PREPARATION OF COMPUTER ASSISTED REMEDIAL MATERIALS IN MATHEMATICS FOR TENTH STANDARD STUDENTS

Dr. Jibby George

Associate Professor

Peet Memorial Training College

Mavelikara

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CERTIFICATE

I, Dr. jibby George do hereby declare that this project entitled **Preparation of Computer Assisted Remedial Materials in Mathematics for Tenth Standard Students** has not been submitted by me for the award of a Degree, Diploma, Title, or Recognition before.

Mavelikara

15.03.2013 **Dr. Jibby George**

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Dr. Jibby George

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INTRODUCTION

Mathematics is one of the fastest growing and radically changing of all branches of learning. It is the oldest organised discipline of human knowledge with a continuous line of development spanning 5000 years and every major culture. Mathematics has numerous practical applications ranging from everyday household usage to the charting of astronauts through outer space. Without mathematical knowledge and skill there can be no complete knowledge of sciences and thus no scientific and technical advancement. Moreover all subjects utilises mathematics in one way or another.

It is an abstract science which investigates inductively and deductively the conclusions implied in the elementary conception of spatial and numerical relation. It has been considered as the science of logical thinking and reasoning. The **National Policy on Education (**1986) has pointed out that *Mathematics should be visualized as a vehicle to train a child to think, reason, analyse and articulate logically*. Mathematics is the fundamental subject which inculcates scientific curiosity, spirit, skill and attitude of mind. Intuition and construction are the deriving forces of mathematics. Through the study of mathematics, intellectual powers like concentration, precision, exactness, patience, sense of achievement, power of imagination, memorization inventions and creativity will develop.

Without a sound knowledge of mathematics every society will remain undeveloped. Considering the practical, disciplinary and cultural values and the key role played by mathematics in the modern world, the **Education Commission** (1966) recommended that, *mathematics should be taught on a compulsory basis to* *all pupils during the first ten years of schooling*. Hence it is included as a compulsory subject in the school curriculum.

NEED AND SIGNIFICANCE OF THE STUDY

Mathematics under the traditional set up was a major area of difficulty for most of the school students in Kerala state. Though the school mathematics curriculum has been revised to keep abreast with the needs of the modern world, even now it is a nightmare for students. Since tenth standard is the turning point in the academic life of every student and the future deciding phase, the backwardness in mathematics will lag the child behind in all other disciplines especially science. Success in science depends to a great extent on the success in mathematics. Hence immediate attention and remediation is needed for tenth standard students who are weak in mathematics.

Remediation in mathematics should be planned in accordance with the abilities and interest of students. Computer Assisted Instruction (CAI) is one of the innovative strategies that can be effectively used for remediation in mathematics. Using CAI one can learn at his own pace, receive immediate personalized feedback and freely choose the content, sequencing, and degree of difficulty of instruction. It provides immediate feedback, it may be programmed to handle specific student errors in certain ways and as a teacher the computer has unlimited patience. Hence remediation in mathematics for tenth standard students can be done using computers.

Computers are widely used for the remediation purpose in foreign countries but no such efforts are commonly made in our country. So software useful for such purpose is not available in India on demand. Since computer assisted remediation software based on the tenth standard mathematics syllabus of Kerala state is not readily available in the market or with the education department it has to be prepared carefully by analyzing the nature of difficulties encountered by the students while learning it. Taking into consideration, the non availability of

appropriate software for the remediation in mathematics the investigator has decided to prepare and standardize computer assisted remedial materials (software) in mathematics based on tenth standard syllabus. The software may help tenth standard students to learn mathematics at their own pace and remedy their difficulties in learning the subject.

STATEMENT OF THE PROBLEM

The study is entitled as ***PREPARATION OF COMPUTER ASSISTED REMEDIAL MATERIALS IN MATHEMATICS FOR TENTH STANDARD STUDENTS.***

DEFINITION OF KEY TERMS

Preparation : The act of preparing for some use or purpose.

Computer assisted remedial materials in mathematics refers to a computer software in mathematics specially prepared for remedying the learning difficulties of students.

Tenth standard refers to the upper class in the secondary school level comprising Standard VIII to X.

