S. THOMAS' COLLEGE
MOUNT LAVINIA

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Upper 6 – Pre-O/Level Examination2020

Mathematics I | *Two hours only*

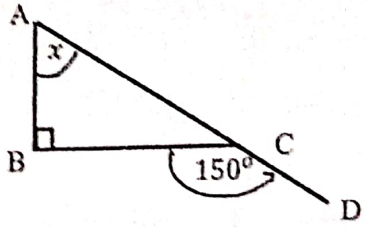
- *Answer **All** questions in **Part A** and **Part B** in the spaces provided*

Part A

1. A man purchased 1000 shares from a company at Rs.30/- per share. If the company pays Rs.3/- dividends per share, find the total dividends he would receive at the end of the year.

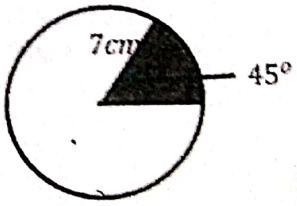
2. Find the Factors of $\pi a^2 - \pi b^2$

3. Find the magnitude of x according to the information given in the diagram.



4.

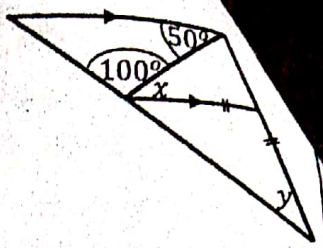
(i) Express the arc length of the shaded region as a fraction of the perimeter of the circle.



(ii) Find the length of the arc

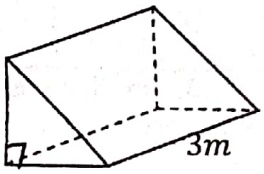
5. Simplify $\frac{x}{3} \div \frac{x^2}{9y^2}$

6. Find the values of x and $y$according to the information given in the figure.

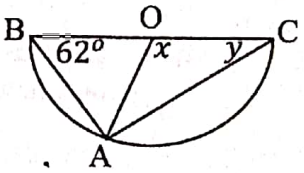


7. Find the value of x if $x = \log_3 \sqrt{9}$

8. Find the volume of the prism shown in the given diagram, if the area of the cross-section is $4.25\ cm^2$



9. The given diagram represents a semicircle, whose centre is O and the diameter is BC. Find the magnitudes of the angles marked as x and y.



10. Express the quadratic equation whose roots are 2 and -5, in the $(x + a)(x + b) = 0$ form.

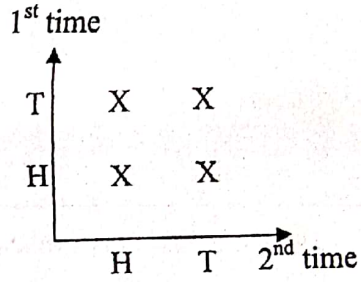
11. How long (in minutes) will it take to fill $\frac{1}{8}^{th}$ of a tank whose capacity is $8m^3$, using a pipe through which water flows at a rate of 100 l per minute.

12. Fill in the blanks with the correct word(s)

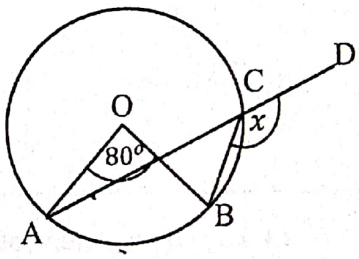
The line joining the _____ *of two sides of a triangle is parallel to the third side and*

is _____ *of the third side.*

13. The sample space with the outcomes observed by tossing a coin twice has been represented in the given diagram. Mark the outcomes of getting Heads at least once and find the probability of the same.



14. O is the centre of the circle and AC is a chord which has been produced to D. Find the magnitude of the angle marked as x.



15. Choose and underline the statements which describe inversely proportional events

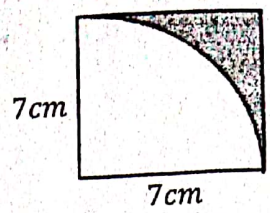
(i) Find the cost of 15 Mangoes when the price of 1 Mango is given.

(ii) Changes in length and breadth of a rectangle whose area is constant.

