

## OPEN BOOK TEST, CLASS IX (MATHEMATICS)

### OPEN TEXT MATERIAL

#### 1. Theme - *Planning a Garden*

##### Abstract:

*You must have noticed that the gardens are prepared by proper planning. This involves many mathematical concepts like coordinate geometry, linear equations, perimeter, area and volume. Here we have tried to plan a garden which will not only have applications from mathematics but will inculcate value addition amongst students.*

ECO CLUB members in a school observed that a land area of 70 x 70 square feet in their school is a wasteland. They planned to develop it as a Herbal Garden and a central attraction point of school to convey the message “Go green, go healthy.”

They shared their thought with ECO Club teacher incharge Mrs. Singh. She appreciated the students’ idea and said that to take over this project we need to plan. Let’s first list out the work needed to be done and then we will form small groups to work in each area as per the expertise and interest of each student. Mrs. Singh divided the students into six groups and suggested that all the groups will start working simultaneously. Responsibilities were assigned as per the following chart:

<b>Team</b>	<b>Team leader</b>	<b>Responsibility assigned</b>
A	Anuj	Preparing layout of garden Designing and landscaping of the garden
B	Bindu	Budgeting
C	Chetna	Checking the suitability of condition for growth of Plants like soil, sunlight, availability of water, fertilizer
D	Dilip	Selection of appropriate plants
E	Esha	Tools required for planting and maintaining the garden

## **Work of Team A**

Anuj and his team members took the measurements and found that ground of 70 x 70 square feet is occupied by four identical rooms of dimension 21 x 14 square feet on the four corners. Ground available appears as follows:

14 ft

21ft.

70 ft

70 ft

Anuj first prepared the layout on a grid. He drew the following plan taking the scale as:

Length of 1 square =3.5.feet.

Symbols are used to represent the following items:

Foot path

Sprinkler

Pots

## **Work of Team B**

Bindu and her team members prepared the list of items for which the money was required. She got the price list of all the items.

### **Item Prices**

Plants Rs.30/- per plant

Soil Rs.3000/- for 300 cubic ft. 150 cubic ft. of soil would be enough to cover an area of 1000 square ft.

Pesticide Rs. 450/-per litre

Compost Fertilizer Rs.1600/- for 150 cubic ft.,Rs. 18000/- per ton

Boat shaped Pots of size 6" x 18"for plants in boundary Rs. 250/-  
each

Sprinkler Rs. 1500/-

Cost of tiling

Width of path =4 feet

Rs.10/- per tile of 6" x 6"

Labour & other material Rs.20/- per square feet

### **Work of Team C**

Chetna and her team members consulted their biology and geography teachers and also looked up books in the library for information. They found that:

#### **1. Climatic condition**

Minimum four hours of sunlight is a must for healthy growth of plants.

#### **2. Planting Herbs**

Planting herbs according to their height ensures that all plants get the right amount of sunlight.

Here is list of herbs according to their plant height. For example:

3-4feet - Rosemary, Sage, Mint, Oregano, Marjoram

2 feet - Basils, Thyme, Tarragon,

1 foot - Cilantro, Chives, Dill, Parsley

#### **3. Preparation of the Soil**

Garden must be prepared with at least 5 inches of garden soil and 2 inches of fertilizer in depth. Composted manure works well as a fertilizer for supporting healthy herb growth.

Adding compost to soil, about an inch or so on top and then mixing it into the soil, helps prevent drainage problems and adds fertilizer to the garden.

### **Work of Team D**

Dilip and his team members prepared the list of 25 Herbs suitable for the location.

### **Work of Team E**

While planning for the tools required for plantation and maintenance of garden Esha found that all tools were available with school gardener, but a sprinkling system was required to water the plants.

As a final step every one took a pledge to plant, water at care for the herbs they planted in the garden and to educate their school mates about medicinal value of each herb.

