

#### Case Based Question (CBQ) :

##### Case Study - 1

1. Read the following passage and answer the questions given below :



Companies are very alert regarding expenditure, profit, loss and other issues related to the company and at equal interval they keep on evaluating the performance. In one such case the profit of the company is  $p(x) = -10x^2 + 4000x + 37000$ , where  $x$  represents the number of units.

- (i) What is critical point of profit function ?
- (ii) What is maximum profit ?
- (iii) For what units, profit function is increasing ?

OR

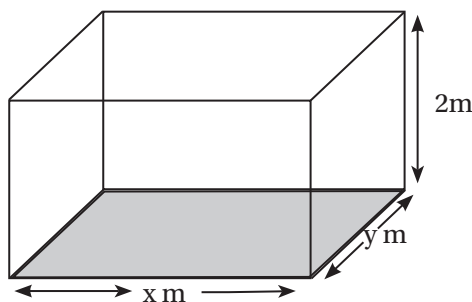
- (iii) What is marginal profit when  $x = 75$  ?

##### Case Study - 2

2. Read the following passage and answer the questions given below :

The village panchayat decided to build an open rectangular tank to store water for future needs. Depth of the tank is 2 m and volume of tank is  $8 \text{ m}^3$ .

The cost of building tank is ₹70/ $\text{m}^2$  for the base and ₹45/ $\text{m}^2$  for the sides. Taking base dimensions as  $x \text{ m}$  and  $y \text{ m}$ .



- (i) Write a relation between  $x$  and  $y$ .
- (ii) Find the cost of building tank in terms of  $x$ .

(iii) For what value of  $x$ , cost is minimum?

OR

(iii) Find the marginal cost when  $x = 3$  m.

3. Read the following passage and answer the questions given below.



During examinations a candidate has to reach examination centre and he has three options, i.e. going by bus or scooter or by car. The probability of his going by bus or scooter or by car are  $\frac{3}{10}, \frac{1}{10}, \frac{3}{5}$  respectively. The probabilities that he will be late are  $\frac{1}{4}$  and  $\frac{1}{3}$  and a if he travels by bus and scooter respectively but if he travels by car he is not late.

(i) What is the probability of reaching late if he travels by car ?

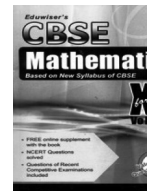
(ii) What is the probability that candidate reaches late ?

4. Read the following passage and answer the questions given below :

A student has to prepare for board examination and has choice of books published by Publishers 1 : V, Publisher 2 : X and Publisher 3 : Y. The chances of selection of books by Publisher 1, publisher 2 and publisher 3 by a student are in the ratio of 4 : 2 : 1. The probabilities that student will improve her/his performance in board exam by studying books of Publisher 1, Publisher 2 and Publisher 3 are 0.9, 0.8 and 0.6 respectively.

Based on the above information answer the following questions.

(i) What is the probability that books of publisher 1 : selected ?



(ii) What is the probability that books of publisher 3 : Y are selected and performance is improved in board?

(iii) If it is known that performance is improved in the boards, what is the probability that books of publisher 2 : X were selected ?

OR

(iii) What is the probability that student selected books of publisher 1 : V for revision given that student improved performance in boards ?

5. Read the following passage and answer the question given below.

In a 400 metre race, two athletes Milkha Singh and Otis David are running on the track along the lines

$\vec{r} = 3\hat{i} + 2\hat{j} - 4\hat{k} + \lambda(\hat{i} + 2\hat{j} + 2\hat{k})$  and  $\vec{r} = 5\hat{j} - 2\hat{j} + \mu(3\hat{i} + 2\hat{j} + 6\hat{k})$  respectively.

(i) Find the Cartesian equation of the line along which Milkha Singh is running.

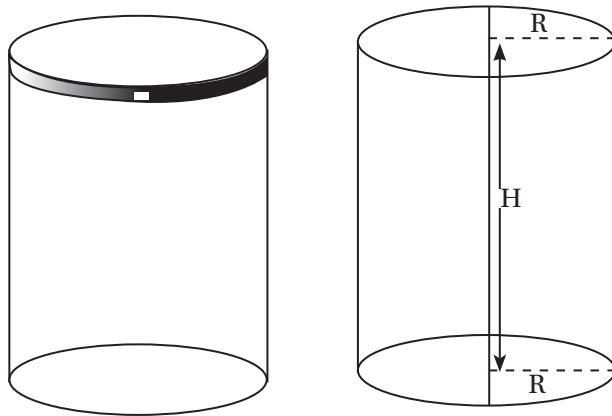
(ii) Find the direction cosines of the line along which Otis David is running.