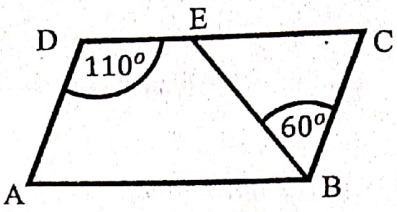
(iii) The relationship between the radius and the perimeter of a circle.

(iv) Number of men vs number of hours required to complete a certain work.

16. Find the area of the shaded area of the given figure.

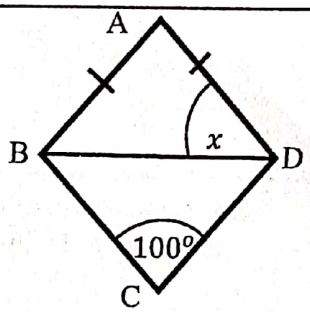


17. Find the magnitude of the angle $B\hat{E}C$ from the given ABCD parallelogram.

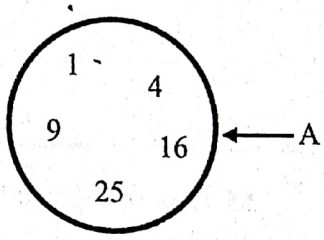


18. Find the value of y in the given matrix $\begin{pmatrix} 2 \\ -1 \end{pmatrix}(6 \quad y) = \begin{pmatrix} 12 & 6 \\ -6 & -3 \end{pmatrix}$

19. If the ABCD is cyclic quadrilateral find x



20. Express the elements in the given Venn diagram in Set Notation.



21. Choose and underline the Geometric progressions from among the given number patterns.

(i) $3, -18, 108, -648$

(ii) $3, 18, 108, 648$

(iii) $3, -18, -108, 648$

(iv) $-3, -18, -108, -648$

22. Considering the straight line represented by the equation $3y = 4 - 6x$,

(i) Write down the gradient of the straight line.

(ii) Write down the line parallel to the given line passing through the point of origin.

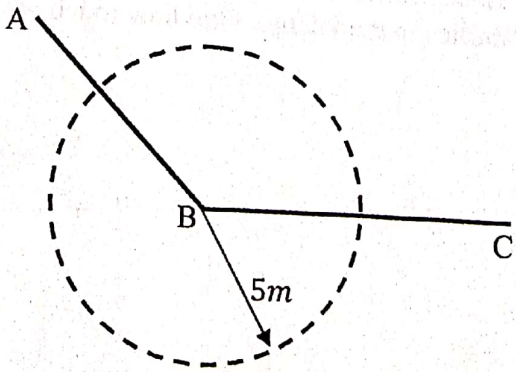
23. The 1^{st}, 2^{nd} and 3^{rd} quartiles of a certain data distribution are12, 22 and x respectively.

(i) What is the median of the distribution?

(ii) If the interquartile range is 28, find the value of x.

24. Find the least common multiple of $3x^2$, $6xy$ and $9xy^2$

25. The boundaries AB and BC of a plot of land is shown in the given figure. It is required to build a well $5m$ from the corner B and $6m$ away from at least one of the two boundaries. Using your knowledge in loci, draw a rough diagram to show where the well should be situated.



Part B

1. A rural village was given a grant in order to improve their facilities. A $\frac{2}{7}$th portion of the grant money was set aside for cultivation and to purchase seeds.

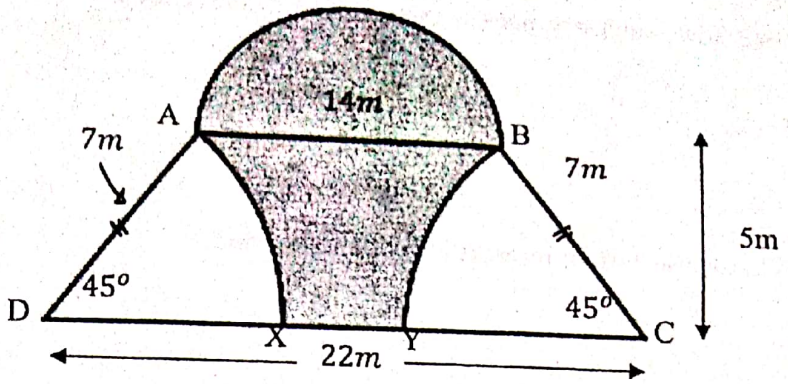
   (i) What is the remaining portion of the grant money after setting aside for the cultivation and the purchasing of seeds?

