Model Examination SSLC 2022-2023
## Mathematics

Score 80

2 hours 30 minutes

Instructions

* ★ 15 minutes extra time should be treated as cool-off time . This time should be utilized for reading the questions and planning the answers

* ★ Not necessary to simplify using the approximate value of irrational numbers like $\sqrt{2}, \sqrt{3}.\pi$ unless it is asked to do so.

* ★ Read the instructions of each section carefully .

Questions from 1 to 4 carries two scores. Answer any three. $3 \times 2 = 6$

1) Sum of a number and its square is 0.

    a) If x stands for the number then write the equation

    b) What is the number?

2) Consider the sequence of first n even numbers.

    a) What is the mean of these numbers?

    b) If the median of first n even numbers is 78 then what is n?

3) The lines $y = 3$ and $y = x$ intersect at P

    a) What are the co-ordinates of P

    b) What is the equation of the circle centerd origin and passing through P

4) In the figure O is the center of the incircle of triangle $ABC.\angle OBC = 20°, \angle OCB = 30°$
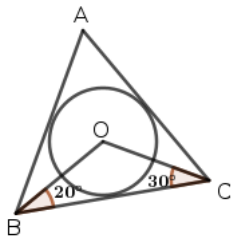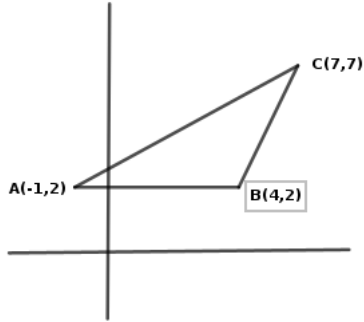

    a) What is the measure of $\angle BOC$?

    b) What is the measure of $\angle A$?

**Questions from 5 to 11 carries three scores. Answer any five .** $5 \times 3 = 15$

5) The slant height of a square pyramid is 13 and total surface area 360 sq.cm
If the base edge is x then

    a) Write the second degree equation connecting the given measurements

    b) Find the base edge

6) The vertices of triangle ABC are marked in the figure.

- a) Find the length of side AB
- b) What is the altitude from C to AB?
- c) Calculate the area of triangle ABC

7) In the figure O is the center of the circle and $\angle APB = 30°$
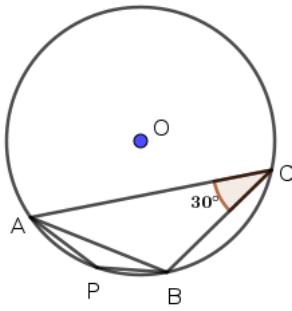
- a) What is the central angle of arcAPB?
- b) If the radius of the circle is 8cm then what is the length of chord AB?
- c) What is the measure of $\angle APB$?

8) In the figure BP is $\frac{1}{3}$ of BC and O is the mid point of AP.
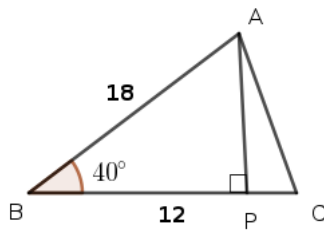The region AOC is shaded .
A fine dot is placed into the figure at random. What is the probability of falling the dot in the shaded part?
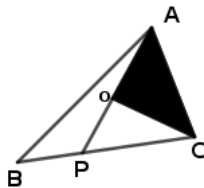
9) Draw a rectangle of sides 6cm and 2cm . Construct a square having the area of the rectangle.

10) In triangle ABC , $\angle B = 40°, BA = 18, BC = 12$
AP is perpendicular to BC.

$\sin 40 = 0.64, \cos 40 = 0.76, \tan 40 = 0.83$

   a) What is the length of AP?
   b) Find the area of the triangle .

11) $p(x) = ax^3 + bx^2 + cx + d$ is a third degree polynomial.
$p(x)$ has a second degree factor $x^2 - 1$

   a) What are the two first degree factors of $p(x)$?
   b) What is $a + b + c + d$?