(iii) Find the point of intersection, where both Milkha Singh and Otis David meet together.

OR

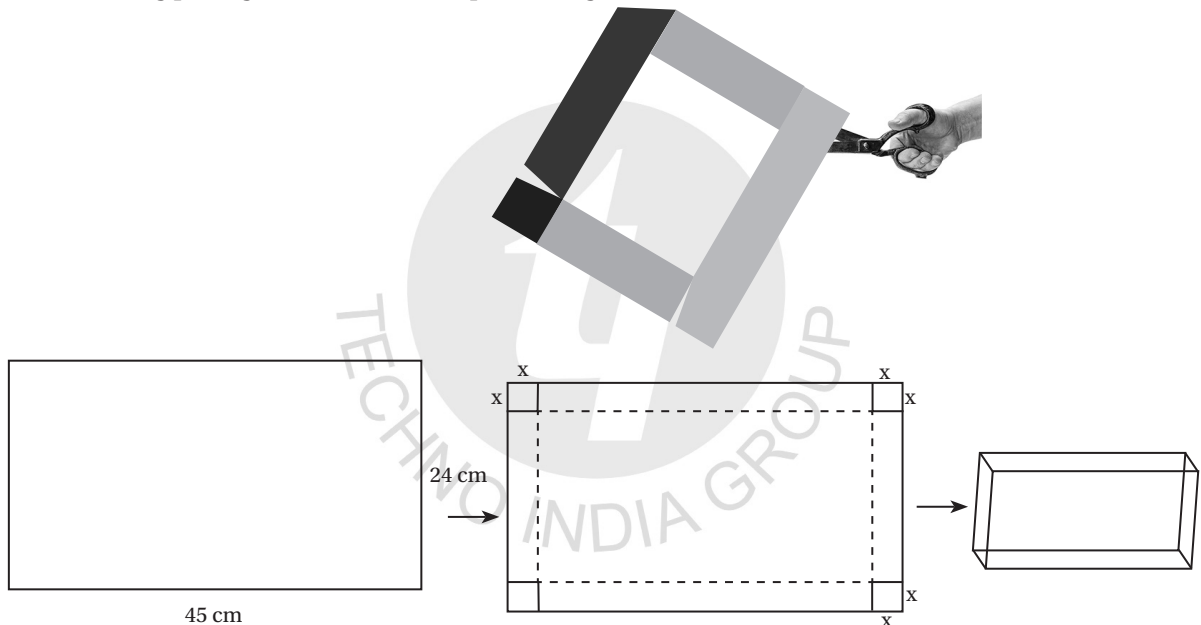
(iii) Find the shortest distance between Milkha Singh and Otis David.

6. Read the following passage and answer the questions given below.



XYZ Ltd. wants to manufacture right circular cylindrical dustbin with height  $H$  and radius  $R$  which is open at the top and has given surface area.

- Find the surface area of dustbin in terms of radius at critical point where its volume is maximum.
  - Find the relationship between height and radius of the dustbin, when the volume is maximum.
7. Read the following passage and answer the questions given below :



Three friends A, B and C are given a rectangular sheet of sides 45 cm and 24 cm. they are asked to work independently and form an open box by cutting the squares of equal length from all the four corners as shown and folding up the flaps. They want to check the volume of boxes so formed.

- If a square of side  $x$  cm is cut from all corners, then find length, breadth and height of box in terms of  $x$ .
- Find the volume of the box in terms of  $x$ .
- Find the value of  $x$  for which volume is maximum.

OR

- Find the maximum volume of the box.

8. Read the following passage and answer the questions given below.

These days competitive examinations are online, a student has to go to a particular place to give the examination at the given time. For this, examination centres have to make perfect arrangements and students are expected to be well prepared. But as a human nature sometimes a student guesses or copies or knows the answer to a

multiple choice question with four choices each.

The probability that a student makes a guess is  $\frac{1}{3}$  and that he copies the answer is  $\frac{1}{6}$ . The probability that his answer is correct, given he copied it, is  $\frac{1}{8}$ .

- (i) What is the probability that he knows the answer?
- (ii) What is the probability that his answer is correct, given that he guessed it?
- (iii) What is the conditional probability that his answer is correct, given that he knew it?