   (ii) $\frac{1}{5}$th of the remaining portion was set aside for farming equipment. What fraction of the entire grant money was set aside for farming equipment?

   (iii) After setting aside money for the cultivation and for the farming equipment, if $\frac{1}{2}$ of the remaining money was used to build a water tank for the village school amounting to Rs.72,000/-, find the total grant money which was provided to the village.

   (iv) After utilising the money for all the functions as mentioned above, the balance money was divided among 6 families in the village. Find how much was received by each family.

2. A plan used to setup a garden space to grow ornamental flowers is shown in the figure below.



(i) Find the length of the arc AB

(ii) It was decided to plant ornamental flowers along the border of the shaded area at $2m$ intervals. Find how many such plants are required to go round the entire shaded area.

(iii) It was decided to build a rectangular flower section equal in area to the section ABYX, and having a length equal to CD. Find the width of the section in a whole number.

3. (a) A person who took a loan of Rs.12,000/- from a institution at an annual simple interest rate of 15%, had to pay Rs.16,500/- at the end of the loan period in order to be released from the loan.

(i) Find how much was paid as interest for the above loan.

(ii) What is the annual interest in this transaction?

(iii) After how long was he released from the loan?

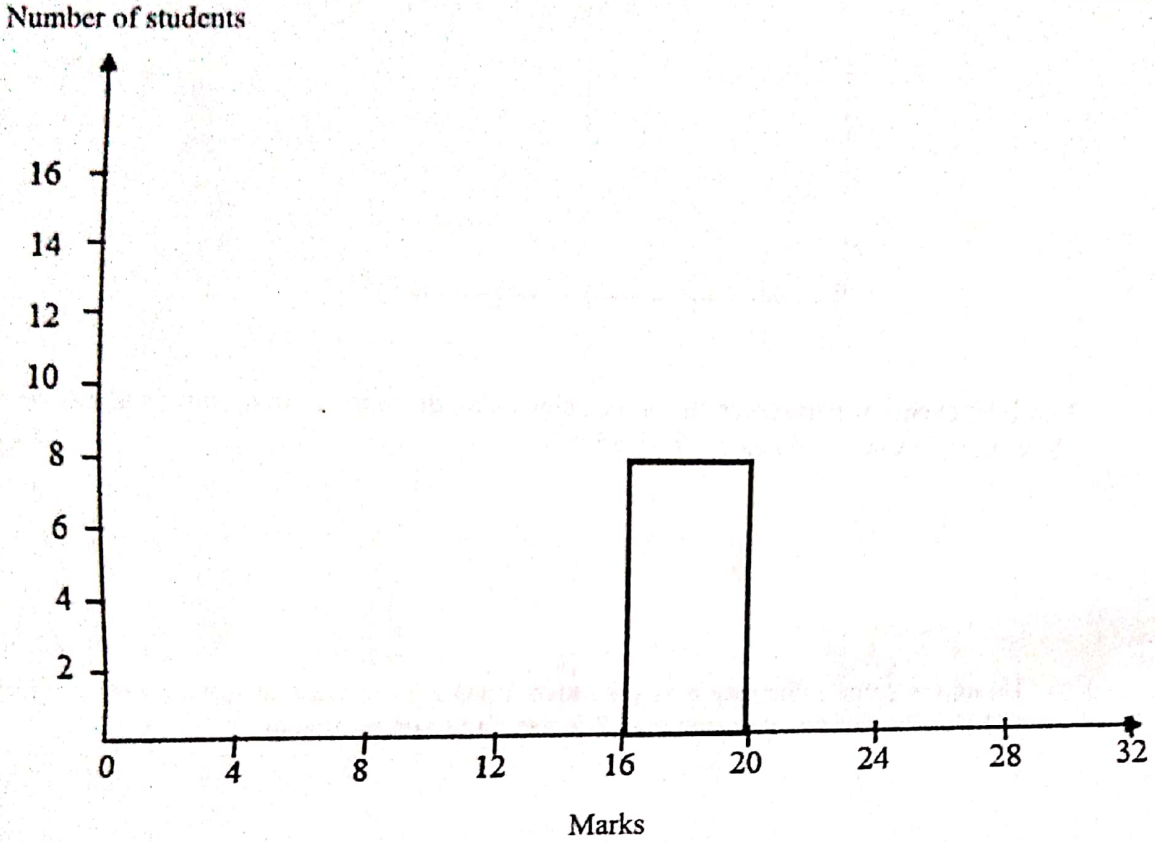
(b) A duty of 60% must be paid when importing a certain item.