Questions from 12 to 20 carries four scores. Answer any six . $6 \times 4 = 24$

12) Draw an equilateral triangle of side 4cm. Construct the circle which touches all sides of the triangle inside.

13) The scores of 45 students of a class are tabulated below

Scores	Number of children
$0 - 10$	5
$10 - 20$	11
$20 - 30$	10
$30 - 40$	12
$40 - 50$	7

   a) At what position the median score occurs in the arrangement?
   •]b)]What is the score of 17 th student according to the assumption of calculating median?
   c) What is the basic assumption of calculating median ?
   d) Find the median mark .

14) Arjun wants to participate in a 100 m race.He can run that distance in the first day of practice in 51 seconds.With each day of practice it takes him 2 seconds less.He wants to do in 31 seconds .

   a) Write the running times in each day as a sequence
   b) How much times he takes to complete the run in 5 th day?
   c) What is the minimum number of days he needs to practice to attain the goal?

15) In the figure AD and BC are tangents common to both circles .M and N are the centers and $\angle APB = 40°$
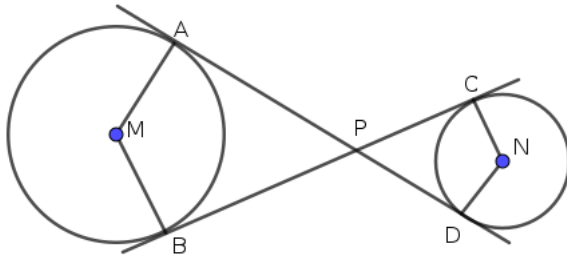
   a) Name the lines of equal length in the figure.

   b) Prove that $AD = BC$

   c) Find the measure of $\angle APB$ and $\angle CPD$

16) As observed from the top of a 100 high light house from the sea level , the angles of depressions of two ships are $30°$ and $45°$. If one ship is exactly behind the other on the same side of the light house.

   a) Draw a suitable diagram to illustrate the situation

   b) Find the distance between two ships.

  (Use the approximate value $\sqrt{3} = 1.73$ for simplification)

17) $P(4, 4)$ is a point on the circle with center origin.
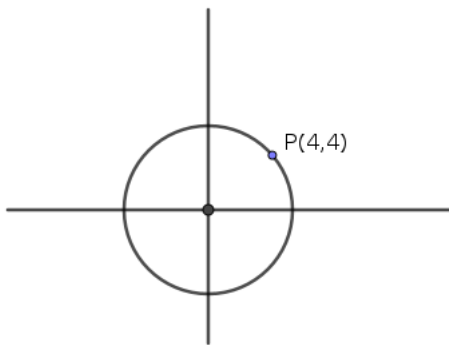
   a) What is the radius of the circle?

   b) What are the co-ordinates of the points the circle cut the axes

   c) Write the equation of this circle.

18) A sphere of largest size is carved from a wooden cube of side 10cm

   a) What is the radius of the sphere ?

   b) Find the surface area of the sphere so formed

   c) The sphere is cut into two hemispheres. What is the surface area of one hemisphere.

19) A rectangular plot of land has larger side 8 meter more than twice the smaller side.Area of the land is 504 sq.meter

   a) If the smaller side is x then what is the other side?

   b) Find the length of the sides.

   c) How much money is needed to make wall along the sides at the rate of 200 rupees per meter?

**20)** $ABCD$ is a trapezium in which vertices are on a circle and AB parallel to CD
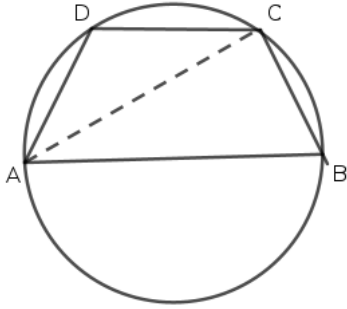
AB is the diameter of the circle and AC is diagonal.

    a) Prove that $ABCD$ is an isosceles trapezium

    b) If $\angle A = 40°$ then what are the other angles of the trapezium ?

    c) What is the measure of $\angle ACD$?