### Sample Questions

Q1. a) Determine the area of ground available for gardening.  
(3marks)

b) How much soil is required to cover the whole ground? (2marks)

Q2. a) How many pots will be required to cover the boundary?  
(2marks)

b) What is the cost of tiling the path? (3marks)

### Marking Scheme

#### Question 1:

a) Total area of available ground = Area of a wasteland – Area of 4 rooms (1 mark)

$$= 702 - 4 \times 21 \times 144$$

$$= 3724 \text{ sq. feet (1 mark)}$$

$$= 3724 \times .3048 \times .3048$$

$$= 345.97 \text{ sq. metre (1 mark)}$$

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b) Volume of soil required = Area of available ground x depth of soil required (1 mark)

$$= 3724 \times \text{cubic feet}$$

$$= 1551.67 \text{ cubic feet (1 mark)}$$

#### Question 2:

a) Length along horizontal axis = 42 feet

Length of each pot = 18"

No. of pots can be placed along horizontal axis =  $2 \times 42 \times$

$$= 56 \text{ pots (1 mark)}$$

Length along vertical axis = 28 feet

Length of each pot = 18"

No. of pots can be placed along vertical axis =  $28 \times 28 \div 18 + 18 \div 18 =$

$$36 \text{ pots (}\frac{1}{2}\text{ mark)}$$

Total Pots required = 92 (½ mark)

b) Cost of tiling the path

Area of Tiling =  $4 \times 10.5 \times 4$  feet<sup>2</sup>

= 168 sq. feet (1 mark)

No. of tiles required =  $168 \times 4 = 672$

Cost of tiling @ Rs 10 per square feet =  $672 \times 10 = \text{Rs. } 6720$  (1 mark)

Cost of labour @ of Rs 20 sq. feet =  $168 \times 20 = \text{Rs. } 3360$

Total cost = Rs. 10,080 (1 mark)

**The following additional questions are prepared:**

**Q1. Determine the cost of land available for gardening @Rs.100 per m<sup>2</sup>.**

**Ans: Total cost of land = area of land x price per unit  
=  $345.97 \times 1000 = \text{Rs. } 34597$  (1 mark)**

**Q2. Determine the cost of soil required to cover the whole ground @ 20 per m<sup>3</sup>**

**Ans: Total cost of soil = volume of soil required to cover the whole ground x cost of soil per m<sup>3</sup> =  $1551.67 \times 20 = \text{Rs. } 31033.4$  (1 mark)**

**Q3. Determine the total cost of 92 pots?**

**Ans: Total cost of 92 pots =  $92 \times \text{price per pot} = 92 \times \text{Rs. } 250 = \text{Rs. } 2300$  (1 mark)**

**Q4. Determine the total cost of 92 plants ?**

**Ans: Total cost of 92 plants =  $92 \times \text{price per plant} = 92 \times \text{Rs. } 30 = \text{Rs. } 2760$  (1 mark)**

**Q5. Find the cost of fertilizer required for the garden? (2 marks)**

**Ans: Volume of fertilizer = area of ground available for gardening x depth of fertilizer =  $3724 \text{ sq. feet} \times \frac{2}{12} \text{ feet}$**

= 6206.6 cubic feet. (1 mark)

Cost of fertilizer required for the garden =  
Volume of fertilizer x unit price =  $6206.6 \times 1600/150$   
=Rs.6620.4 (1 mark)

Q6.Find the cost of all the 13 sprinklers used in the garden?

Ans: cost of sprinklers = No. of splinkers x cost of each  
sprinkler =  $Rs.13 \times 1500 = Rs.19,500$  (1 mark)

Q7.If the length of each path is 20 feet ,find the area of all the four paths?

Ans: area of all the four paths =  $4 \times \text{length} \times \text{breadth}$   
=  $4 \times 20 \times 4 \text{ sq.feet} = 320 \text{ sq.feet}$  (1mark)

Q8.Find the cost of plastering the floor of the rooms @ Rs. 15 per sq.feet ?

Ans: area of the floor of each room= length x breadth  
=  $21 \text{ ft} \times 14 \text{ ft} = 294 \text{ sq.feet}$  . (1 mark)  
Total cost of plastering =  $Rs.294 \times 4 \times 15 = Rs.17640$ . (1mark)

Q9.If 10 litres of pesticide is required per month to protect the plants ,find the cost of pesticide used per month?

