

අධ්‍යයන පොදු සහතික පත්‍ර (සාමාන්‍ය පෙළ) විභාගය, 2022(2023)
 கல்விப் பொதுத் தராதரப் பத்திர (சாதாரண தர)ப் பரீட்சை, 2022(2023)
 General Certificate of Education (Ord. Level) Examination, 2022(2023)

ලේඛනය II
 கணிதம் II
 Mathematics II

පැය තුනයි
 மூன்று மணித்தியாலம்
 Three hours

අමතර කියවීමේ කාලය - මිනිත්තු 10 යි Use additional reading time to go through the question paper,
 மேலதிக வாசிப்பு நேரம் - 10 நிமிடங்கள் select the questions and decide on the questions that you give
 Additional Reading Time - 10 minutes priority to in answering.

Instructions:

- * Answer ten questions selecting five questions from Part A and five questions from Part B.
- * Write the relevant steps and the correct units in answering the questions.
- * Each question carries 10 marks.
- * The volume of a sphere of radius r is $\frac{4}{3}\pi r^3$.

Part A

Answer five questions only.

1. Bank A pays an annual compound interest rate of 10% for fixed deposits. The interest is added to the principal amount annually.

A share of finance company B can be purchased for Rs. 40. Annual dividends of Rs. 2.50 is paid per share.

Saman deposits 200 000 rupees in bank A for two years in the above manner. He withdraws the interest and the principal amount at the end of the two years.

Kamal purchases shares in company B by investing 200 000 rupees. After receiving annual dividends at the end of the first year and at the end of the second year, he sells all his shares at 45 rupees per share.

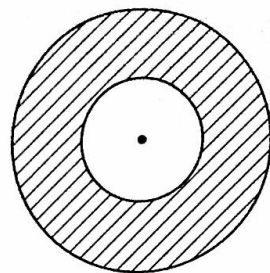
Show with reasons that the amount that Kamal has with him when the annual dividends of the two years and the amount he received by selling the shares are added together is 8000 rupees more than the amount Saman has.

2. An incomplete table of y -values corresponding to several x -values of the function $y = 4 + 2x - x^2$ in the interval $-2 \leq x \leq 4$ is given below.

| | | | | | | | |
|-----|----|----|---|---|-----|---|----|
| x | -2 | -1 | 0 | 1 | 2 | 3 | 4 |
| y | -4 | 1 | 4 | 5 | ... | 1 | -4 |

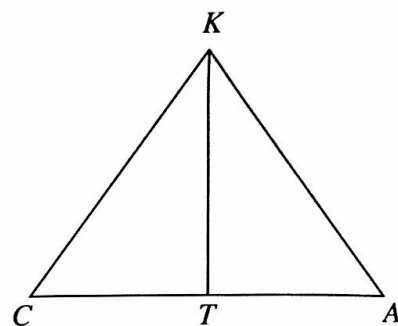
- (a) (i) Find the value of y when $x = 2$.
 (ii) Using the standard system of axes and a suitable scale, draw the graph of the given quadratic function on a graph paper according to the above table of values.
- (b) Using the graph,
 (i) write the interval of values of x on which the function is decreasing in the interval $1 < y < 4$.
 (ii) express the function in the form $y = b - (a - x)^2$; here a and b are two constants.
 (iii) find the value of the positive root of the quadratic equation $4 + 2x - x^2 = 0$ to the nearest first decimal place and thereby obtain a value for $\sqrt{5}$.

3. When a circular lamina of radius r is cut out from a circular lamina of radius $2r + 3$, the area of the remaining portion of the lamina is $27\pi \text{ cm}^2$. Show that r satisfies the quadratic equation $r^2 + 4r - 6 = 0$ and by solving it find the value of r to the nearest first decimal place. (Take the value of $\sqrt{10}$ to be 3.16)



By considering the value of π to be 3.1, find the circumference of the smaller lamina.

4. Chamara (C) and Amal (A) are standing on a level ground on opposite sides of a vertical tree (KT) as shown in the figure. Amal is 30 m away from the tree and Chamara is flying a kite. The kite suddenly gets entangled at the top of the tree (K) such that the string is taut. The string is 40 m long. At that moment, Chamara sees the kite with an angle of elevation of $44^\circ 50'$. (Disregard the heights of Chamara and Amal.)



- (i) Copy the given figure onto your answer script and include the above information in it.

Use trigonometric ratios in the following computations.

- (ii) Find the height (KT) of the tree.
 (iii) What is the angle of elevation with which Amal sees the kite at this moment?
 (iv) With reasons, state which of the two, Chamara or Amal is standing closer to the tree.

5. It is required to buy cricket bats and balls for sports practices in the schools A and B. It costs 6160 rupees to buy 3 cricket bats and 8 balls for school A. It costs 4000 rupees to buy 2 cricket bats and 5 balls for school B.

- (i) By taking the price of a cricket bat as x rupees and the price of a ball as y rupees, construct a pair of simultaneous equations and by solving them, find separately the price of a cricket bat and the price of a cricket ball.
 (ii) Find the number of cricket bats and the number of balls that can be bought for exactly 9200 rupees such that the number of balls is twice the number of cricket bats.

6. A frequency distribution giving the number of trips that Nimal made in his car during two weeks together with the distances is shown below.

| Distance (km) | 1-3 | 3-5 | 5-7 | 7-9 | 9-11 | 11-13 | 13-15 |
|-----------------|-----|-----|-----|-----|------|-------|-------|
| Number of trips | 6 | 10 | 20 | 8 | 4 | 0 | 2 |

(Here the interval 3-5 represents greater than or equal to 3 and less than 5.)