Questions from 21 to 29 carries seven scores. Answer any seven . $7 \times 5 = 35$

21) In the first figure you can see a tangent PA from outer point P to the circle with center O. In the second figure OP is the diameter of a semicircle and A is a point on the semicircle.
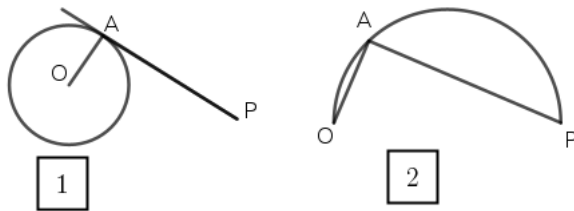
    a) What is the measure of $\angle OAP$ in both diagrams

    b) Draw a circle of radius 3cm, mark a point P at the distance 7cm from the center .Construct tangents from P to the circle.

    c) Write the length of tangent by measuring it .

**22)** Manju draws a right triangle in a graph sheet
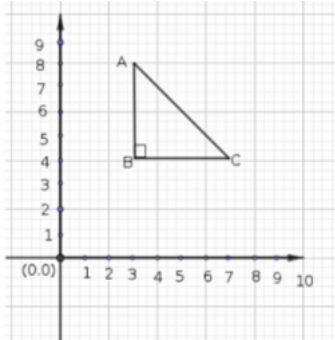
    a) Write the co-ordinates of the vertices.

    b) What is the length of each side

    c) Find the center and radius of the circle passing through the vertices of the triangle.

23) The difference between fifth term and first term of an increasing arithmetic sequence is 16.Third term is 19

a) What is the difference between second term and sixth term of this sequence?

b) What is 7 th term?

c) What is the common difference of this sequence ?

d) Write the algebraic form of the sequence.

24) Two circles touch externally as shown in the figure.
Radius of big circle is 1 more than three times the radius of the small circle.Sum of the areas of these circles is 53π
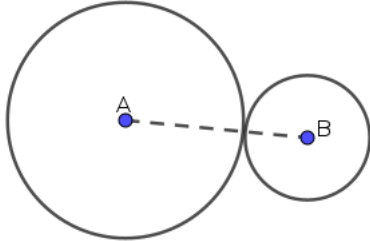
a) If x is the radius of small circle then form an equation.

b) Find the radii of the circles.

c) What is the distance between the centers.

25) A circular sheet of radius 12cm is cut into three sectors of central angles in the ratio $1 : 2 : 3$.
Central angles of the sectoral sheets are $60°, 120°$ and $180°$.
Each of them is rolled into cones.

a) All cones so formed have a common measure 'slant height'. What is the slant height?

b) Find the base radii of cones

c) What is the relation between the radii of the cones and radius of the circular sheet?

26) From the top of a 7 meter building the angle of elevation of the top of a light house is $60°$ and angle of depression of the foot of the light house is $32°$.

a) Draw a diagram

b) What is the difference between the building and light house?

c) Find the height of the light house.

$(\sin 32 = 0.52, \cos 32 = 0.84, \tan 32 = 0.62)$

27) The lines $y = 7$ and $y = -1$ touches the circle at $A(4, 7)$ and $B(x, y)$ with reference to the co-ordinate axes shown in the figure
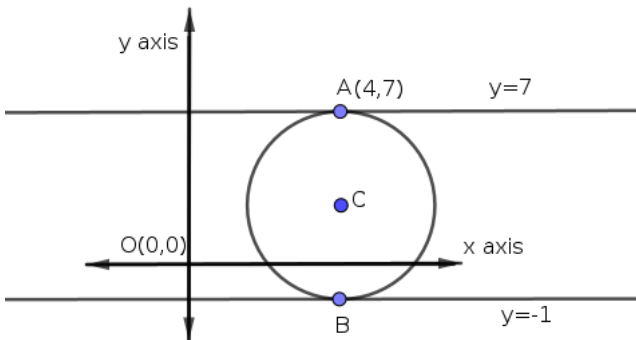
a) Write the co-ordinates of B

a) What is the radius of the circle.

b) Find the co-ordinates of the center of the circle.

c) Write the equation of this circle.