Ans: cost of pesticide used per month= quantity x unit price  
=  $10 \text{ litres} \times 450 = Rs.4500$ . (1 mark)

Q10.If the rooms at each corner of the garden are 7 ft high, find the total cost of white washing the walls of the rooms at the rate of Rs. 10 per sq.feet ? (2 marks)

**Ans: Area of four walls of each room =  $2(lb + bh + lh)$**

**=  $2(14 \times 21 + 21 \times 7 + 14 \times 7)$ sq feet = 1078 sq feet (1 mark)**

**Cost of whitewashing = Rs.1078 x 4 x 10 =Rs.43120 (1 mark)**

**Q10.If the shape of the land available for the garden were circular, what would have been its circumference? (2 marks)**

**Ans:  $\pi r^2 = 3724$  sq.feet. so,  $r = \sqrt{(3724 \times 7) / 22}$  feet = 10.15 feet. (1 mark)**

**Circumference =  $2 \pi r = 2 \times 3.14 \times 10.15$  feet = 63.74 feet. (1 mark)**

## **OPEN TEXT MATERIAL**

### **2. Theme – Adventure Camp**

#### **Abstract:**

*Adventure Camps are the perfect place for children to practice decision making for themselves without parents and teachers guiding their every move. Managing their daily choices in the safe and caring environment of a camp, gives children the opportunity to blossom in dimensions unknown. Coming to a camp means joining a close-knit community where everyone must agree to cooperate and respect each other. They live in harmony with others. They share chores, resolve disagreements, and experience*

*effective communication. Knowingly or unknowingly they develop their analytical skills. The present study attempts to apply the knowledge of statistical techniques, volumes and surface areas to resolve the situations faced by students.*

It was a bright sunny morning when Akash stood in his school's assembly ground, thinking about the adventures he would have in Mukteshwar. Yes, they were going to the much awaited Adventure

Camp!

They would live in tents, trek in the forest, spot some flora and fauna, climb the rocks, observe the valleys, perhaps make their own food and what not. Akash just could not stop gushing.

“Hurry up boys, fall in line” said the Principal. The Principal, Dr. Sharma was a man of beliefs and ideals. Taking students out for camps and observing them in the vicinity of nature was his mode of working and re - enforcing appreciation for natural environment among them.

Within no time the teachers and all the students gathered in the ground. Dr. Sharma continued,

“You are representing your school in this Adventure Camp. So, *behave, act and perform well*. Be disciplined and do not harm the nature. I hope you would not let us down. Well, you would go to Mukteshwar by bus. Now, stand in order and move towards your buses.”

The students stood in lines – class and section wise. There were exactly 10 students per section.

The students lined up as follows.

**IX - A IX - B IX - C IX - D IX - E IX - F**

1	11	21	31	41	51
2	12	22	32	42	52
3	13	23	33	43	53
4	14	24	34	44	54
5	15	25	35	45	55
6	16	26	36	46	56
7	17	27	37	47	57
8	18	28	38	48	58
9	19	29	39	49	59



10    20    30    40    50    60

10 teachers, including Dr. Sharma, were to accompany the students. All moved outside to board the buses.

Mrs. Saxena, the coordinating teacher exclaimed, “We have got only 4 mini buses; how do I adjust the students?”

Mr. Singh, the sports teacher, came forward and said, “Ma’am, I can see we have 4 buses in which 3 buses are 15 seater and 1 bus is 25 seater. That makes it

$$15 \times 3 + 25 \times 1$$

$$= 45 + 25$$

$$= 70 \text{ seats.}$$

So, that should be enough.” Mrs. Saxena explained, “But Mr. Singh, we need to adjust the students with least disturbance. The criteria is that each bus should have **atleast**

1. two teachers; and
2. two students of the same section.”

