

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
 இலங்கைப் பரீட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம்
 Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka
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 கல்விப் பொதுத் தராதரப் பத்திர (சாதாரண தர)ப் பரீட்சை, 2015 டிசம்பர்
General Certificate of Education (Ord. Level) Examination, December 2015

ගණිතය **I**
 கணிதம் **I**
Mathematics I

පැය දෙකයි
 இரண்டு மணித்தியாலம்
Two hours

Index Number:

Certified correct

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Signature of invigilator

Important:

- * This question paper consists of **8** pages.
- * Write your **Index Number** correctly in the appropriate places on **this page** and on **page three**.
- * Answer **all** questions on **this paper itself**.
- * Use the space provided under each question for working and writing the answer.
- * It is necessary to indicate the **relevant steps** and the **correct units** in answering the questions.
- * Marks will be awarded as follows:
 In **Part A**
 1 mark for each question from **1** to **10**
 2 marks for each question from **11** to **30**.
 In **Part B**
 10 marks for each question.
- * A blank paper can be obtained for scratch work from an invigilator on request.

For marking examiners' use only		
Question Numbers		Marks
A	1 - 10	
	11 - 30	
B	1	
	2	
	3	
	4	
	5	
Total		
..... <i>Marked by</i>	 <i>Code Number</i>
..... <i>Checked by</i>	 <i>Code Number</i>
..... <i>Marks checked by</i>	 <i>Code Number</i>
..... <i>Chief Examiner</i>	 <i>Code Number</i>

[see page two

Part A*Answer all questions on this paper itself.*

1. Express 2 000 metres in kilometres.

2. Solve: $5x = 20$

3. Simplify: $5a \times a^2$

4. Find 60% of Rs 20.

5. If $A = \{\text{integer multiples of } 2\}$ and $B = \{\text{integer multiples of } 3\}$, then write down one element of $A \cap B$.

6. Write down 101_{two} in base ten.

7. Make p the subject of the formula $pq - r = u$.

8. Simplify: $\log_3 9$

9. Find the time taken by a vehicle travelling at a uniform speed of 100 kilometres per hour to travel a distance of 25 kilometres.

10. If the sum of two interior angles of a triangle is 100° , write down the magnitude of the remaining interior angle in degrees.

[see page three]

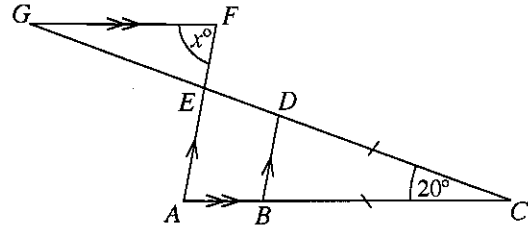
11. The profit made by a trading company on Sunday is 20% more than the profit made on Monday. If the profit on Monday is Rs 8 000, then find the profit on Sunday.
-
12. Find the least common multiple of the two algebraic expressions $x(x + 2)$ and x^2 .
-
13. Find the factors: $x^2 + 3x - 10$
-
14. If the two events A and B are mutually exclusive and $P(A) = P(B) = \frac{1}{5}$, then find $P((A \cup B)')$.
-
15. The first Rs 500 000 of the annual income of a person is free of income tax and the next Rs 500 000 is subject to 4% income tax. Find the income tax that should be paid by a person who earns an annual income of Rs 600 000.
-
16. If a bank pays an annual compound interest rate of 10%, find the total amount of money at the end of two years, in an account opened with a deposit of Rs 100 in this bank.
-
17. The second and third terms of a geometric progression are 6 and 18 respectively. Find its
- (i) common ratio
- (ii) first term.

[see page four]

18. Solve the inequality $1 - 2x \leq 7$.

19. If the straight line given by the equation $y = 2x + c$ passes through the point $(1, 5)$, then find the value of c .