OBJECTIVES OF THE STUDY

The major objectives of the study are

(i) To prepare a diagnostic test based on tenth standard mathematics syllabus followed in Kerala state

(ii) To analyze the nature of difficulties encountered and errors committed by tenth standard students in learning of mathematics using the Diagnostic test

(iii) To prepare and standardize a Computer assisted remedial software based on tenth standard mathematics syllabus followed in Kerala state

SCOPE AND LIMITATIONS

The present study is intended to find out the difficulties encountered and errors committed by tenth standard students in learning mathematics and to prepare materials for remediation. The use of the remedial material will the students to remedy their difficulties in learning mathematics and become successful in mathematics and sciences.

METHODOLOGY

The investigator analyzed the mathematics curriculum of tenth standard followed in Kerala state and prepared a diagnostic test to analyze the nature of difficulties encountered and errors committed by students in learning mathematics. The diagnostic test was administered on a sample of 124 tenth standard students and an unstructured interview was conducted with 11 mathematics teachers.

The analysis of the answer scripts of the students revealed that, their major difficulty in learning mathematics was lack of adequate explanations from teachers. Since mathematics is a sequential subject, if one concept/process is not understood by students, it is not possible to understand the rest of the topics. Thus students lack interest in learning mathematics and gets frustrated. Majority of mathematics teachers opined that if the students get an idea / concept properly, they will not find any difficulty in learning the rest of the topics. Based on these observations, the investigator prepared and validated (content validity using judgements of experts) a computer software consisting of nine units of tenth standard mathematic syllabus for remediation of learning difficulties of students.

COMPUTER SOFTWARE FOR REMEDIATION IN MATHEMATICS

For the preparation of the software each unit in the tenth standard mathematics text book was sub divided into different modules. The content in each module was presented as follows:

Students are given opportunity to **Remember** what they have already learned followed by a description of the **New Topic** with proper explanations. After the introduction of the new topic, **Examples** are worked out. Then students are given opportunity for **Self Check** (problems based on the new topic) to find out how far they have understood the topic. Students can verify their answers by clicking the

Answer Options given. Based on the options they will be directed to **Remedial Frames** where the problems are explained in detail.

The full version of the remedial computer software is made available in

http://www.peetmemorialcollege.org.php53-12.dfw1-1.websitetestlink.com/

Sample modules are given below:

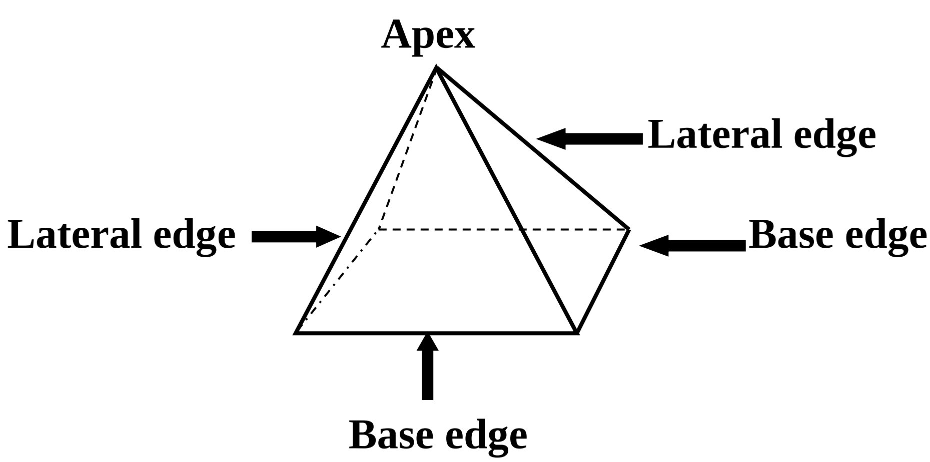
5.1. Pyramids

We have already learnt about the concept of a Prism. **Prism** is a solid whose bases are congruent and parallel polygons and the other faces are rectangles. **Pyramid** is a solid having only one polygonal base and the other faces are triangles. The **base of a pyramid** can be a triangle, rectangle, square, pentagon,,...............

Pyramids of Egypt are examples of this geometrical shape.

REMEMBER

The sides of the polygon forming the base of a pyramid are called it's **base edges** and the other sides of the triangles are called **lateral edges**. The top end of the pyramid is called it's **apex**.