28) The second degree polynomial $p(x) = x^2 + 4x - 21$ is written as
$p(x) = (x + a)(x + b) = x^2 + (a + b)x + ab$

a) What is $a + b$ and ab

b) Find a and b . Write the polynomial as the product of two first degree factors.

c) Find the solution of the equation $x^2 + 4x - 21 = 0$

29) Consider the numbers $0, 1, 2, 3 \cdots 20$. Teacher asked the students to write these numbers into 7 groups , each group contains 3 numbers.
Sum of numbers in a group is called 'group sum'
All the seven group sums should be consecutive natural numbers.

a) If the first group sum is n then what are other six group sums ?

b) What is $7n + 21$?

c) Find n and write group sums.

d) Write the group of numbers .First group is $0, 7, 20)$

Model Examination SSLC 2022-2023
# Mathematics

Score 80

2 hours 30 minutes

Questions from 1 to 4 carries two scores. Answer any three. $3 \times 2 = 6$

1) a) $x^2 + x = 0$

   b) $x = -1$

2) a) $\frac{n(n+1)}{n} = n + 1$

   b) This is an arithemtic sequence. Mean and median are equal. So median is $n + 1$
   $n + 1 = 78, n = 77$.
   77 numbers are considered.

3) a) $P(3,3)$

   b) Radius of the circle is $3\sqrt{2}$
   Equation is $x^2 + y^2 = (3\sqrt{2})^2$
   $x^2 + y^2 = 18$

4) a) $\angle BOC = 180 - (20 + 30) = 130°$

   b) Since the circle touches the sides we bisect the angles for construction. $\angle B = 40°, \angle C = 60°$.
   So $\angle A = 80°$

Questions from 5 to 11 carries two scores. Answer any five . $5 \times 3 = 15$

5) a) Total surface area $= a^2 + 2al$
   $x^2 + 26x = 360$

   b) $x^2 + 26x + 169 = 360 + 169$
   $x^2 + 26x + 169 = 529, (x + 13)^2 = 23^2, x + 13 = 20, x = 10$cm

6) a) $\mid 4 - (-1) \mid = 5$

   b) Altitude $= \mid 7 - 2 \mid = 5$

   c) Area $= \frac{1}{2} \times 5 \times 5 = \frac{25}{2}$

7) a) $60°$

   b) Since triangle formed by joining O to A and B is an equilateral triangle. $AB = 8$cm

   c) $\angle APB = 180 - 30 = 150°$

8) ★ Area of triangle APB is $\frac{1}{3}$ of triangle APC.

   ★ So $\triangle APC$ has area $\frac{2}{3}$ of triangle ABC.

   ★ Since O is the mid point of AP, area of $\triangle COA$ and area of $\triangle COP$ are equal.

   ★ Probability is $\frac{1}{3}$

8

9) Construction
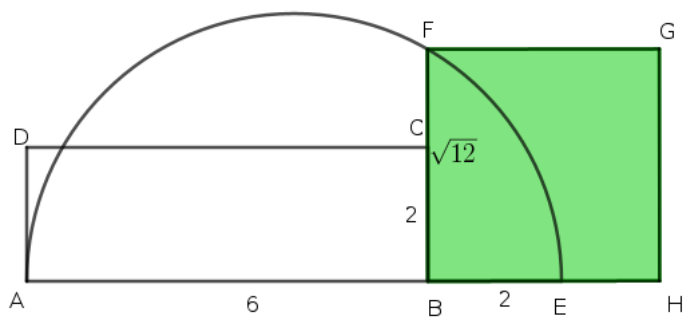
* ★ Draw rectangle $ABCD$ with $AB = 6$ and $BC = 2$cm
* ★ Produce AB to E such that $BC = BE$. Draw a semicircle with AE as the diameter
* ★ Produce BC to F in the semicircle. $BF^2 = AB \times BE$
  $BF^2 6 \times 2 = 12$
* ★ Draw square $BFGH$ .Area of this square is 12, equal to area of rectangle.