20. Using the information given in the figure, find the value of x .



21. Given that $\begin{pmatrix} -1 & 0 \\ x & y \end{pmatrix} + \begin{pmatrix} 3 & 2 \\ 0 & x \end{pmatrix} = 2 \begin{pmatrix} 1 & 1 \\ 2 & 6 \end{pmatrix}$, find the values of x and y .

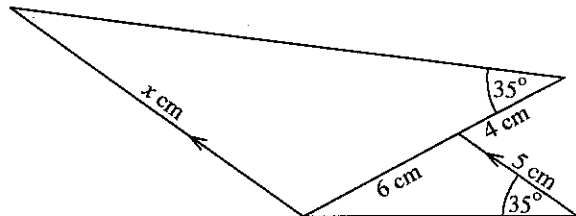


22. The circumference of the base of a cone is 16π centimetres. Find

(i) the radius of the base

(ii) the perpendicular height if the slant height is 10 cm.

23. Using the knowledge on equi-angular triangles and the information given in the figure, find the value of x .



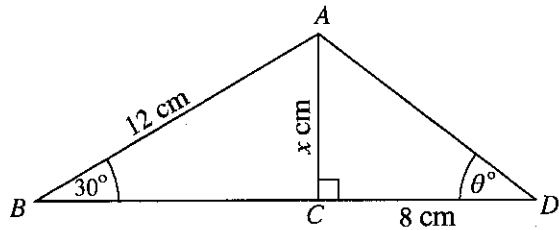
24. Write down an expression, in terms of n , for the sum of the first n terms of a geometric progression whose first term is 1 and common ratio is 2.

[see page five]

25. Using the information given in the figure and the fact that $\sin 30^\circ = \frac{1}{2}$, find

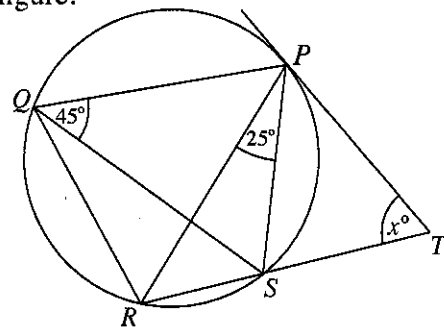
(i) the value of x .

(ii) the value of $\tan \theta^\circ$.



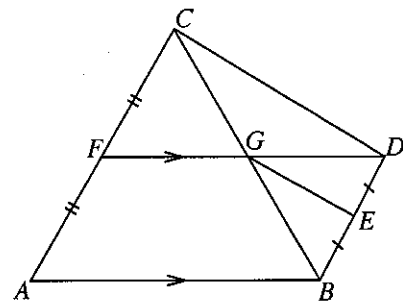
26. Considering the expansion of $(x - y)^3$, find the value of $2(24^3 - 3 \times 24^2 \times 4 + 3 \times 24 \times 4^2 - 4^3)$.

27. A tangent is drawn to the circle at P as shown in the figure. Using the given information, find the value of x .

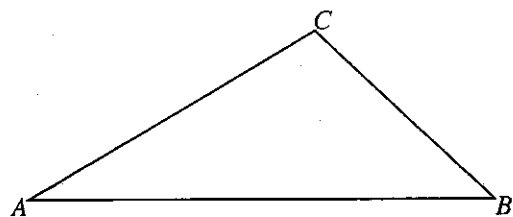


28. The surface area of a solid sphere of radius 2 cm is $A \text{ cm}^2$. The area of the curved surface of a solid cylinder of radius and height 2 cm each is $B \text{ cm}^2$. Find the value of $\frac{A}{B}$. (The surface area of a solid sphere of radius r is $4\pi r^2$ and the area of the curved surface of a solid cylinder of radius r and height h is $2\pi rh$.)

29. In the figure, the area of triangle ABC is twice that of triangle BCD . Using the given information, find the ratio of the area of triangle CFG to the area of triangle BEG .



30. In triangle ABC shown in the figure, draw a sketch of the construction lines required to locate the point D on AB such that $DB = DC$.