**Suddenly, Dhruv, a student of IX – C, came up with a plan.**

Mrs. Saxena followed the plan and all were happily adjusted. They all set off for the journey and reached Mukteshwar. It was a place brimming with positivity and the scenic beauty was breath – taking. At the camp, the waiters served each student with a welcome drink in a cylindrical glass with the following dimensions:

The drink was two – thirds of the glass. Observing this, the teacher complained to the manager,

“Sir, my students have travelled from a far off place. The least they deserve is a full glass of the welcome drink.”

The manager gently complied but realized that the pantry had only a limited supply of the drink.

Quite cleverly, he ordered the waiters to serve the drink in hemispherical cups. The cups looked like the figure shown below.

**The students looked satisfied, but, Shivam of IX–D sensed the cleverness of the manager and reported it to his teacher.** The teacher listened to him patiently but asked him to let go of the matter.

Soon the rooms were allotted and they all met in the Conference Hall. After an hour, they were greeted by Brigadier Tripathi and his team of 50 members who would guide the students and teachers in their camping activities. The students were divided into groups and it was not a difficult task. Within half an hour, the groups reached the camping site, where they would take part in the adventure activities.

The jungle trek was enjoyable but tiring. As dusk fell, it was time to take shelter. But, where was the house? A house in a jungle? Brigadier Tripathi soon came up with a plan.

Each group of four students was given a canvass of area **551 m<sup>2</sup>**. Each group had to make a conical tent to accommodate all the four students. Assuming that all the stitching and wasting incurred while cutting, would amount to **1 m<sup>2</sup>**, the students tried many combinations. Finally, Riya, a student of IX – A came up with a plan. She took the radius of the tent to be 7 m.

$$d = 7 \text{ cm}$$

$$h = 10.5 \text{ cm}$$

$$d = 7 \text{ cm}$$

The tent was put up. They all laid down. **Suddenly, Swati exclaimed, "The volume of air in the tent seems to be 1200 m<sup>3</sup>."** Riya said, **"No, it is not."**

At night, the students sat around the bonfire and presented group plays. With ample security around, the students and teachers all were comfortable and excited to spend the night amidst natural surroundings. At first light, the students were served breakfast and soon they were all raring to go for a rock

climbing competition. The group would be declared a winner only if all members would successfully climb the rock. But, the task seemed too difficult. Almost everybody looked surprised.

Many students backed out. **Soon, Sarah came up with a plan.** She took out her pen and paper and set out for something unknown to her friends. After about half an hour, she came back, smiling.” Why are you smiling Sarah? And where were you?” asked Rashi. **“Oh, I had gone for a survey. Just wait and watch.”** With a smile, Sarah asked her group members to gather near her. She whispered something into their ears and showed them her paper. She had asked all the people working with Brig. Tripathi about their performance and success rate in climbing the given rock in their past. Some were successful in the first attempt, while some took more attempts; there were a few who had not tried rock climbing at all. However, they all wanted to try it. The paper had the following table and the following bar graph.

**No. of attempts      No of people**

1st attempt	10
2 attempts	20
more than 2 attempts	15
did not attempt at all	5
<b>Total</b>	<b>50</b>

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Within no time, the group was ready to climb the rock. They all walked with energy and finally Sarah’s group managed to win. Brigadier Tripathi asked Sarah about the little talk that she had with her group before the activity. Sarah, the clever girl said that she would tell him on the last day. The days passed with village walks, visit to organic farms, bird watching and river crossing. There were some in-house activities as well. Finally the departure time arrived. But, all this while, Dr. Sharma was eager to know the answers to some of his questions. He had never thought that class IX students would come up with such quick and effective solution

in critical times. He was getting eager and eager. However, when he got the answers, he realized that he was perhaps, under-estimating his students.

