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General Certificate of Education (Ordinary Level) Support Seminar - 2018

Mathematics I

2 hours

- Answer all questions in the pa per itself.
- It is necessary to indicate the relevant **steps** and **correct units** in answering the questions**.**
- Marks will be awarded as follows:

  In **Part A**

  2 marks for each question.

  In **Part B**

  10 marks for each question.

PART A

Answer all questions in the paper itself.

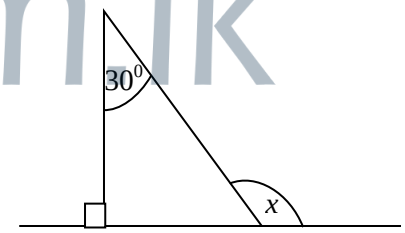
1. A value added tax (VAT) of 15% is charged on the selling price of mobiles. If the selling price a mobile phone is Rs. 24 000, find the amount to be charged as tax (VAT).

2. Express $lg1000 = 3$ in index form.

3. Find the lowest common multiple of the following algebraic expressions.

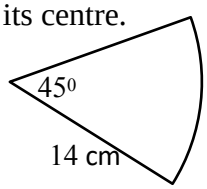
   $4x^2y$, $6x$, $3y^2$

4. Find the value of x.



5. Factorise: $x^2 - 5x + 6$

6. Find the arc length of a sector of radius 14 cm with an angle of 45^0 at its centre.



7. Find the 21st term of the arithmetic progression 7, 12, 17, ...

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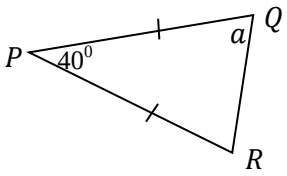
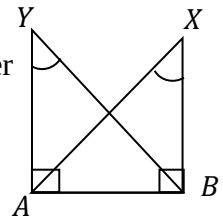
8. Five men work for three days to complete $\frac{1}{4}$ of a certain work. Find the number of days required for 10 men to complete the whole work.

9. According to the given data in the figure find the value of *a*.



10. Area of the curved surface of a right circular cylinder of base radius 7 cm is 880 cm^2. Find its height. (The area of the curved surface of a right circular cylinder with base radius r and height h is $2\pi rh$. Take $\pi = \frac{22}{7}$)

11. According to the data shown in the diagram, underline the state under which the triangles ABY and ABX are congruent.
(i) S,S,S (ii) S,A,S (iii) A,A,S (iv) R,H,S



12. Simplify: $\frac{2x^2}{y} \div \frac{4x}{5y}$

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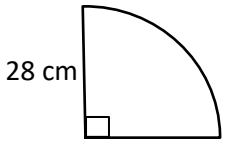
13. Find the area of a sector of radius 28 cm and an angle of 90^0 at the centre.



14. Write the largest possible integer which satisfies the inequality, $x + 1 < -3$.

15. Solve: $\frac{1}{x} + \frac{1}{2x} = \frac{1}{6}$

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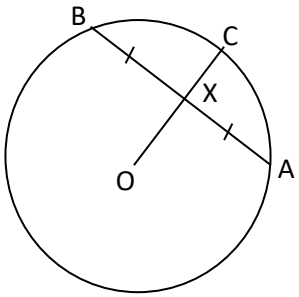
16. This is a diagram of a circle with centre O and radius 10cm. X is the midpoint of the chord AB. If the length of AB chord is 16 cm, find the length of XC.