[see page six

Part B

Answer all questions on this paper itself.

1. Ananda had a small library. $\frac{1}{6}$ of the books in the library were children's story books and $\frac{1}{4}$ were literature books. Ananda donated these children's story books and literature books to the village school.

(i) Find what fraction of the total number of books was donated.

The number of books donated was 150.

(ii) Find the total number of books that were originally in the library.

Of the remaining books, Ananda gave 60 to a neighbour.

(iii) Find what fraction of the total number of books that were originally in the library was given to the neighbour.

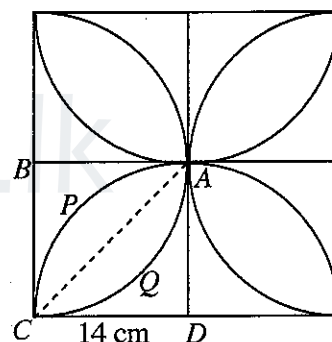
After giving to the neighbour, Ananda sold $\frac{3}{5}$ of the remaining books.

(iv) Find what fraction of the total number of books that were originally in the library was sold.

2. A wall decoration, consisting of four equal parts, is shown in the figure. One of the parts is a square $ABCD$, with each side 14 cm long, containing a petal-like shape $APCQ$. Here, $APCD$ and $AQCB$ are sectors with centres D and B respectively.

In the following calculations, take the value of π as $\frac{22}{7}$ wherever necessary.

- (i) Find the area of the triangle ABC .
- (ii) Find the area of the sector $AQCB$.
- (iii) Find the area of the petal-like shape $APCQ$.
- (iv) Find the perimeter of the composite figure consisting of only the four petal-like shapes.
- (v) If it is needed to attach beads along the boundary of the composite figure considered in part (iv) above, starting from the point A , and lying 5.5 cm apart when measured along the boundary, find the required number of beads.



[see page seven

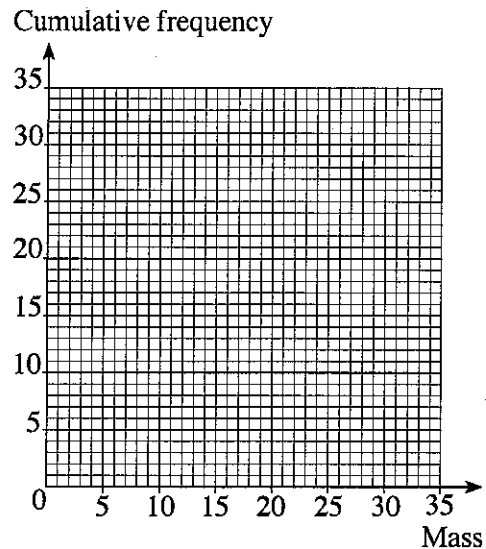
3. An incomplete table containing information on the masses (in kg) of children brought to a clinic is shown below.

Class interval (mass)	5 – 10	10 – 15	15 – 20	20 – 25	25 – 30	30 – 35
Frequency (number of children)	2	5	8	8	6	3
Cumulative frequency	2	7				32

- (i) Complete the cumulative frequency row of the table.
 (ii) Using the table, draw the cumulative frequency curve on the given coordinate plane.

Using the cumulative frequency curve, find the following:

- (iii) median
 (iv) first quartile, third quartile and the interquartile range
 (v) the number of children whose mass is 24 kg or more.



4. (a) The ratio of the income from apparel exports to the income from tea exports in Sri Lanka was 10 : 3 in 2006.

- (i) In 2006, if the income from tea exports was 90 billion rupees, then find the income from apparel exports in billions of rupees.

During the same year, the income from gem exports was 260 billion rupees less than the income from apparel exports.

- (ii) Find, in the simplest form, the ratio of the export incomes from tea to apparels to gems.

- (b) The food stock at a camp is sufficient for 15 days for the 60 soldiers stationed there. After 3 days, 20 more soldiers join the camp.