- (i) Find the mean distance he travelled on a trip during these two weeks.
 (ii) For a certain reason Nimal expects to make 120 such trips during the next month. For that month, he is entitled to exactly 80 litres of fuel. To be able to make the 120 trips in his car, on average, what is the distance his car should be able to run on a litre of fuel?
 (iii) Nimal decides to cycle instead of using his car for trips that are less than 5 kilometres. By considering that all his trips are as in the above table and that the car can travel 9 kilometres per litre on average, if a litre of fuel is 400 rupees, show that Nimal can save **at least** 1600 rupees.

Part B

Answer five questions only.

7. For a school sports activity, the students have been placed such that the first row consists of 7 students and every other row consists of 3 students more than the row before it. Then the number of students in each row when taken in order forms an arithmetic progression.
- Write the first, second and third terms of this progression respectively.
 - Show that the n^{th} term of this progression T_n is given by $T_n = 3n + 4$.
 - In which row are there 40 students?
 - If only 700 students have been selected for this sports activity, show with reasons whether the first 20 rows can be filled when the students are placed in the above manner.

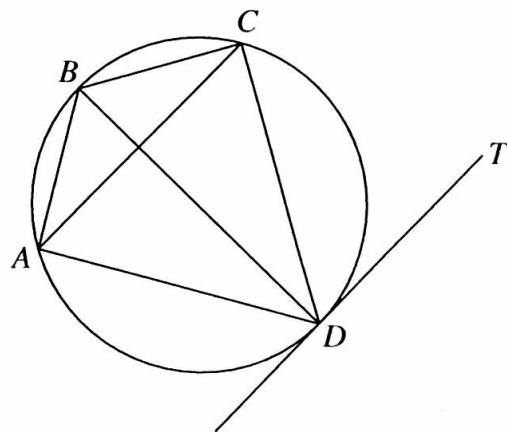
8. Use only a straight edge with a cm/mm scale and a pair of compasses for the following geometric constructions. The construction lines should be drawn clearly.

- Construct a circle of radius 5 cm and name its centre as C .
- Construct a chord AB of length 7.5 cm.
- Construct the perpendicular bisector of AB and name the point at which it intersects the major arc of the circle as P .
- Draw the line PA and construct the interior bisector of $\hat{P}AB$.
- Construct a tangent to the circle at P and name the point at which it meets the angle bisector drawn in part (iv) above as K . Give reasons why PK and AB are parallel.

9. In the cyclic quadrilateral $ABCD$ in the given figure, $AB = BC$ and $CD = DA$. Take $\hat{DCA} = x^\circ$.

Copy the given figure onto your answer script and include the above information in it.

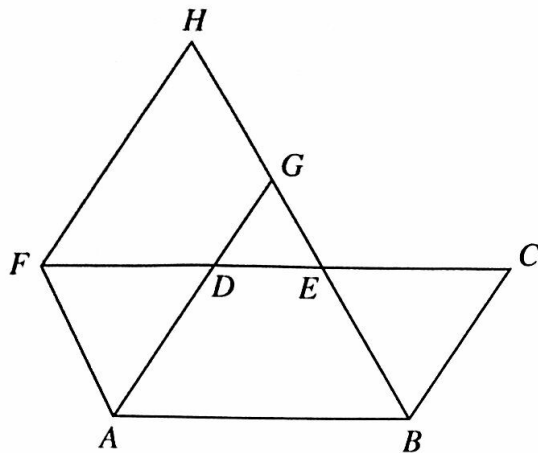
- If the tangent drawn to the circle at D is DT , show that $AC \parallel DT$.
- Show that \hat{ABC} is bisected by BD .
- Show that BD is a diameter of the given circle.



10. The cross-sectional area of a container with water, in the shape of a right prism with a uniform triangular cross-section, is 42 cm^2 . When 7 spheres of radius a cm each are submerged in the water in the container, the water level rises by h cm without water spilling over. Show that the radius a of a sphere is given by $a^3 = \frac{9h}{2\pi}$.

By taking the value of h as $\sqrt{31.17}$ and the value of π as 3.14, find the value of a^3 to the nearest whole number using the logarithms tables and thereby obtain the value of a .

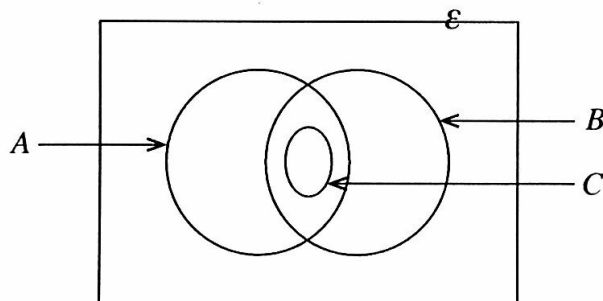
11.



$ABCD$ shown in the figure is a parallelogram. E is a point on CD as shown in the figure. Moreover, the straight line CD has been produced to F such that $DF = CE$, and AD produced and the straight line through F drawn parallel to AD , meet BE produced at G and H respectively.

Copy the given figure onto your answer script and show that the triangles ADF and BCE are congruent, and give reasons why $ABEF$ and $AGHF$ are parallelograms and why their areas are equal.

12. An incomplete Venn diagram drawn to represent the information collected from 60 homes in a certain location on the use of firewood, gas and electricity to prepare food is shown below.



All the homes that use electricity also use the two types firewood and gas.

- (i) Copy the given Venn diagram onto your answer script.
If the set A denotes the homes that use firewood, name the set B and the set C .
- (ii) The number of homes that do not use any one of firewood, electricity and gas is 5, the number of homes that use firewood is 24 and the number of homes that use gas is 48. How many homes use only gas?
- (iii) How many homes use both firewood and gas?
- (iv) The number of homes that use electricity is equal to the number of homes that use only firewood. How many homes use only the two methods firewood and gas? Shade the region that represents these homes in the Venn diagram.