OR

- (iii) What is the probability that he copied if given that his answer is correct?

9. Read the following passage and answer the questions given below :

Suppose there are 4 men, 4 women and 4 children in family A and 2 men, 2 women and 2 children in family B. The recommended daily amount of calories is 2400 for a man, 1900 for a woman, 1800 for a child and 45 grams of proteins for a man, 55 grams for a woman and 33 grams for a child.

- (i) Find the requirement of calories and proteins for each of the two families in matrix form.
  - (ii) If the number of children in family A becomes 8, then using matrices find requirement of calories of family A.
10. Sherlin and Danju are playing Ludo at home during Covid-19. While rolling the dice, Sherlin's sister Raji observed and noted that possible outcomes of the throw every time belongs to set  $\{1, 2, 3, 4, 5, 6\}$ . Let A be the set of players while B be the set of all possible outcomes.



$A = \{S, D\}$ ,  $B = \{1, 2, 3, 4, 5, 6\}$

- (i) Let  $R : B \rightarrow B$  be defined by  $R = \{(x, y) : y \text{ is divisible by } x\}$ . Show that relation R is reflexive and transitive but not symmetric.
- (ii) Let R be a relation on B defined by  $R = \{(1, 2), (2, 2), (1, 3), (3, 4), (3, 1), (4, 3), (5, 5)\}$ . Then check whether R is an equivalence relation.
- (iii) (a) Raji wants to know the number of functions from A to B. How many number of functions are possible ?

OR

- (iii) (b) Raji wants to know the number of relations possible from A to B. How many numbers of relations are possible ?

11.  $P(x) = -5x^2 + 125x + 37500$  is the total profit function of a company, where x is the production of the company.



Now answer the following :

- (i) What will be the production when the profit is maximum ?
- (ii) What will be the maximum profit?
- (iii) (a) When the production is 2 units what will be the profit of the company ?

OR

- (iii) (b) What will be production of the company when the profit is ₹ 8250 ?

**12.** A building contractor undertakes a job to construct 4 flats on a plot along with parking area. Due to strike the probability of many construction workers not being present for the job is 0.65. The probability that many are not present and still the work gets completed on time is 0.35. The probability that work will be completed on time when all workers are present is 0.80.

Let :  $E_1$  represent the event when many workers were not present for the job;

Let :  $E_2$  represent the event when all workers were present ; and

Let :  $E$  represent completing the construction work on time.

Based on the above information, answer the following questions :

- (i) What is the probability that construction will be completed on time?
- (ii) What is the probability that many workers are not present given that the construction work is completed on time ?



**Section - A**

1. (i)  $x = 200$   
(ii) 4,37,000  
(iii)  $x < 200$   
or (iii) 2500
2. (i)  $x \times y = 4$   
(ii) ₹280 + 180  $\left(x + \frac{4}{x}\right)$   
(iii) ₹1000  
or (iii) ₹100
3. (i)  $P(E|C) = 0$   
(ii)  $P(E) = \frac{13}{120}$
4. (i)  $\frac{4}{7}$   
(ii) 0.6  
(iii)  $\frac{8}{29}$   
or (iii)  $\frac{18}{29}$
5. (i)  $\frac{x-3}{1} = \frac{y-2}{2} = \frac{z+4}{2}$   
(ii)  $\left\langle \frac{3}{7}, \frac{2}{7}, \frac{6}{7} \right\rangle$   
(iii) 0
6. (i)  $3\pi R^2$   
(ii)  $H = R$
7. (i)  $n = x \text{ cm}$   
(ii)  $v = (45 - 2x)(24 - 2x)x \text{ cm}^3$   
(iii)  $x = 5$   
or (iii)  $2450 \text{ cm}^3$
8. (i)  $\frac{1}{2}$   
(ii)  $\frac{1}{4}$   
(iii) 1  
or (iii)  $\frac{1}{29}$
9. (i)  $\begin{pmatrix} A \\ B \end{pmatrix} = \begin{pmatrix} 24400 & 532 \\ 12200 & 266 \end{pmatrix}$   
(ii)  $A \rightarrow 31600$ .



**10.**

(ii) 'R' is not an equivalence relation.

(iii)  $6^2$

or (iii)  $2^{12}$

**11.** (i) 12.5 units

(ii) 38281.25

(iii) 37730

or (iii) 90 units

**12.** (i) 0.51

(ii) 0.45