- (i) Find for how many days the remaining stock of food is sufficient for the 80 soldiers.

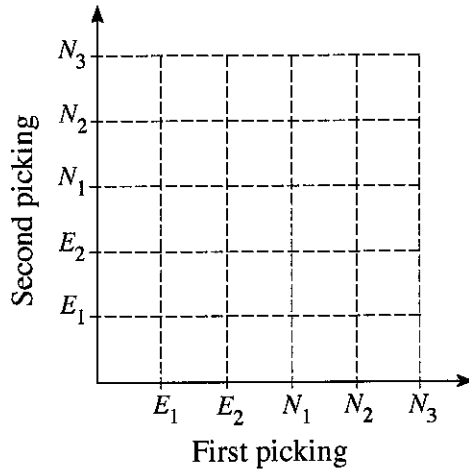
After 2 more days, the camp receives a stock of food sufficient for 10 soldiers for 16 days.

- (ii) Find for how many days the total stock of food in the camp at present would be sufficient for the 80 soldiers.

[see page eight

5. In a box, there are 5 bottles of fruit juice of the same type and size. Of them, 2 are expired and the other 3 are nearly expired. A lab assistant picks a bottle from the box randomly and **without replacement**, he picks another bottle randomly.

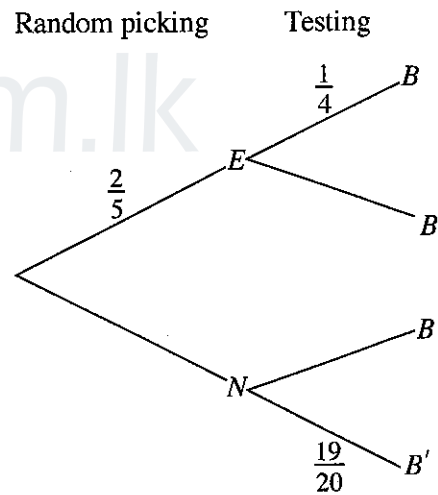
An incomplete grid prepared to represent the sample space relevant to this random experiment is given in the figure. Here E_1 and E_2 denote the expired bottles and N_1, N_2 and N_3 denote the nearly expired bottles.



- (i) Indicate the sample space in the grid using the mark 'x'.
- (ii) In the grid, enclose the event of "the two bottles picked being expired", and find its probability.

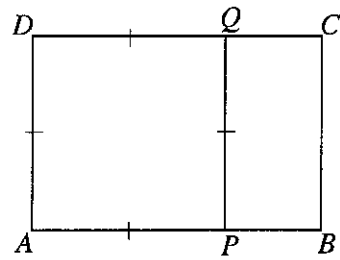
The assistant replaces both bottles in the box. After that, a researcher picks a bottle randomly from the same box and tests the juice in it for the presence of a certain bacteria.

An incomplete tree diagram relevant to this random experiment is shown in the figure below, where E denotes the bottle being expired, N denotes the bottle being nearly expired, B denotes the presence of the bacteria and B' denotes the absence of the bacteria.



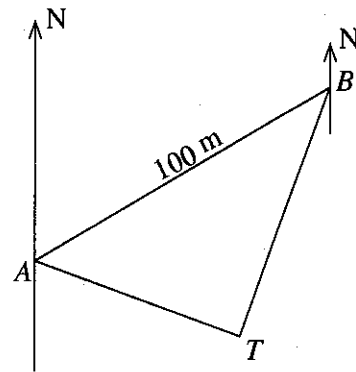
- (iii) Write down the relevant probabilities in the tree diagram.
- (iv) Find the probability that the juice in the bottle picked contains the bacteria.

3. In the rectangle $ABCD$ given in the figure, $AB = 3x + 2$ cm and $AD = x + 3$ cm. It is given that $APQD$ is a square.