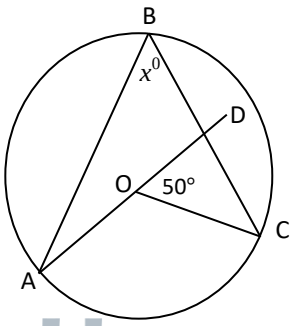


17. If $n(\varepsilon) = 15,\ n(B) = 7,\ n(A \cup B) = 10$ and $n(A \cap B) = 2$ find;

i. $n(A)$

ii. $P(A)$

18. The centre of this circle is O and AD is a straight line segment. Find the value of x, based on the given data.



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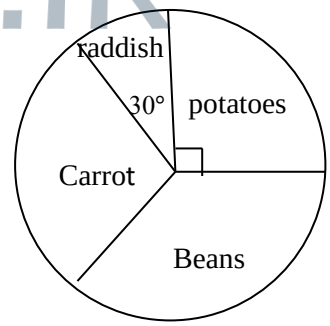
19. This pie chart shows data collected from 180 farmers on their cultivation. If the number of farmers who cultivated carrots and beans are equal, find the number of farmers who cultivated carrots.



20. A fair cubical dice numbered from 1 to 6, is tossed and the side which turns up is observed.

i. What is the probability of obtaining 6 ?

ii. What is the probability of obtaining 6 or 5 ?

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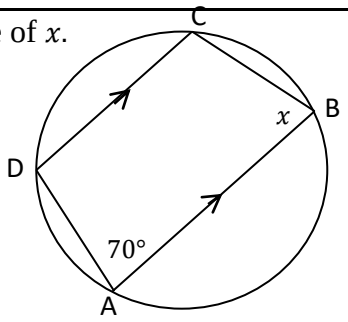
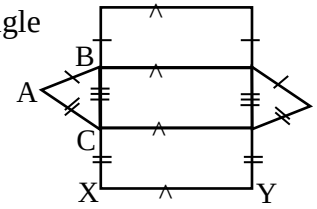
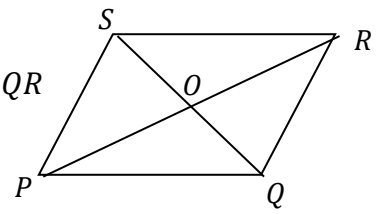
21. According to the data given in the diagram find the value of x.



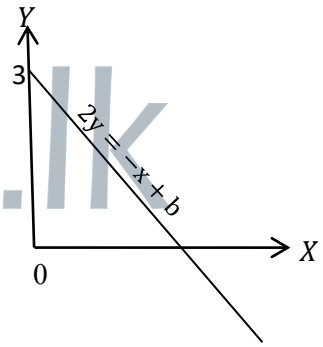
22. The diagram is of a net of a prism. If the area of the triangle ABC is 10 cm^2 and XY = 1.5 cm find the volume of the prism that can be made by using this net.



23. $PQRS$ is a parallelogram. If the area of the triangle PQR is 25 cm^2, find the area of the triangle QRS.



24. If the equation of the given graph is $2y = -x + b$ find the value of b.



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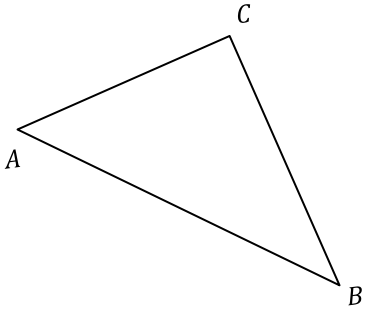
25. Following is a rough sketch of a triangular piece of land ABC. Draw the rough construction lines required, to find the point P on AB border which is equidistant to A and C.



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Part B

Answer all questions.

1. It is expected to paint $\frac{1}{2}$ of the area of a metal sheet in white colour and $\frac{2}{3}$ of the remainder in silver colour. The remaining portion is expected to be painted in gold colour.

   i. What fraction of the whole metal sheet is to be painted in silver colour ?

   ii. What fraction of the whole metal sheet is to be painted in gold colour ?

   The cost of painting 1 cm^2 of area in white, silver and gold colours is Rs. 10, Rs. 25, Rs. 100, respectively.

   iii. If the expected cost of painting in silver is Rs. 400, find the area of the whole metal sheet.