(i) If Rs.52,200/- was paid as duty, what is the value of the item?

(ii) If the importer has to pay another Rs.3,000/- to transport the item in addition to the duty, for how much should he sell the item in order to make a 20% profit.

4. The table given below represents the marks obtained by a group of students for a mathematics test.

Class interval Marks	4 – 8	8 – 12	12 – 16	16 – 20	20 - 28
No. of Students	6		10		4



(i) From the histogram, find the number of students who have got 16 – 20 marks and fill in the blank in the above table.

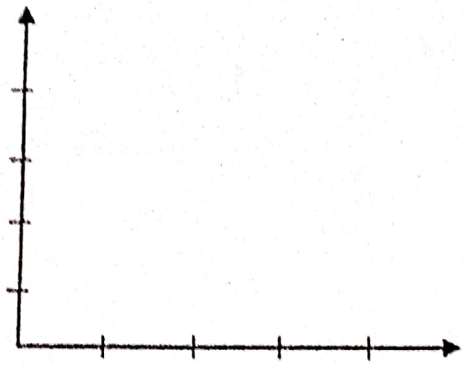
(ii) If 50% of the students got less than 12 marks, find the total number of students who are observed in this experiment, and complete the blanks in the above table.

(iii) Complete the histogram.

(iv) Draw the frequency polygon on the above histogram.

5. (a) There are 4 entry / exit roads leading to / coming out of a tunnel on a certain road named P, Q, R and S. Vehicles can use any of the 4 entry / exit roads to enter / exit the tunnel.

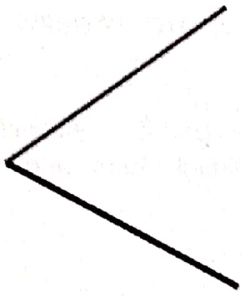
(i) The vehicles enter and exit the tunnel using the 4 entry and exit roads randomly. An incomplete sample space to mark the road selection has been given below. Represent the above experiment in the given sample space



(ii) Mark the events which represent the vehicles using the same road to enter and exit in the above sample space and name it X. Find P(X)?

(b)

(i) Using the same information as (a) above, draw a Tree diagram to represent a vehicle (A) choosing or not choosing road P to enter and exit the tunnel.



(ii) Extend the Tree diagram to represent a vehicle B choosing or not choosing road P to enter and exit the tunnel.

(iii) Find the probability of at least one of the two vehicles A or B choosing the road P to enter and exit the tunnel.

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Upper 6 – Pre-O/Level Examination 2020

Mathematics II	*Three hours only*

- Answer **Five (05)** questions from **Part A** and **Five (05)** questions from **Part B** only
- Each question is marked out of 10 marks.
- The volume of a right circular cylinder with base radius r and height h is $\pi r^2 h$, and the volume of a solid sphere with radius r is $\frac{4}{3}\pi r^3$.

Part A

Answer **Five (05)** questions only

1. The number of minutes spent by 50 workers in a vehicle manufacturing company, to assemble a certain electronic part,is given in the following table.

Time Spent (minutes)	21 – 25	26 – 30	31 – 35	36 – 40	41 – 45	46 – 50	51 – 55	56 - 60
No. of Workers	2	5	7	10	14	8	3	1

(i) Using a suitable mid value as the assumed mean or by using any other method, find the mean time taken by a worker to assemble the electronic device in the vehicle manufacturing company.

(ii) 900 such electronic devices have to be assembled within a six-hour shift.. The management has decided to pay a worker Rs.7,200/- per six-hour shift. Show that the vehicle manufacturing company will not spend more than Rs.1,000,000/- to assemble the said electronic device.