REMEMBER

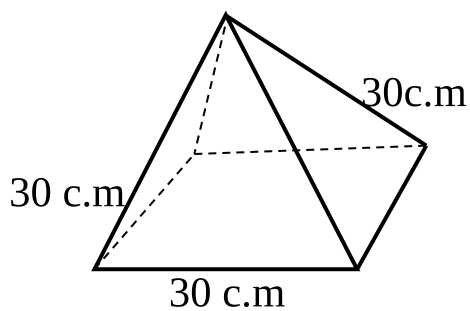
If the base of a pyramid is a regular polygon, then the lateral faces are congruent triangles.

REMEMBER

The sum of the areas of the lateral faces of a pyramid is called it's lateral surface area.

Example 1

The lateral faces of a square pyramid are equilateral triangles of side 30 centimetres. What is it's surface area?



Since the lateral faces of the square pyramid are equilateral triangles of side 30c.m, the base edges of the pyramid are also 30 c.m each.

We know that the area of a square is $(\text{Side})^2$,

the base of the square pyramid = $(30)^2$

$= 30 \times 30$

$= 900$ square centimetres.

Since the base of the square pyramid is a square, the lateral faces of the pyramid are congruent. So their areas are also same.

Since the lateral faces are equilateral triangles,

the area of one lateral face $= \frac{\sqrt{3}}{4} \times (\text{side})^2$

$= \frac{\sqrt{3}}{4} \times (30)^2$

$= \frac{\sqrt{3}}{4} \times 900$

$= \sqrt{3} \times 225$ square centimetres

Since the lateral faces of the pyramid are congruent, the areas of the 4 lateral faces are same.

Hence the lateral surface area of the square pyramid

$= 4\times$ Area of one lateral face

$= 4 \times \sqrt{3} \times 225$

$= \sqrt{3} \times 4 \times 225$

$= \sqrt{3} \times 900$

$= 900\sqrt{3}$ square centimetres

Surface area of the square pyramid

$= \text{base area} + \text{lateral surface area}$

$= 900 + 900\sqrt{3}$ square centimetres

$= 900(1 + \sqrt{3})$ square centimeters

SELF CHECK 5.1

A square of side 5 centimetres and four isosceles triangles each of one side 5 centimetres and the height to the opposite vertex 8 centimetres; these are to be joined to make a square pyramid . How much paper is needed for the job?

Answer Options

A. 106 Sq. C.m

B. 102 Sq. C.m

C. 103 Sq. C.m

D. 105 Sq. C.m

Given that the side of the square is 5 centimetres. So the area of the base of the square pyramid = $(\text{side})^2 = 5^2 = 25$ square centimetres

Given that one side of the isosceles triangle is 5 centimetres and the height to the opposite vertex is 8 centimetres. So the area of the isosceles triangle = $\frac{1}{2}$ × one side × height from this side to the opposite vertex

$$= \frac{1}{2} \times 5 \times 8 \quad = \quad 5 \times 4$$

$$= \quad 20 \text{ square centimetres}$$

Since the four isosceles triangle have the same size,

their total area = 4 × Area of one isosceles triangle

= 4 × 20 = 80 square centimetres

The square having area 25 square centimetres and four isosceles triangles each having area 20 square centimetres are joined to make the square pyramid.

So the paper needed to construct the square pyramid

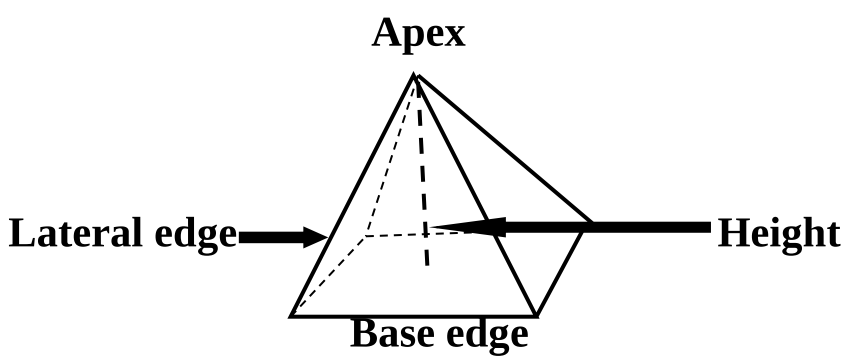
$= 25 + 4 \times 20 \quad = 25 + 80 \quad = 25 + 80$