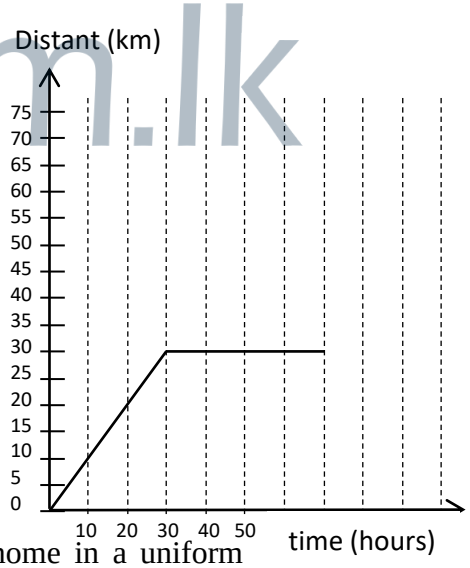
   iv. Find the total cost of painting the whole metal sheet as planned above.

2. Following distance-time graph shows the way Nuwan travelled in his vehicle to see a patient in a hospital.

   i. What is the distance from Nuwans' house to the hospital ?

   ii. What is the speed of the vehicle in kilometres per hour ?

   iii. How much time did Nuwan spend in the hospital ?



   iv. If he travelled along the same route, back to his home in a uniform speed of 90 kmh^{-1} draw the graph for his return journey, on the above distance time graph.

   v. Ignore the time spent in the hospital and find the average speed of the vehicle.

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3. The market value of a share of a company is Rs. 125.

   i. Ranjith buys 600 shares of the above company. What is the amount of money he invested in shares ?

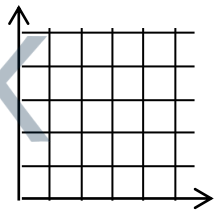
   ii. If Ranjith obtains a dividend of Rs. 9000, find how much the company pays as the annual dividend per share.

   iii. If a person who has bought shares at the same price, earns an annual dividend of Rs. 24000, find the amount he has invested.

   iv. At the end of the year Ranjith sells the 600 shares that he owned. The total dividend he earned and the capital gain obtained, sum up to a 28% of his investment. Find the amount at which he has sold a share.

4. There are similar pens in a box of which 3 are red and 2 are blue. Amal randomly takes a pen out of the box. Without replacing it, he takes another pen out.

   i. Represent the sample space of all the possible outcomes of the above experiment in the given grid.



   ii. Let 'A' be the event of obtaining pens of two different colours. Show the elements of the event A in the grid and find P(A).

In the above experiment, if Amal takes a pen on his second turn, only if the pen in the first turn is red;

   iii. represent the sample space in a tree diagram.

   iv. By using the above tree diagram find the probability of Amal obtaining a blue pen.

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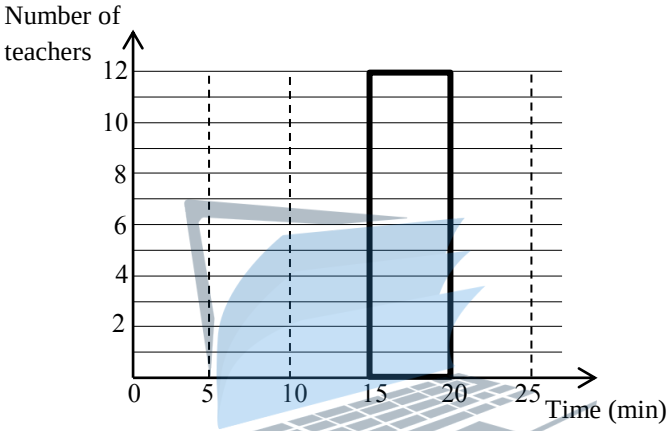
5. An incomplete, cumulative frequency distribution and a histogram representing data on the attendance of teachers on a particular day to school, are given below.

Time elapsed since the arrival till the school starts	Number of teachers (frequency)	Cumulative frequency
0-5	3	---
5-10	5	---
10-15	7	---
15-20	---	---
20-25	---	---



i. If the number of teachers who arrived at the school before the school started is 32, with the use of data in the histogram, complete the frequency column.

ii. Hence complete the histogram.

iii. Complete the cumulative frequency column.

iv. Draw the cumulative frequency curve in the grid below.