2. An incomplete table of $y$values corresponding to x values within the range $-2 \leq x \leq 4$,which satisfies the equation $y = 3 - (x-1)^2$ is given below.

x	-2	-1	0	1	2	3	4
y	-6	-1	2		2	-1	-6

(a)

(i) Find the value of y when $x = 1$.

(ii) Using a suitable scale for the cartesian plane, draw the above graph in the graph paper.

Using the graph;

(iii) Write the range of the $y$corresponding to the range $1 \leq x \leq 2$.

(iv) Write down the roots of the equation $x^2 = 2(x+1)$ which x > 0

(b) Express the equation of the minimum parabolic curve whose turning point is $(1, -3)$ and coefficient of x^2 is 1 in the form $y = (x+a)^2 + b$.

3. Hashan and David are two good friends. Hashan purchased a television outright for Rs.150,000 for which he received a 5% discount.

(i) Find how much Hashan paid to purchase the television.

David purchased the same type of television under a hire purchase scheme making a down payment of Rs.65,000/-. The balance should be paid in 17 monthly instalments of Rs.6,800/- each.

(ii) Find the balance outstanding amount which David should pay.

(iii) Find the interest that David should be paid for the hire purchase.

(iv) Find the interest rate of this hire purchase.

(v) How much more than Hashan did David have to pay in order to purchase the television under the hire purchase scheme?

4. A and B are two rectangles whose lengths are x cm and $(x + 3)$ cm respectively. The area of both rectangles A and B is 11 cm^2. If the width of the rectangle A is 2 cm more that the width of the rectangle B, show that it satisfies the quadratic equation $2x^2 + 6x - 33 = 0$. Subsequently, using the formula or any other method, solve the equation and find the value of $x$to the first decimal place. (Take $\sqrt{3} = 1.73$)

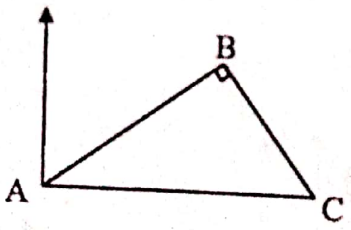
5. (a) Show that x can have exactly 4 integer values which satisfy the inequalities

$3x + 4 > 2x - 3$ and $x + 3 \leq -2(3 + x)$

(b) A certain question paper has 25 questions. Some of which are 2-mark questions while the others are 3-mark questions, totalling to 65.

(i) Taking the number of 2-mark questions as x and the number of 3-mark questions as y, construct a pair of simultaneous equations to satisfy the above statements, and by solving the equations, find the number of 2-mark and 3-mark questions separately.

6. The given diagram represents the situation of three cities named A, B and C. The city D is situated South of C such that $C\hat{A}D = 30°10'$. Further $A\hat{B}C = 90°$, $AB = 80km$ and C is situated $100km$ East of A.



(i) Copy the diagram into the answer script and draw all the given information in the diagram.

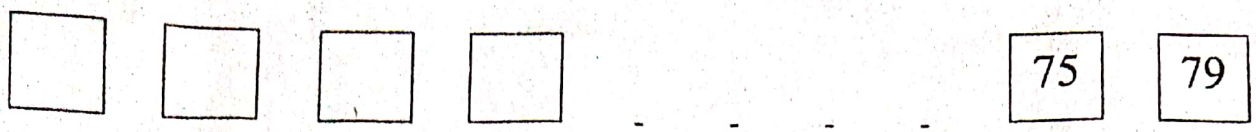
(ii) Find the distance between the cities C and D to the nearest kilometre

(iii) It takes 2 hours for a light aircraft to travel from A to B to C to D. Show that the aircraft is not travelling at a speed in excess of$100km/h$.

Part B

Answer **Five (05)** questions only

7. (a) A Mathematics teacher provided a class with a card pack of 100 cards each being marked with numbers from 1 to 100, and asked the students to form an Arithmetic Progression using the cards. Senaka made the following Progression using 20 of the 100 cards.



(i) What is the common difference in the above progression?

(ii) Using the formula, find the first term of the progression.

(iii) Find the sum of the Arithmetic Progression formed by Senaka.

(iv) If the sum of the cards marked with a number which is a multiple of 5 is 180, find the number of such cards in the above progression

(b) Find the sum of the first 6 terms of the geometric progression 1, 3, 9 ....