= 105 square centimeters

5.2. Height and Slant height

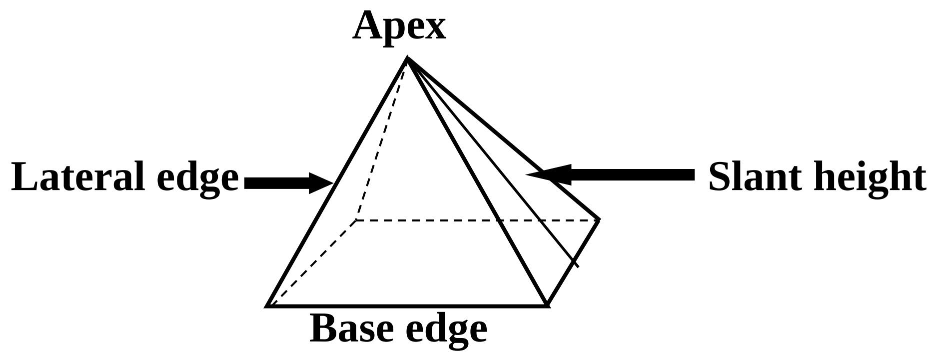
REMEMBER

The height of a pyramid is the perpendicular distance from it's apex to its base.

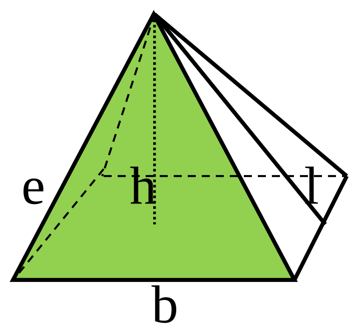


REMEMBER

The slant height of a pyramid is the perpendicular distance from it's apex to it's base edge.



REMEMBER



If '**b**' is the length of the base edge, '**e**' is the length of the lateral edge, and '**h**' is the height, and '**l**' is the slant height of a square pyramid,

then

$$\mathbf{l^2 = h^2 + \frac{1}{4} b^2}$$

$$\mathbf{e^2 = l^2 + \frac{1}{4} b^2}$$

SELF CHECK 5.2

We want to make a pyramid with base a square of side 10 centimetres and height 12 centimetres. What should be the lengths of the sides of the triangle?

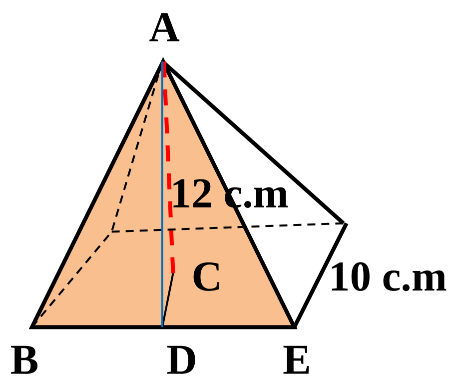
Answer Options

A. √193 c.m

B. √191 c.m

C. √182 c.m

D. √194 c.m



Given that the

base edge is 10 c.m, ⟹ b = 10 c.m

height is 12 c.m. ⟹ h = 12 c.m

We are asked to find out the sides of the triangle ⟹ e = ?

We know that $e^2 = l^2 + \frac{1}{4}b^2$. That means to find 'e', we need the values of 'l' and 'b'. But only the value of 'b' is known to us.

To find the value of ‘l’, we have to use the formula,

$$l^2 = h^2 + \frac{1}{4} b^2$$

$$l^2 = (12)^2 + \frac{1}{4} (10)^2$$

$$l^2 = 144 + \frac{1}{4} \times 100$$

$$l^2 = 144 + 25$$

$$l^2 = 169$$

$$l = \sqrt{169}$$

$$l = 13$$

Hence

$$e^2 = l^2 + \frac{1}{4} b^2$$

$$e^2 = (13)^2 + \frac{1}{4} (10)^2$$

$$e^2 = 169 + \frac{1}{4} \times 100$$

$$e^2 = 169 + 25$$

$$e^2 = 194$$

$$e = \sqrt{194}$$

The lengths of the sides of the triangle are √194 c.m.