- (i) Show that $PB = 2x - 1$ cm.
- (ii) It is given that $\frac{AB}{AD} = \frac{PQ}{PB}$. Show that $5x^2 - 5x - 11 = 0$.
- (iii) Using the formula or by any other method, show that $x = \frac{5 \pm 7\sqrt{5}}{10}$.
- (iv) By substituting the solution $x = \frac{5 - 7\sqrt{5}}{10}$ in the expression in part (i) above for the length of PB , show that this solution is **not** suitable.

4. A rough sketch of a horizontal ground is shown in the figure. The bearing of the tree T from location A is 110° . Location B is at a distance of 100 metres from A , on a bearing of 060° . Moreover, the bearing of T from B is 200° .



- (i) Copy the figure and calculate the magnitudes of \hat{BAT} and \hat{ABT} .
- (ii) Show that $\hat{ATB} = 90^\circ$.
- (iii) Using the trigonometric tables, calculate the distance from B to T .
- The well W is located on the line AT such that $WT = 40$ m.
- (iv) Using the trigonometric tables, calculate the magnitude of \hat{BWT} .

5. The students in a hostel are to get new uniforms. Each girl is to receive a blouse and a skirt, and each boy is to receive a shirt and a pair of trousers. 1 metre of white material is required to sew a blouse and $1\frac{1}{2}$ metres of white material is required to sew a shirt. Moreover, $1\frac{1}{2}$ metres of blue material is required to sew a skirt and 2 metres of blue material is required to sew a pair of trousers. The total amount of white material required is 72 metres and the total amount of blue material required is 100 metres.

- (i) Taking the number of girls as x and the number of boys as y , construct a pair of simultaneous equations in x and y .
- (ii) Solve the pair of simultaneous equations and find the number of girls and the number of boys in the hostel.
- (iii) The sewing cost for m number of blouses is Rs 750 and the sewing cost for $2m$ number of skirts is Rs 1125. Write down an expression for the sewing cost of a girl's uniform in terms of m and simplify it.
6. (a) A right circular cylindrical container made from a thin material, of height 21 cm and radius 6 cm, is filled with water up to a height of 14 cm. Take the value of π as $\frac{22}{7}$ in the following calculations.
- (i) Find the volume of the empty space in the container.
- (ii) If 44 cm^3 of water spills over when a solid spherical object is immersed completely in the water of the container, then show that the radius of the spherical object is $\sqrt[3]{199.5}$ centimetres.

- (b) Using the logarithms table, find the value of $\frac{\sqrt[3]{5}}{0.871}$.

[see page three

Part B*Answer five questions only.*

7. Isuri starts saving money by depositing Rs 5 in her till on the first day. After that, every day, she deposits Rs 2 more than the amount she deposited in the till on the previous day.

(i) Write, in terms of n , an expression for T_n , the amount of money Isuri deposits in the till on the n^{th} day, and thereby find the amount of money she deposits in the till on the 26th day.

(ii) Write, in terms of n , an expression for S_n , the total amount of money in the till at the end of the n^{th} day and by simplifying it, show that $S_n = n(n + 4)$.

(iii) Show that the amount of money in the till at the end of the 26th day is Rs 780.

In order that the amount of money in the till at the end of the 30th day is Rs 1100, Isuri deposits, from the 27th day, x rupees more than the amount deposited on the previous day.

(iv) Write down an equation in x and find the value of x by solving it.

8. ABC is an equilateral triangle with the length of each side 6 cm.

Use only a straight edge with a cm/mm scale and a pair of compasses for the following constructions. Show your construction lines clearly.

(i) Construct the triangle ABC .

(ii) Construct the angle bisector of \hat{BAC} and mark the point it meets BC as D .

(iii) Construct the perpendicular from D to AC and mark its foot as E .

(iv) Construct the circle with centre D , which touches the line AC .

(v) Construct a tangent to this circle from C (other than AC), and mark the point it meets AD produced as F .

(vi) Join B and F , and give reasons why $ABFC$ is a rhombus.