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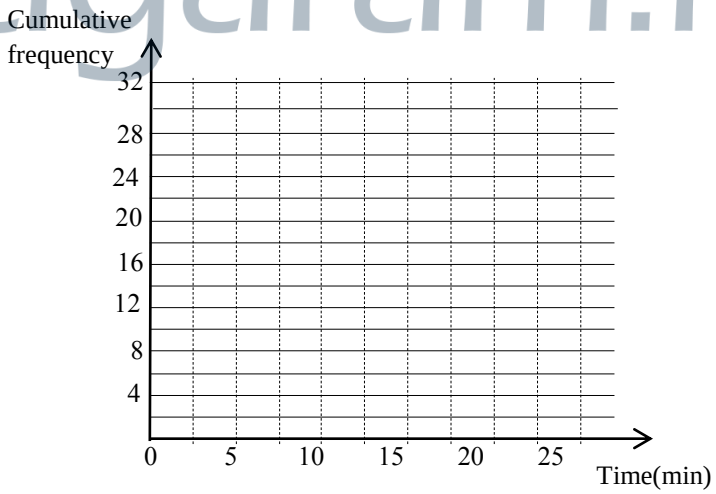

v. Find the median time, of the teachers arriving at school before school starts on this day.

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Mathematics II

3 hours

Important :

- Answer **ten** questions selecting **five** questions from **Part A** and **five** questions from **Part B.**
- It is necessary to indicate the relevant **steps** and **correct units** in answering the questions**.**
- Each question carries **10** marks.
- The volume of a right circular cylinder of base radius r is $\pi r^2 h$.
- The volume of a right circular cone of base radius r and height h is $\frac{1}{3}\pi r^2 h$.

Part A

Answer **five** questions only.

1. From a shop which sells printing equipment, a printing machine can be bought, on outright purchase or by paying a down payment of 10% of the value of the machine and paying the rest in 9 equal instalments. Then the interest is calculated on reducing balance method.

   If Amal has to pay Rs. 5 000 as the initial payment to buy the printing machine;

   (i) what is the amount left to be paid by him ?
   (ii) what is the number of month units for which the interest is calculated ?
   (iii) If the interest per month unit is Rs.90, find the annual interest rate.
   (iv) Kamal who was planning to buy a similar printing machine, takes a loan amount equal to the value of the printing machine under a monthly simple interest rate of 1% to be paid back within 9 months.
   State with reasons who has to pay more in these two transactions of Amal and Kamal.

2. Kapila observes the top of a vertical pillar anchored on horizontal ground, from a point 150 m away from the bottom of the pillar. From that point the angle of elevation is $32^0\ 20'$.
   A supporting tight wire of length 120 m is attached to the top of the pillar, and the other end is connected to a point P which lies on the horizontal ground in the same straight line connecting the bottom of the pillar and the point where Kapila stands. The point P lies in between the pillar and Kapila.
   By using trigonometric ratios, show that the angle of elevation of the wire to the horizontal level is 52^0 to the nearest degree. (Ignore the height of Kapila.)

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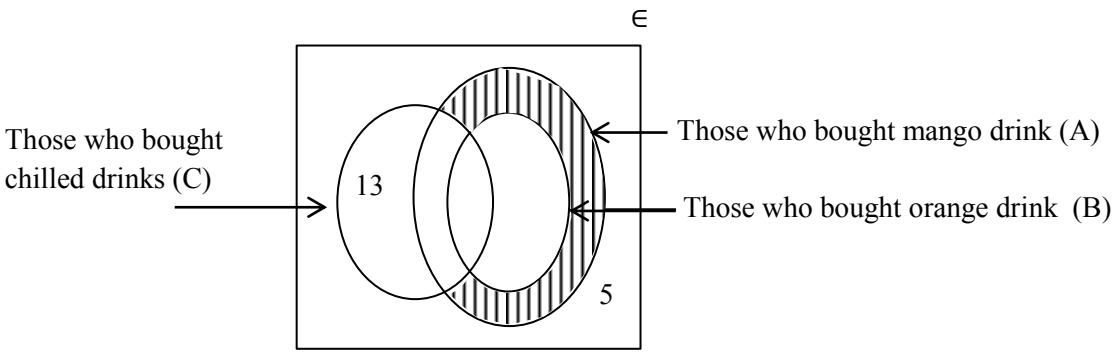
3. Following is an incomplete Venn diagram showing the number of customers who bought different types of fruit drinks from a fruit juice bar on a certain day.