They had used such critical situations to bring out their innate qualities. Who knew that this adventure camp would actually bring out the leaders and the critical thinkers in his students? Now, referring to the instances and situations listed above, answer the following questions using the mathematical knowledge:

### Sample Questions

Q1. a) What is the ratio of volume of cylindrical cup to hemispherical cup? (2 marks)

b) How much juice was offered to the students in the cylindrical cup? (1 mark)

c) Had the hotel manager increased the quantity of the juice? (2 mark)

Q2. a) What is the height of the conical tent prepared to accommodate 4 students? (3 marks)

b) How much space is occupied by each student in the conical tent? (2 marks)

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### Marking Scheme

#### Question 1:

A) Volume of cylindrical cup =  $\pi (3.5)^2 (10.5) = 404.25\text{cm}^3$

Volume of hemispherical cup =  $\pi (3.5)^3 = 134.75 \text{ cm}^3$

Volume of cylindrical cup: volume of hemispherical cup = 9:2 (2 marks)

B) Earlier the juice was offered as two-third of the glass, so the quantity of juice offered is =

$(404.25) = 269.5 \text{ cm}^3$  (1 mark)

C) Juice offered in hemispherical cup =  $134.75 \text{ cm}^3$

Hotel manager has reduced the quantity of juice after complaint by changing the shape of cup. (2 marks)

## Question 2:

a) Area of canvass provided = 551 m<sup>2</sup>

Area remained after wastage = 551 - 1 = 550 m<sup>2</sup> (½ mark)

Area of conical tent =  $\pi r l$  (½ mark)

Here,  $r = 7\text{m}$

So  $l = 25\text{m}$  (1 mark)

So,  $h = \sqrt{(l^2 - r^2)}$

So,  $h = 14\text{m}$  (1 mark)

b) Volume of tent =  $\frac{1}{3} \pi r^2 h = 718.66 \text{ m}^3$  (1 mark)

**The following additional questions are prepared:**

**Q1. What percent of students succeeded in rock climbing? (2 marks)**

**Ans: No. of students succeeded = 10 + 20 + 15 = 45 (1 mark)**

**Required percentage =  $(45/50) \times 100 = 90\%$  (1 mark)**

**Q2. What is the difference of quantity of juice offered in both the cups? (3 marks)**

**Ans: Quantity of juice offered in cylindrical cup =  $\pi r^2 h$**

$$= \pi (3.5)^2 (10.5) = 404.25 \text{ cm}^3 \quad (1 \text{ mark})$$

**Quantity of juice offered in hemispherical cup =  $\frac{2}{3} \pi (r)^3$**

$$= \frac{2}{3} \pi (3.5)^3 = 89.75 \text{ cm}^3 \quad (1 \text{ mark})$$

**Difference in the quantity of juice =  $404.25 \text{ cm}^3 - 89.75 \text{ cm}^3$**

$$= 314.5 \text{ cm}^3 \quad (1 \text{ mark})$$

**Q3. If instead of the conical tent, the students were made cylindrical tents of the same base & same height, what would have been the ratio of their volumes ?**

**Ans: Volume of cone : volume of cylinder = 1:3 (1 mark )**

**Q4.What is the difference in volume proposed by Riya & the actual volume of the conical tent? (2 marks )**

**Ans: Actual volume of the tent =  $(\frac{1}{3}) \pi r^2 h = 718.66 \text{ m}^3$  (1 mark )**

**Volume proposed by Riya =  $1200 \text{ m}^3$  (1/2 marks)**

**Difference in volume =  $1200 \text{ m}^3 - 718.66 \text{ m}^3 = 481.34 \text{ m}^3$  (1/2 marks)**

**Q5.What is the total accommodation capacity of the four buses hired for the tour & how many seats remained vacant after all members were accommodated? (2 marks )**

**Ans: Total accommodation capacity =  $15 \times 3 + 25 \times 1 = 70$  (1 mark )**

**Total no. of students & staff members =  $60 + 10 = 70$  (1/2 mark )**

**No. of seats left vacant =  $70 - 70 = 0$  (1/2 mark )**

**Q6.If the radius of a sphere is doubled , what will happen to its**

**(i) surface area (ii) volume (2 marks )**

**Ans(i) New surface area =  $4\pi(2r)^2 = 4 \times 4\pi r^2 = 4$  times the original surface area of the sphere (1 mark )**

**Ans(ii) New volume =  $(\frac{4}{3}) \pi(2r)^3 = 8 \times (\frac{4}{3}) \pi r^3 = 8$  times the original volume of the sphere (1 mark )**