell an Electronic Sewing Machine at a profit of ₹22.00 and a manually operated sewing machine at a profit of ₹18.00. Assuming that he can sell all the items that he can buy, how should he invest his money in order to maximize his profit? Make it as a linear programming problem and then, solve it graphically. Keeping the rural background in mind justify the 'values' to be promoted for the selection of the manually operated machine.
- Q04. In answering a question on a MCQ test with 4 choices per question, a student knows the answer, guesses or copies the answer. Let  $\frac{1}{2}$  be the probability that he knows the answer,  $\frac{1}{4}$  be the probability that he guesses and  $\frac{1}{4}$  that he copies it. Assuming that a student, who copies the answer, will be correct with the probability  $\frac{3}{4}$ , what is the probability that the student knows the answer, given that he answered it correctly?
- Arjun does not know the answer to one of the questions in the test. The evaluation process has negative marking. Which value would Arjun violate if he resorts to unfair means? How would an act like the above hamper his character development in the coming years?
- Q05. An insurance company insured 2000 cyclists, 4000 scooter drivers and 6000 motorbike drivers. The probability of an accident involving a cyclist, scooter driver and a motorbike driver are 0.01, 0.03 and 0.15 respectively. One of the insured persons meets with an accident. What is the probability that he is a scooter driver? Which mode of transport would you suggest to a student and why?
- Q06. In a backward state, there are 729 families having six children each. If probability of survival of a girl child is  $\frac{1}{3}$  and that of boy child is  $\frac{2}{3}$ , find the number of families having 2 girls and 4 boys. Do you believe that a female child is neglected in backward areas? What steps will you take to restore the respect of a female child in society?
- Q07. Let  $A = \begin{bmatrix} 8 & 16 \\ 32 & 48 \end{bmatrix}$ , where first row represents the number of table fans and second row represents the number of ceiling fans which two manufacturing units x and y makes in one day. Compute  $7A$  and, state what does it represents?
- Q08. The income I of Dr.Rastogi is given by  $I(x) = ₹(x^3 - 3x^2 + 5x)$ . Can an insurance agent ensure him for the growth of his income?
- Q09. A manufacturer's marginal revenue function is  $MR = 275 - x - 0.3x^2$ . Find the increase in the manufacturer's total revenue if production is increased from 10 units to 20 units.
- Q10. Two airships are moving in space along the following lines
- $$\frac{x-3}{1} = \frac{5-y}{2} = \frac{z-7}{1} \quad \text{and} \quad \frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}$$

