Projects

Project work in mathematics may be performed individually by a student or jointly by a group of students. These projects may be in the form of construction such as curve sketching or drawing of graphs, etc. It may offer a discussion of a topic from history of mathematics involving the historical development of particular subject in mathematics/ topics on concepts. Students may be allowed to select the topics of their own choice for projects in mathematics. The teacher may act as a facilitator by creating interest in various topics. Once the topic has been selected, the student should read as much about the topic as is available and finally prepare the project.

Project 1

To minimise the cost of the food, meeting the dietary requirements of the staple food of the adolescent students of your school.

Task to be done

(i) Make a survey of atleast 100 students to find which staple food they consume on daily basis.

(ii) Select two food items constituting one cereal and one pulse.

(iii) Find from dietician the minimum requirement of protein and carbohydrate for an adolescent and also find the content of protein and carbohydrate in 1 kg. of selected cereal and pulse respectively.

(iv) Find the minimum cost of the selected cereal and pulse from market.

(v) Formulate the corresponding Linear Programming problem.

(vi) Solve the problem graphically.

(vii) Interpret the result.

Project 2

Estimation of the population of a particular region/country under the assumptions that there is no migration in or out of the existing population in a particular year.

Task to be done

1. Find the population of a selected region in a particular year.
2. Find the number of births and number of deaths in the existing population in a particular year t (say). Let

   P(t): denote the population in a particular year t

   B(t): denote the number of births in one year between t and $t + 1$.

   D(t): denote the number of deaths in one year between t and $t + 1$.
3. Obtain the relation

   $$P(t+1) = P(t) + B(t) - D(t) \qquad (1)$$
4. Assume that

   $b = \dfrac{B(t)}{P(t)}$ represents the birth rate for the time interval t to $t + 1$.

   $d = \dfrac{D(t)}{P(t)}$ represents death rate for the time interval t to $t + 1$.
5. From (1), we have

   $$P(t+1) = P(t) + B(t) - D(t)$$

   $$= P(t)\left[1 + \frac{B(t)}{P(t)} - \frac{D(t)}{P(t)}\right]$$

   $$= P(t)(1 + b - d) \qquad (2)$$

6. Taking $t = 0$ in equation (2), we get

$$P(1) = P(0)(1 + b - d).$$

For $t = 1$, we get

$$P(2) = P(0)(1 + b - d)^2.$$

Continuing above equation, we get

$$P(t) = P(0)(1 + b - d)^t \qquad (3)$$

Here, it is assumed that birth rate and death rate remains the same for consecutive years. P(0) denote the initial population. Equation (3) gives the mathematical model for calculation the population in t year.

7. Using calculator find the population in different number of years.

8. Compare the population data obtained theoretically and draw the inferences.

Project 3

Finding the coordinates of different points identified in your classroom using the concepts of three dimensional geometry and also find the distances between the identified points.

Tasks to be done

1. Choose any corner of your classroom as the origin.
2. Take three perpendicular edges of walls as x–, y– and z-axes.
3. Find the coordinates of each corner of the room, corners of windows, doors and blackboard etc.
4. Find the coordinate of the tips of ceiling fan, bulbs and all other possible points in the space of the classroom.
5. Find the distances between different points by measurement as well as by using distance formula.
6. Find the coordinates of the diagonals of the room and length of the diagonals by distance formula.

Project 4

Formation of differential equation to explain the process of cooling of boiled water to a given room temperature.

Task to be done

1. Boil 1 litre of water in a pan/beaker.
2. Note the room temperature and the temperature of the boiled water.
3. Note the temperature at an interval of every half hour till the temperature of the water reaches the room temperature. Prepare a corresponding table as shown below:

Time (t) at an interval of $\frac{1}{2}$ hour	Temperature of water (T)	Room Temperature (P)	Difference T – P

4. Let T denote the temperature of the boiled water at time t. P denote the room temperature under the assumption it remains constant throughout the experiment.

$$\frac{dT}{dt} \alpha\ T - P.$$

or $\frac{dT}{dt} = -k\,(T - P)$, k is proportionality constant and minus sign signifier that temperature is decreasing.

or $\frac{dT}{T - P} = -kdt$. Integrating, we have

$$\log |T - P| = -kt + C \qquad (1)$$

5. Find the value of C and k by using two initial values of T and t from the observation table to get the particular solution of the differential equation (1).

List of Projects

1. Project on history of Mathematicians: It may include history of Indian mathematicians such as Aryabhata, Brahmgupta, Varahamihir, Sridhara, Bhaskaracharya, Ramanujan etc., and history of foreign mathematicians such as Cantor, Pythagoras, Thales, Euclid, Appollonius, Descartes, Fermat, Leibnitz, Euler, Fibonac, Gauss, Newton, etc.
2. On linear Programming problems related to day-to-day life like collecting data from families of their expenditures and requirements from the factories to maximum out put.
3. Collect data from dieticians, transporters, agents and formulate linear programming problems.
4. Make a chart of the formulae of applications of calculus.
5. Applications of conic sections, vectors, three dimensional geometry, calculus, etc., in Mathematics and Physics.
6. Mathematics and Chemistry: Study structure of organic compounds.
7. Mathematics and Biology: Study of science of heredity etc.
8. Mathematics and Music
9. Mathematics and Environment
10. Mathematics and Arts: Construction of shapes using curves
11. Mathematics and Information and Communication Technology: Writing of Mathematical programmes, flow charts, algorithm, circuit diagrams etc.
12. Collection of statistical data and analysing it for standard deviation and mean deviation.
13. Observe the various patterns and properties in Pascal's triangle and make a project.

14. Prepare a project based on the Fibonacci sequence, their properties and similar pattern found in nature.

15. Form a differential equation for the growth of bacteria in different environments.

16. Study the nature of mathematics and make a project showing where three aspects of nature of mathematics - formalism, logic, intuition is applied in the development of mathematics.

Scheme of Evaluation

The following weightage are assigned for evaluation at Higher Secondary Stage in mathematics:

Theory Examination	:	80 marks
Internal Assessment	:	20 marks

l. Internal assessment of 20 marks, based on school based examination will have following break-up:

Year-end assessment of activities	:	12 marks
Assessment of Project Work	:	5 marks
Viva-voice	:	3 marks

- **Assessment of Activity Work**
  (a) Every student will be asked to perform two given activities during the allotted time.
  (b) The assessment may be carried out by a team of two mathematics teachers, including the teacher who is taking practical classes.
  (c) The break-up of 12 marks for assessment for a single activity may be as under:

• Statement of objective of the activity	:	1 mark
• Material required	:	1 mark
• Preparation for the activity	:	3 marks
• Conduct of the activity	:	3 marks
• Observation and analysis	:	3 marks
• Results and Conclusion	:	1 mark
Total	**:**	**12 marks**

  (d) The marks for two activities may be added first and then marks calculated out of 12.
  (e) Full record of activities may be kept by each student.

- **Evaluation of Project Work**
  (a) Every student will be asked to do at least one project based on the concepts learnt in the classroom.
  (b) The project may be carried out individually (or in a group of two or three students).
  (c) The weightage of 5 marks for the project may be as under :

• Identification and statement of the project	:	1 mark
• Planning the project	:	1 mark
• Procedure adopted	:	1 mark
• Observations from data collected	:	1 mark
• Interpretation and application of result	:	1 mark

Total Score out of 20 : The marks obtained in year-end assessment of activities and project work be added to the marks in viva-voice to get the total score out of 20.

Note : Every student should be asked to perform at least twenty activities in one academic year.

Set-up of Mathematics Laboratory