"36 out of those who came to the shop bought mango drinks and 25 out of them bought orange drinks. Out of the 46 who bought chilled drinks, 24 had bought mango and orange drinks."

(i) Copy the given Venn diagram and insert the above data.
(ii) How many customers bought fruit drinks on this day ?
(iii) How many of the customers bought mango drinks, which are **not chilled** ?
(iv) Express the shaded region of the Venn diagram in set notation.
(v) Show that the total percentage of customers who bought only orange juice and mango juice which are not chilled is 50%.

4. Following is an incomplete table of values prepared to draw the graph of the function $y = (x + 1)^2 - 5$.

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

(i) Find the value of y corresponding to x = -1 and using the scale of 10 small divisions as one unit along both axes x and y, draw the graph of the above function on a graph paper.

Answer the following questions **using the graph.**

(ii) Find the range of values of x such that y is increasing and $-1 < y < 3$.
(iii) If the graph is shifted vertically up by one unit, express the new equation, in the form of $y = (x + a)(x + b)$ and show that the product ab is a negative value.
(iv) If the graph in (iii) is shifted vertically up, find the minimum number of units by which it is to be shifted for the product ab to be zero.

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5. Ramesh expects to paint the surface of a sphere of radius $(2x - 1)$. The cost of painting is Rs. 3.50 per $1cm^2$. If the total cost of painting the whole surface of the sphere is Rs. 1 232 build up a quadratic equation in terms of x and by solving it find the value of x to the first decimal place.

(The surface area of a sphere of radius r is $4\pi r^2$. Take $\pi = \frac{22}{7}$ and $\sqrt{7} = 2.64$)

6. (a) The three matrices *A*, *B* and *C* are as follows.

$$A = \begin{pmatrix} 3x & 1 & 5 \\ 0 & 2x & -3 \end{pmatrix},\ B = \begin{pmatrix} y & 0 & -4 \\ 1 & -3y & 2 \end{pmatrix},\ C = \begin{pmatrix} 31 & 2 & 6 \\ 1 & 17 & -4 \end{pmatrix}$$

(i) Write the matrix 2*A*.

(ii) If $2A + B = C$ build up a pair of simultaneous equations using the matrices.

(iii) Solve the pair of simultaneous equations obtained, and find x and y.

(b) If $P = \begin{pmatrix} 3 & 0 \\ -2 & 1 \end{pmatrix},\ Q = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$;

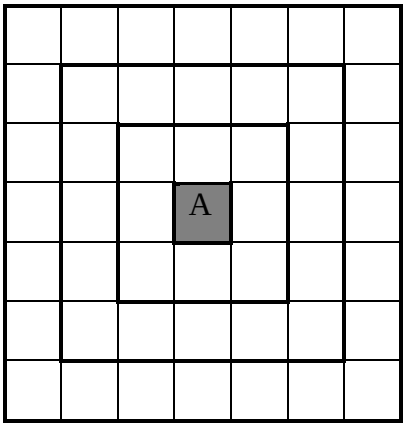
(i) Write the order of the product PQ using the orders of the matrices P and Q.

(ii) Find the matrix PQ.

Part B

Answer five questions only.

7. (a) The tile A is placed in the exact middle of a square shaped floor of a house, and there are similar tiles of same area placed around it. The diagram shows the first three rounds of tiles placed around A. If the total number of tiles placed on the floor is 440, using formulae related to arithmetic progression, find the number of square shaped rounds the tiles are placed around A.