8. Using a compass and a straight edge with mm / cm rule scale, do the following construction. The construction lines should be clearly visible.

(i) Construct the Triangle ABC such that $AB = 8cm$, $A\hat{B}C = 60^o$ and $BC = 7cm$..

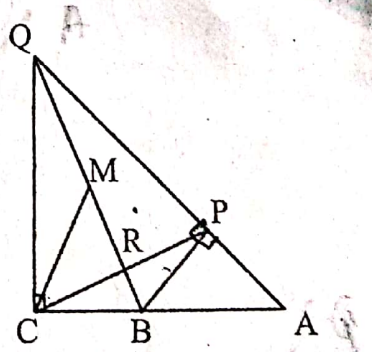
(ii) Construct a circum-circle of the above triangle ABC.

(iii) D is a point which lies on the above circle such that B and D lie on either side of the line AC and $A\hat{D}C = 120^o$. Mark D on the circle.

(iv) Construct a tangent to the circle at D and name it PQ.

(v) Give reasons why $P\hat{D}A = A\hat{C}D$.

9. ACQ is a right angled triangle and $Q\hat{C}A = 90^o$. The bisector of $C\hat{A}Q$ meets the side CA at B while BP is perpendicular to the side AQ and M is the midpoint of BQ. Copy the diagram into the answer scripts and mark the above data. (Take $P\hat{Q}B = \hat{a}$)



With reasons;

(i) Show that PQCB is a cyclic quadrilateral.

(ii) Prove that $P\hat{B}A = C\hat{M}B$.

(iii) Show that BCP is an isosceles triangle.

(iv) If $CR = 6cm$ and $QR = 9cm$ show that $BR = \frac{2}{3}PR$.

10. ABCD is a trapezium where $AB \,//\, DC$ and $AB > DC$. The midpoints of AD and BC are P and Q respectively. The produced lines BP and CD meet at E. Show that ABDE is a parallelogram and that $2PQ = (AB + CD)$.

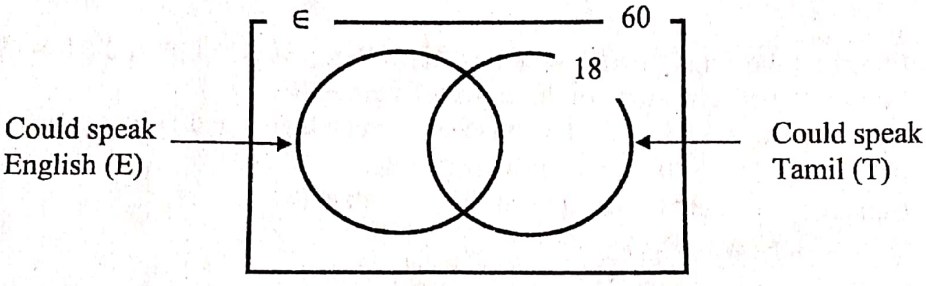
11. (a) The radius of the bottom surface of a hollow right cylinder is r. The height of the cylinder is 5 times its radius. The cylinder has been filled with water to a height of $2r$. 18 small solid spheres each of radius a are inserted into the cylinder. Show that the water in the cylinder will overflow if $a > \frac{r}{2}$.

(b) Find the value of $\frac{\sqrt[3]{82.75}}{0.425}$ using Log tables.

12. The competency of language spoken by 60 participants at an interview have been observed and summarised as follows:-

* Everyone who could speak in English could also speak in Sinhala while everyone who could speak in Tamil could also speak in Sinhala.
* There were 6 participants who could speak in Sinhala, Tamil and English
* 18 participants could speak in Tamil while 17 participants could speak in Sinhala only.
* All those who participated in the interview could speak in one of the three languages (Sinhala, Tamil or English)

(i) Copy the incomplete Venn diagram into the answer scripts and fill with the given data.



(ii) How many participants could speak only in two languages?

(iii) Shade the area denoted by $S \cap (T \cup E)'$

(iv) Two people who couldn't participate in the interview with the others, participated in the interview on the next day. One of them could speak in all three languages while the other person could speak in Tamil only. Change and redraw the Venn diagram to include these two people in the original Venn diagram.