- An astronaut wants to move from one ship to another ship when two airships are closest. What is the least distance between the ships that he has to travel?
- Q11. A bird is located at the point A(3, 2, 8) in space. It wants to move to the plane whose equation is given by  $3x + 2y + 6z + 16 = 0$  in the shortest time. Find the distance she covered.
- Q12. The marginal cost of a manufacturer is given by  $MC = \frac{500x}{\sqrt{x^2 + 40}}$ , where x is the number of units of a product in thousands. If x increases from 3000 to 9000 units, find the total increase in cost.
- Q13. There are 40 hardworking scholars in a class. Out of which 10 are sports-persons. Three scholars are selected at random out of them. Write the probability distribution for selected persons who are sports-persons. Find the mean of distribution. Explain the importance of sports in education.
- Q14. The confidence gained by playing x games of tennis at a trial function is given by  $C(x) = 11 + 15x + 6x^2 - x^3$ . Find the marginal confidence gained after playing 5 games.
- Q15. Three friends A, B and C visited a Super Market for purchasing fresh fruits. A purchased 1kg apples, 3kg grapes and 4kg oranges and paid ₹800. B purchased 2kg apples, 1kg grapes and 2kg oranges and paid ₹500. While C paid ₹700 for 5kg apples, 1kg grapes and 1kg oranges. Find the cost of each fruit per kg by using matrix method. Why are the fruits good for health?
- Q16. From the point A(2, 3, 8) in space, a shooter aims to hit the target at P(6, 5, 11). If the line of fire is  $\frac{x-2}{4} = \frac{y-3}{2} = \frac{z-8}{3}$ , what do you think about the success of the shooter?
- Q17. The radius of a spherical diamond is measured as 7cm with an error of 0.04cm. Find the approximate error in calculating its volume. If the cost of  $1\text{cm}^3$  diamond is ₹1000, what is the loss to the buyer of the diamond? What lesson do you get from this observation?
- Q18. The marginal cost is defined as the rate of change of total cost with respect to the number of units of the product. The marginal cost of producing x units of a product is given by Marginal Cost =  $2x\sqrt{x+5}$ . If the cost of producing 4 units of the product is ₹314.40, find the cost function.
- Q19. Mr. Priyanshu has invested a part of his income in 10% (bond A) and another part of his income in 15% (bond B). His interest during a certain period is ₹4000. Had he invested 20% more in bond A and 10% more in bond B, his interest would have been increased by ₹500 for the same period. Then: (i) Represent the above situation by a matrix equation and form linear equations using matrix multiplication. (ii) Is it possible to solve the system of equations so obtained by matrices? If yes, solve it too.
- Q20. A bird at A(7, 14, 5) in space wants to reach a point P on the plane  $2x + 4y - z = 2$  when AP is least. Find the position of P and also the distance AP travelled by the bird.
- Q21. Show that a powerful bomb shot along the line of fire  $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$  will never hit a helicopter flying in the plane  $2x + 4y - 4z + 11 = 0$ .
- Q22. The contentment obtained after eating x units of new dish at a trial function is given by the function  $C(x) = x^3 + 7x^2 + 8x + 6$ . If the marginal contentment is defined as the rate of change of C(x) with respect to the number of units consumed at an instant, then find the marginal contentment when four units of dish are consumed.
- Q23. The velocity v and mass m of a rocket at time t are given by the equation:  $m \frac{dv}{dt} + V \frac{dm}{dt} = 0$ , where V is the constant velocity of emission. If the rocket starts from rest when  $t = 0$  with mass  $m_0$ , then prove that:  $v = V \log \left( \frac{m_0}{m} \right)$ . Should we encourage the rocket technology? Comment.
- Q24. A gunner who is hiding himself from the enemy is at the point G(2, 1, 3) and observes an enemy bomber flying along the plane  $3x + 6y + 2z + 10 = 0$ . What is the least distance of G from the plane?
- Q25. In XII class examination, 25 students from school A and 35 students from school B appeared. Only 20 students from each school could get through the examination. Out of them, 15 students from school A and 10 students from school B secured full marks. Write down this information in matrix form.

- Q26. A survey revealed that 70% men and 30% women eat pan-masala. 10% of these men and 20% of these women eat brand X pan-masala. What is the probability that a person seen eating brand X will be a man? Why would you discourage intake of pan-masala?
- Q27. An electric manufacturing company makes small house-hold switches. The company estimates the marginal revenue function for these switches to be  $MR = \frac{x^2}{(x+2)^2} e^x$ , where x represents the number of units (in thousand) and MR is the rate of change of revenue R w.r.t. x. What is the total revenue function? Use integrals.

❖ HINTS / ANSWERS ❖

Q01. i)  $5x + 4y + 3z = 11000, 4x + 3y + 5z = 10700, x + y + z = 2700$  (ii) -3 (iii) We prefer to reward most the value of **honesty** as it is of highest value in the character development.

Q02. **Probability Distribution:**

X	0	1	2
P(X)	87/245	120/245	38/245

Mean = 196/245.

**Importance of Non-violence in patriotism:** In order to have a peaceful environment both the values i.e., patriotism and non-violence are required. Only patriotism with the violence could be very dangerous.

Q03. Max. Z = ₹360. No. of electronic machines = 8 and no. of manually operated machines = 12. Keeping the ‘**save environment**’ factor in mind the manually operated machine should be promoted so that energy could be saved.

Q04. 2/3. If Arjun copies the answer, he will be violating the value of honesty in his character. He should not guess the answer as well as that may fetch him negative marking for a wrong guess. He should accept the question the way it is and leave it unanswered as cheating may get him marks in this exam but this habit may not let him develop integrity of character in the long run.

Q05. 3/26. **Suggestion:** Cycle should be promoted as it is good for: i. Health, ii. No pollution, iii. Saves energy (i.e., no need of petrol).

Q06. Let N = 729 be the no. of families having six children. Let probability of survival of a girl child be p = 1/3 and, that of boy be q = 2/3. Let X be the no. of girls in the family. Then X = 0, 1, 2, 3, 4, 5, 6. So, probability of 2 girls and 4 boys in the family of six is  $= P(2) = {}^6C_2 \left(\frac{1}{3}\right)^2 \left(\frac{2}{3}\right)^{6-2} = \frac{80}{243}$ . So, no. of families

having 2 girls and 4 boys in that state  $= N \times P(2) = 729 \times \frac{80}{243} = 240$ . Yes, the female child is neglected in the

backward state. **Steps to be taken to restore respect of female child:** Moral education to society to spread awareness among people and incentives for the female child (just like free education, various schemes should be organised like one run by Delhi Govt. i.e., Laadli-Yojna).