(b) Find the common ratio of a geometric progression, where the first term is 2 and eighth term is $\frac{1}{64}$.

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8. (a) The radius of a straight solid cylindrical metal piece, is r and the height of it is three times its' radius.

(i) Express the height of the cylinder in terms of r.

A straight solid cone of base radius $\frac{r}{2}$ is made by melting the above metal piece without any wastage.

(ii) Show that the height of the cone is 72 times its' base radius.

(iii) If the volume of the cone is v show that $r = \sqrt[3]{\frac{v}{3\pi}}$

(iv) When the volume of the cone $v = 450(cubic\ units)$ and $3\pi = 9.42$

find the radius of the cone using logarithms table.

9. Following is a table of data collected from a sample of 50 students out of 300 students who travel in 20 school vans, on the monthly amounts paid by them as school van fee.

Amount paid as van fee (in Rupees)	Number of students
0 - 1000	1
1 000 - 2 000	2
2 000 – 3 000	10
3 000 – 4 000	12
4 000 - 5 000	10
5 000 – 6 000	8
6 000 – 7 000	7

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(i) By taking the mid value of the modal class interval as the assumed mean or by using any other method, find the mean amount paid by a student as school van fee per month.

(ii) Estimate the total amount paid for a month as school van fee by all the students who travel in school vans.

It was found out that if 6 school buses were used instead of the school vans, the estimated
travelling cost reduces by Rs. 300 000.

(iii) Then by how much will the average monthly transport cost of each student reduce ?

(iv) From the next month onwards the school bus fee is to rise by 10% . State with reasons whether it is still advantageous to use school buses, than the school vans for transport.

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10. Do the following construction using only a straight edge with a cm/mm scale and compass. Show the construction lines clearly.

    (i) Construct the triangle *ABC* such that *AB* = 7 cm, $A\hat{B}C = 60^0$ and *BC* = 6 cm.

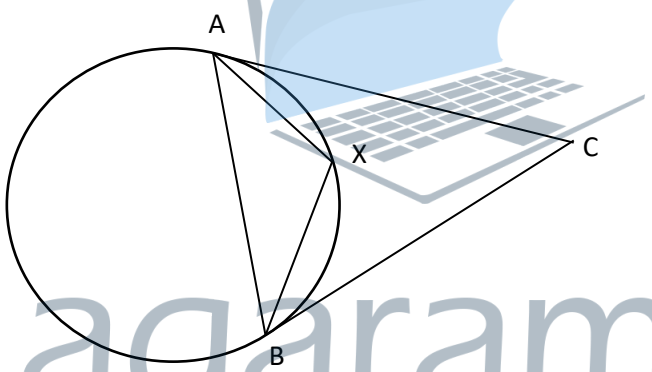
    (ii) Construct the straight line through *C*, parallel to *BA* and find the point *D* to complete the *ABCD* parallelogram.

    (iii) Construct the circle which touches straight line *AB* at A and goes through the point *D*.

    (iv) Construct a tangent to the circle at *D* and mark the point that the tangent meets the extended *BA*, as *E*.

    (v) According to the lengths of the sides of *ADE*, show with reasons, what type of a triangle *ADE* is.

11. *AB* is a chord of a circle. The tangents drawn to the circle at points *A* and *B* meet at *C*. The point *X* lies on the smaller arc separated by *AB*.
Show that $A\hat{C}B = 2A\hat{X}B - 180°$.



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12. The mid points of sides AB and BC of triangle ABC are E and F respectively. The lines AF and CE intersect at G. The point D lies on extended BG such that $BG = GD$.

    i. Express two geometrical relationships between the line segments GE and AD.

    ii Show that $AGCD$ is a parallelogram.

    iii. The lines BD and AC intersect at P. Express the reason why $AP = PC$.

    iv. Show that $BP = \frac{3}{4} BD$.