5.3. Volume of a Pyramid

REMEMBER

The volume of a square pyramid is a third of the product of it's base area and height

ie., The volume of a square pyramid = $\frac{1}{3}$×Base area× Height

Example 1

What is the volume of a square pyramid of base edge 10 centimetres and slant height 15 centimetres?

Given that the base edge, b = 10 centimetres

Slant height, l = 15 centimetres

Since the volume of a square pyramid is $\frac{1}{3}$×Base area× Height, first of all we have to find the height of the pyramid.

We know that $l^2 = h^2 + \frac{1}{4}b^2$

$$h^2 = l^2 - \frac{1}{4}b^2$$

$$h^2 = (15)^2 - \frac{1}{4}\times(10)^2$$

$$h^2 = 225 - \frac{1}{4} \times 100$$

$$h^2 = 225 - 25$$

$$h^2 = 200$$

$$h = \sqrt{200}$$

$$h = \sqrt{2 \times 100}$$

$$h = \sqrt{2} \times \sqrt{100}$$

$$h = \sqrt{2} \times 10$$

$$h = 10\sqrt{2}$$

$$h = 10 \times 1.41$$

h = 14.1centimetres

Base area of a square pyramid = (base edge)^2

= $(10)^2$

= 100 Square centimetres

Therefore the volume of the square pyramid

$$= \frac{1}{3} \times \text{Base area} \times \text{Height}$$

$$= \frac{1}{3} \times 100 \times 14.1$$

$$= \frac{1}{3} \times 1410$$

= 470 cubic centimetres

The volume of the square pyramid is 470 cubic centimetres.

SELF CHECK 5.3

1. **Each edge of a metal cube is 30 centimetres. It is melted and recast into a square pyramid of base edge 15 centimetres. What would be it's height?**

2. **In two square pyramids of the same volume, the base edge of one is half the base edge of the other. How many times the height of the pyramid with larger base is the height of the other?**

3. **The base edges of two square pyramids are in the ratio 1:2 and their heights are in the ratio 1:3. The volume of the first pyramid is 180 cubic centimetres. What is the volume of the second?**

Qn.5.3.1

Answer Options

A. 365 c.m
B. 360 c.m
C. 345 c.m
D. 395 c.m

Each edge of a metal cube is 30 centimetres. It is melted and recast into a square pyramid of base edge 15 centimetres. What would be it's height?

Given that the edge of the metal cube is 30 centimetres.

So the volume of the metal cube = $(\text{edge})^3$

$$= (30)^3$$

$$= 30\times30\times30$$

$$= 27000 \text{ square centimetres}$$

Given that the base edge of the square pyramid is 15centimetres. Let 'h' be the height of the square pyramid.

Then the volume of the square pyramid

$$= \frac{1}{3}\times\text{Base area}\times \text{Height}$$

$$= \frac{1}{3}\times(\text{Base edge})^2\times h$$

$$= \frac{1}{3}\times(15)^2\times h \quad = \frac{1}{3}\times(225)\times h$$

$$= 75\times h$$

Since the metal cube is melted and recast into the square pyramid, their volumes will be the same.

ie. Volume of the square pyramid = Volume of the cube

$$75\times h = 27000$$

$$h = \frac{27000}{75} = 360 \text{ centimetres}$$

The height of the square pyramid is 360 centimetres.

Answer Options

Qn.5.3.2

A. **3 times**

B. **4 times**

C. **2 times**

D. **5 times**

In two square pyramids of the same volume, the base edge of one is half the base edge of the other. How many times the height of the pyramid with larger base is the height of the other?

Let b_1 and b_2 be the base edges of the first and second square pyramids respectively.

Given that the base edge of one is half the base edge of the other.

$$\Rightarrow b_1 = \frac{b2}{2}$$

Let h_1 and h_2 are the heights of the square pyramids.