Q07.  $7A = \begin{bmatrix} 56 & 112 \\ 224 & 336 \end{bmatrix}$ . It represents the number of table fans and ceiling fans that the manufacturing units x and y produce in 7 days.

Q08. Show that  $\frac{d}{dx} I(x) > 0$  for all x.

Q09. Find  $R(x) = \int_{10}^{20} MR(x) dx \Rightarrow 1900$ .

Q10. Find S.D.  $\Rightarrow 2\sqrt{29}$  units.

Q11. 11 units

Q12. Use  $\int_3^9 MC(x) dx \Rightarrow \text{Rs.}2000$ .

Q13. **Probability Distribution:**

X	0	1	2	2
P(X)	406/988	435/988	135/988	12/988

Mean = 741/988 = 3/4.

**Importance of sports in Education:** It takes care of the mental and physical fitness of the body. It is helpful for the growth of student in the field of studies as well.

Q14. 0 Q15. Let cost of each fruit be x, y, z respectively. Then solve the equations so formed by using matrix method. So, x = 100, y = 100, z = 100. Hence the cost of each fruit is ₹100 per kg. **Importance of fruits:** Fruits contain nutrients and vitamins which help our body in its proper growth and maintenance.

**Q16.** Since both the points lie on the line of fire so, the shooter will be successful in his attempt.

**Q17.** Approximate error in volume =  $24.64\text{cm}^3$ . Loss to the buyer = (Error in volume).(Cost) = ₹24,640.

**Lesson:** A small error of 0.04cm can result in huge loss of ₹24,640. So it is needed to be careful while taking measurements.

**Q18.** Use  $MC = \frac{d}{dx} C(x) \Rightarrow dC(x) = MC dx \Rightarrow \int dC(x) = \int MC dx \Rightarrow$

$C(x) = \int MC dx \Rightarrow C(x) = \frac{4}{15}(x+5)^{3/2}(3x-10) + k$ . Use  $x = 4$ ,  $C(x) = 314.40$  to get  $k = 300$ . Hence write  $C(x)$ .

**Q19.** Let  $x$  and  $y$  be the initial investments by Mr. Priyanshu in bond A and bond B respectively.

(i)  $\begin{bmatrix} 2 & 3 \\ 8 & 11 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 80000 \\ 300000 \end{bmatrix}$  (ii)  $x = ₹10000$ ,  $y = ₹20000$ .

**Q20.** Note that point P is foot of perpendicular  $\Rightarrow P(1, 2, 8)$ . Also,  $AP = 3\sqrt{21}$  units.

**Q21.** Show that the line is parallel to the given plane.

**Q22.** Find  $MC(x) = \frac{d}{dx} C(x) = 3x^2 + 14x + 8 \Rightarrow MC(4) = 112$ .

**Q23.** Use  $m \frac{dv}{dt} + V \frac{dm}{dt} = 0 \Rightarrow \int dv + V \int \frac{dm}{m} = 0 \Rightarrow v + V \log m = C$ . It is given that when  $v = 0$ ,  $m = m_0$ .

So,  $V \log m_0 = C$ . Hence  $v = V \log \left( \frac{m_0}{m} \right)$ . We should not encourage the rocket technology as they can be used to carry nuclear weapons to destroy countries.

**Q25.** The given information is expressed in matrix:

	School	
	A	B
Appeared	25	35
Got through exam	20	20
Secured full marks	15	10

**Q27.**  $R = \left( \frac{x-2}{x+2} \right) e^x + k$ .

**Q24.** 4units.

**Q26.**  $P(M|E) = \frac{P(M)P(E|M)}{P(M)P(E|M) + P(W)P(E|W)}$ ,  
 where E: event of taking brand X.  
 $\Rightarrow = \frac{(70/100).(10/100)}{(70/100).(10/100) + (30/100).(20/100)}$

**Reason:** Intake of pan-masala could be highly injurious to health. It causes cancer. So we would discourage its intake.

☞ For any clarification(s), please contact on any of the followings.

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