10)   a) In triangle APB, $\sin 40 = \frac{AP}{18}$, $AP = 18 \times 0.64 = 11.52$cm

       b) Area of triangle $ABC = \frac{1}{2} \times 12 \times 11.52 = 69.12$ sq.cm

11)   a) $x^2 - 1 = (x - 1)(x + 1)$. Two first degree factors are $x - 1$ and $x + 1$

       b) Since $x - 1$ is a factor $p(1) = 0$
  $a \times 1^3 + b \times 1^2 + c \times 1 + d = 0$
  $a + b + c + d = 0$

Questions from 12 to 20 carries four scores. Answer any six . $6 \times 4 = 28$

12)   ★ Draw the triangle

       ★ Bisect the angles (two angles) and mark the intersecting point of bisectors as$O$

       ★ Draw perpendicular ftom O to one of the sides. Take this perpendicular distance as the radius and O as center , draw the circle.

13) Table for calculating median

Scores	Number of children
Below 10	5
Below 20	16
Below 30	26
Below 40	28
Below 50	45

    a) $n = 45$, Number of students is odd
  $\frac{45+1}{2}$ th score comes in the middle.
  23 rd score is the median.

    b) $20 - 30$ is the median class.10 scores are divided equally among 10 students each one's score is 1.
  $1 = \frac{1}{2} + \frac{1}{2}$
  Score of 17 th student is $20 + \frac{1}{2} = 20.5$

    c) Assuming that the distribution of scores in the median class are in arithmetic sequence.
  $f = 20.5, d = 1$

d) 23 rd score is 7 th term of the arithmetic sequence. It is the median
Median $= f + 6d = 20.5 + 6 \times 1 = 26.5$

14)   a) $51, 49, 47 \cdots$

b) Fifth term is $f + 4d = 51 + 4 \times 2 = 51 + 8 = 59$

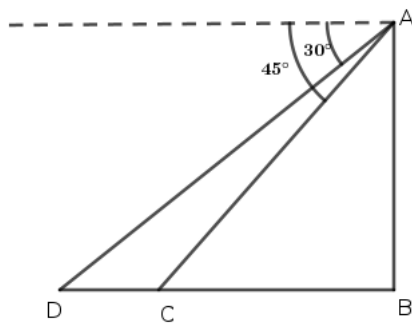c) $-2n + (51 - {}^- 2) = 31$
$-2n + 53 = 31, -2n = -22, n = 11$
He should practice 11 days

15)   a) $PA = PB, PD = PC$

b) Adding these equations $PA + PD = PB + PC$
$AD = BC$

c) $\angle AMB = 180 - 40 = 140°, \angle CND = 180 - 40 = 140°$

16)   a) Diagram

b) Triangle ABC is a $45° - 45° - 90°$ triangle . $BC = 100$ meter.
Triangle ABD is a $30° - 60° - 90°$ triangle.
$BD = 100\sqrt{3} = 173$ meter
The distance between the ships is 73 meter.

17)   a) $4\sqrt{2}$

b) $(4\sqrt{2}, 0), (0, 4\sqrt{2}), (-4\sqrt{2}, 0), (0, -4\sqrt{2})$

c) $x^2 + y^2 = (4\sqrt{2})^2$
$x^2 + y^2 = 32$

18)   a) 5

b) $4 \times \pi \times 5^2 = 100\pi$

c) 75π

19)   a) Smaller side is x
Other side is $2x + 8$

b) $x(2x + 8) = 504$, $2x^2 + 8x = 504, x^2 + 4x = 252$
$x^2 + 4x + 4 = 256$m $(x + 2)^2 = 16^2, x + 2 = 16, x = 14$
Sides are 14meter and 36meter

c) Amount $=$ perimeter $\times$ 200
Expense $= 50 \times 200 = 10000$ rupees

20)   a) Since $ABCD$ is cyclic $\angle A + \angle C = 180°$
Since AB parallel to CD $\angle B + \angle C = 180°$
$\angle A + \angle C = \angle B + \angle C \rightarrow \angle A = \angle B$
Since base angles are equal opposite sides are also equal.
$AD = BC$. This is an isoscels trapezium.

