GRADE : OFFICER IN CHARGE OF A NAVIGATIONAL WATCH ON SHIPS OF 500 GT OR MORE (UNLIMITED)

SUBJECT : MATHEMATICS

DATE : 14.Dec.2023

Time allowed THREE hours	Total marks : 100
Answer all questions	Pass marks : 50%

Formulae and all intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches wherever required.

1)

   a) Define irrational numbers   (2 marks)

   b) Express with positive indices $4x^{-\frac{1}{2}} \times 3\sqrt{x^{-1}}$ (4 marks)

   c) Solve $\log_5 x + 3\log_x 5 = 4$.   (6 marks)

   d) In spherical triangle DEF, $d = 112^0 3'$, $E = 113^0 23'$ and $F = 90^0$. Calculate D,e and f.   (8 marks)

2)

   a) Show that $x - 2$ is a factor of the polynomial $x^3 - 3x^2 - 4x + 12$, find the other factor.   (5 marks)

   b) Find the equation of a hyperbola if the standard equation whose conjugate axis 5 and the distance between foci is 13   (5 marks)

   c) Find the size of the each of the angles marked with letters in the diagram below
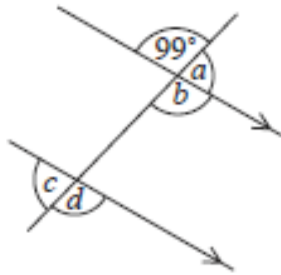
(4 marks)

d) The distance to a tower of height 25 m from point B is 40 m. If points A and B lie on a straight line leading to the tower and the angle of elevation to the top of the tower from point B is twice the angle of elevation from point A, determine the distance from point A to point B. (6 marks)
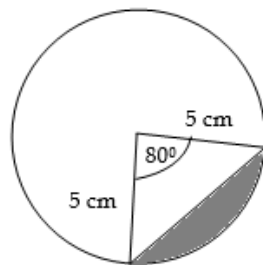
3)

a) Find 'K' such that line $4x - ky + 4 = 0$ and $8x + 2ky + 5 = 0$ are perpendicular.

(4 marks)

b) Prove

tanAsinA + cosA = secA (4 marks)

c) Find the shaded area

(4 marks)

d) A map has a scale of 1:200000. The distance between the two towns is 60km. how far is the town on the map? (4 marks)

e) Simplify

$$a^2c - (2a^2c - 4a^2c + 8a^2c) - 7a^2c$$ (4 marks)

4)

a) Construct the triangle ABC where AB=6 cm ,BC= 4cm ,$A\widehat{B}C$ =75^{0}and draw circum-circle. Find the radius of it. (6 marks)
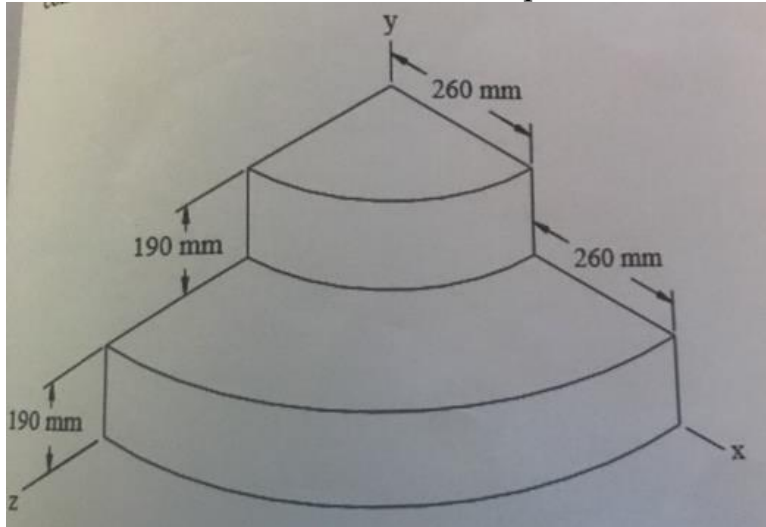
b) Divide $(5x^4 - 3x^2 - 5)$ by $(x - 1)$ (4 marks)
c) Factorize $x^2 - 17x - 84$ (4 marks)

d) The concrete steps shown are in the shape of a quarter circle. Determine the total number of cubic meters of concrete required to construct the steps

(6 marks)

5)
a) Find the area under the graph $y = \frac{1}{1+x^2}$ from 0 to 1 using 3/8 Simpson's rule

(8 marks)

b) ABCDOE is a regular hexagon with O as origin. The position vector of A is a and the position vector of B is b.Find the following in terms of a and b
   i) the position vector of C
   ii) $\overrightarrow{OE}$ (6 marks)
c) Draw the graph of y=x² +2x+3   (6 marks)

6)
a) In spherical triangle LMN, $M = 44^0 16.0'$, $L = 90^0 and\ m = 39^0 37'$. Calculate l and n.   (8 marks)
b) Find General solution
   $$\sin \theta = \frac{1}{2}$$ (4 marks)

c) The table below shows the amount of time a group of students spent revising for an end of year exam and the score they achieved in the exam. Draw a scatter graph to represent the above information. Find the relationship between the amount of time a group of students spent revising for an end of year exam and the score they achieved in the exam.

Hours of revision	0	2	5	6	8	10	13	14	15	16
Exam score	20	28	23	85	32	63	52	60	58	68

(8 marks)