9. A frequency distribution containing information on the tickets issued to passengers during a morning trip of a bus is shown in the table below.

Price of a ticket (Rs)	8 - 12	12 - 16	16 - 20	20 - 24	24 - 28	28 - 32
Number of tickets	6	7	13	17	13	8

(i) Write down the modal class of the distribution.

(ii) Find the mean price of the tickets issued.

(iii) Find the expected income from a morning trip in which tickets are issued to 180 passengers.

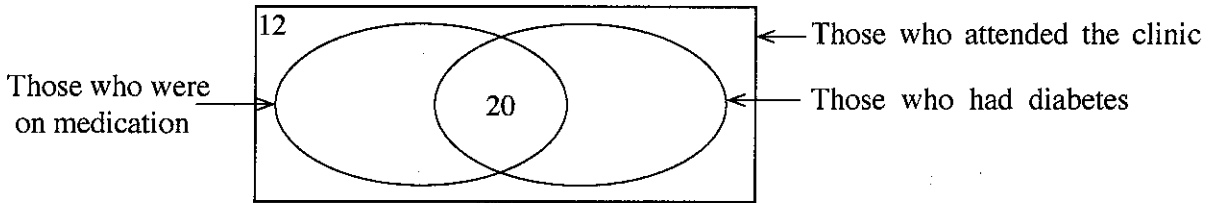
(iv) Assuming that the total expenditure including fuel is Rs 700 for a morning trip, estimate the minimum number of tickets that should be issued to make a profit from such a trip.

[see page four]

10. It was revealed that out of 40 persons who visited a medical clinic, 20 had heart diseases and 25 had diabetes. All those who had heart diseases and all those who had diabetes suffered from stress too. 3 persons suffered from stress only and 4 persons did not suffer from stress.

- (i) Draw a Venn diagram to depict this information and write down in it, the number of elements belonging to each region.
- (ii) How many persons had diabetes but did not have heart diseases?

Among the 40 persons who visited the clinic, there were persons who were on medication and those who were not on medication as well. An incomplete Venn diagram drawn using this information too is shown below.



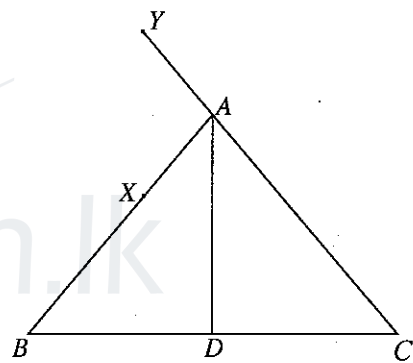
- (iii) Copy the Venn diagram given above and write down the values relevant to the two empty regions in it.
- (iv) How many persons had diabetes but were not on medication?

11. In the given figure, $\hat{A}BC = \hat{A}CB$, X is a point on AB and Y is a point on CA produced such that $AY = AX$. The angle bisector of $\hat{B}AC$ meets BC at D .

- (i) Copy the figure and indicate the information given above in it.
- (ii) Show that $\triangle ABD \equiv \triangle ADC$.

YX produced meets BD at E .

- (iii) Show that $\hat{X}YA = \hat{B}XE$.
- (iv) Show that $\hat{B}EX = \hat{B}XE + \hat{E}BX$.
- (v) Show that $XE \parallel AD$.



12. In the given figure, AB is a chord of the circle with centre O . The point C is on AB produced such that $OB = BC$. The line BO produced meets the circle again at X . The tangents drawn to the circle at A and B meet at D . DB produced meets OC at E .

If $\hat{A}XO = x^\circ$, giving reasons, find the following angles in terms of x .

- (i) $\hat{A}OB$
- (ii) $\hat{O}BA$
- (iii) $\hat{B}OD$
- (iv) $\hat{B}OE$
- (v) $\hat{B}EO$

By using the angles obtained in the above parts,

- (vi) show that ODE is an isosceles triangle.