b) $\angle A = 40°, \angle B = 40°, \angle C = 180 - 40 = 140°, \angle D = 140°$

c) Since AB is the diameter $\angle ACB = 90°$
$\angle ACD = 140 - 90 = 50°$

Questions from 21 to 29 carries seven scores. Answer any seven . $7 \times 5 = 35$

21) a) $90°$

b) ■ Draw the circle with center O
■ mark a point P outside the circle at the distance 7 cm away from the center
■ Draw a circle with OP as the diameter.
■ Circles intersect at A and B. Draw PA and PB, the tangents

c) Measure the length and write here.

22) a) $A(3,8), B(3,4), C(7,4)$

b) $AB = BC = 4, AC = 4\sqrt{2}$

c) Mid point of the hypotenuse is $(5,6)$. It is the center of the circumcircle
Radius $= 4\sqrt{2}$

23) a) Since $x_5 - x_1 = 16$ then $x_6 - x_2$ is also 16

b) $x_7 - x_3 = 16$
$x_7 = x_3 + 16 = 19 + 16 = 35$

c) $4d = 16, d = 4$

d) $f = x_3 - 2d = 19 - 2 \times 4 = 11$
$x_n = 4n + 7$

24) a) Let x be the radius of small circle.
$\pi \times x^2 + \pi \times (3x + 1)^2 = 53\pi$
$x^2 + (3x + 1)^2 = 53$

b) The equation can be written as $5x^2 + 3x - 26 = 0$
Solving $x = 2$. Radii of the circles are 2cm and 7cm

c) Distance between the centers is $2 + 7 = 9$

25) a) $l = 12$cm

b) $lx = 360r$
For the first cone $12 \times 60 = 360 \times r_1$
$r_1 = 2$cm
For the second cone $r_2 = 4$cm , For the third cone $r_3 = 6$cm .

c) $12 = 2 + 4 + 6$
Sum of the radii of the cones is equal to radius of the circular sheet.
(This is a general relation)

26) a) Draw a diagram
$AB \rightarrow$Building
$CE \rightarrow$ Light house
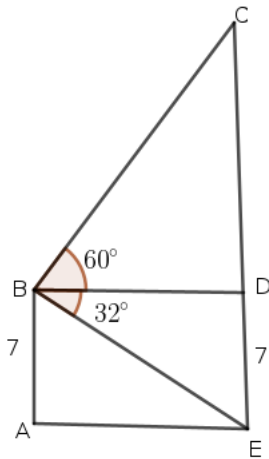
b) In triangle BDE , $\tan 32 = \frac{7}{BD}$

$BD = 11.92$ meter

The distance between building and light house is 11.92 meter

c) Triangle BDC is a $30 - 60 - 90$ triangle.$CD = BD \times \sqrt{3} = 11.92 \times 1.73 = 20.62$ meter

27) **a)** $B(4, -1)$

a) 4

b) $(4, 3)$

c) $(x - 4)^2 + (y - 3)^2 = 16$

28) **a)** $a + b = 4, ab = -21$

b) $(a - b)^2 = (a + b)^2 - 4ab$
$(a - b)^2 = 4^2 - 4 \times 21 = 100$
$a - b = 10, a + b = 7 \rightarrow a = 7, b = -3$

c) $p(x) = (x + 7)(x - 3) = 0$
$x + 7 = 0, x = -7$
$x - 3 = 0, x = 3$

29) **a)** $n + 1, n + 2, n + 3, n + 4, n + 5, n + 6$

b) $7n + 21$ is the sum of first 20 natural numbers. It is $\frac{20(20+1)}{2} = 210$
$7n + 21 = 210$

c) $7n = 210 - 21 = 189, n = 27$

d) Group sums are $27, 28, 29, 30, 31, 32, 33$
Grous are $(0, 7, 20)(1, 8, 19)(2, 9, 18)(3, 10, 17), (4, 11, 16), (5, 12, 15).(6, 13, 14)$.