Since the volumes of the square pyramids are same,

$$\Rightarrow \frac{1}{3}\times(b_1)^2\times h_1 = \frac{1}{3}\times(b_2)^2\times h_2 \quad [\text{Base area} = (\text{Base edge})^2]$$

$$\Rightarrow \frac{1}{3}\times\left(\frac{b_2}{2}\right)^2\times h_1 = \frac{1}{3}\times(b_2)^2\times h_2 \quad \left[b_1 = \frac{b2}{2}\right]$$

$$\Rightarrow \left(\frac{b_2}{2}\right)^2\times h_1 = (b_2)^2\times h_2 \quad \left[\text{Cancelling } \frac{1}{3} \text{ on both sides}\right]$$

$(\frac{1}{2})^2 \times (b_2)^2 \times h_1 = (b_2)^2 \times h_2$

$\frac{1}{4} \times h_1 = h_2$ [Cancelling $(b_2)^2$ on both sides]

$h_2 = \frac{1}{4} \times h_1$

$h_1 = 4\, h_2$

the height of the second square pyramid is 4 times the height of the first square pyramid.

4 times the height of the pyramid with larger base is the height of the other. (The second square pyramid has larger base, because b_1 is half of b_2)

Answer Options

Qn.5.3.3

A. 2176 c.c

B. 2356 c.c

C. 2170 c.c

D. 2160 c.c

The base edges of two square pyramids are in the ratio 1:2 and their heights are in the ratio 1:3. The volume of the first pyramid is 180 cubic centimetres. What is the volume of the second?

Let b_1 and b_2 are the base edges of two square pyramids.

The base edges are in the ratio 1:2 ⇒ $b_1 : b_2 = 1:2$

⇒ $\frac{b1}{b2} = \frac{1}{2}$

⇒ $2\times b_1 = 1\times b_2$

⇒ $2\,b_1 = b_2$

⇒ $b_1 = \frac{b2}{2}$

Let h_1 and h_2 are the heights of the square pyramids.

The heights are in the ratio 1:3 ⇒ $h_1 : h_2 = 1:3$

⇒ $\frac{h1}{h2} = \frac{1}{3}$

⇒ $3\times h_1 = 1\times h_2$

⇒ $3\,h_1 = h_2$

⇒ $h_1 = \frac{h2}{3}$

Given that the volume of the first pyramid is 180 cubic centimetres.

⇒ $\frac{1}{3}\times \text{Base area} \times \text{Height} = 180$

⇒ $\frac{1}{3}\times (b_1)^2 \times h_1 = 180$

⇒ $\frac{1}{3}\times \left(\frac{b_2}{2}\right)^2 \times \frac{h_2}{3} = 180$

$$\frac{1}{3} \times \frac{(b_2)^2}{2^2} \times \frac{h_2}{3} = 180$$

$$\frac{1}{3} \times \frac{(b_2)^2}{4} \times \frac{h_2}{3} = 180$$

$$\frac{1}{3} \times \frac{(b_2)^2 \times h_2}{4 \times 3} = 180$$

$$\frac{1}{3} \times \frac{(b_2)^2 \times h_2}{12} = 180$$

$$\frac{1}{3} \times (b_2)^2 \times h_2 = 12 \times 180$$

$$\frac{1}{3} \times (b_2)^2 \times h_2 = 2160$$

Since b_2 is the base edge and h_2 is the height of the second square pyramid, $\frac{1}{3} \times (b_2)^2 \times h_2$ is the volume of it. So **the volume of the second square pyramid is 2160 cubic centimetres.**

CONCLUSION AND SUGGESTIONS

Mathematics is a subject having great importance in the school curriculum because of it's educational values. Since mathematics is highly correlated with sciences, lack of proficiency of students in mathematics adversely affects their achievement in sciences also. A tenth standard student who fails to have adequate knowledge and skills in mathematics will not be able to succeed in his higher studies which points to the need for proper diagnosis and remediation in mathematics. In this study the investigator attempted to find out the deficiencies and difficulties experienced by tenth standard students in learning mathematics and prepared a remedial software. This may motivate the students to learn mathematics at their own pace and the correct his mistakes without the help of the teacher. The prepared software is made available in the web so that everyone can access it at anytime from anywhere.

Similar remedial softwares have to be prepared and made available to the students so that they can remedy their difficulties in learning mathematics. The use of these softwares may motivate them to study mathematics without much difficulty by moving in tune with the modern technology.

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