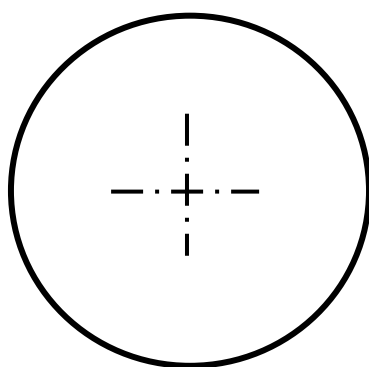


QUESTION 1

(15 marks)

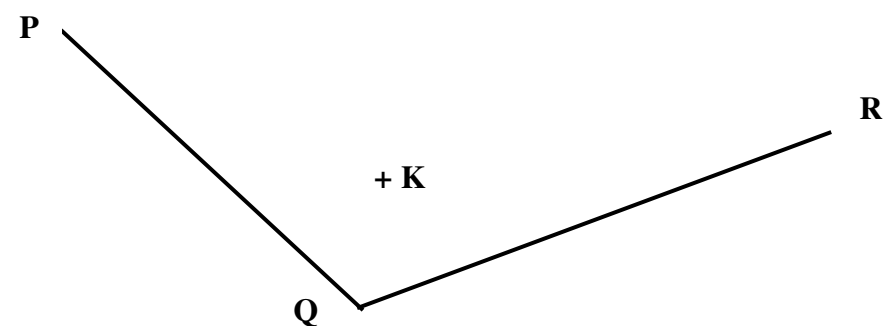
(a) **Given:** A point S on the outside of a circle.

Required: (i) Draw an involute of S back to the circle. (5 marks)



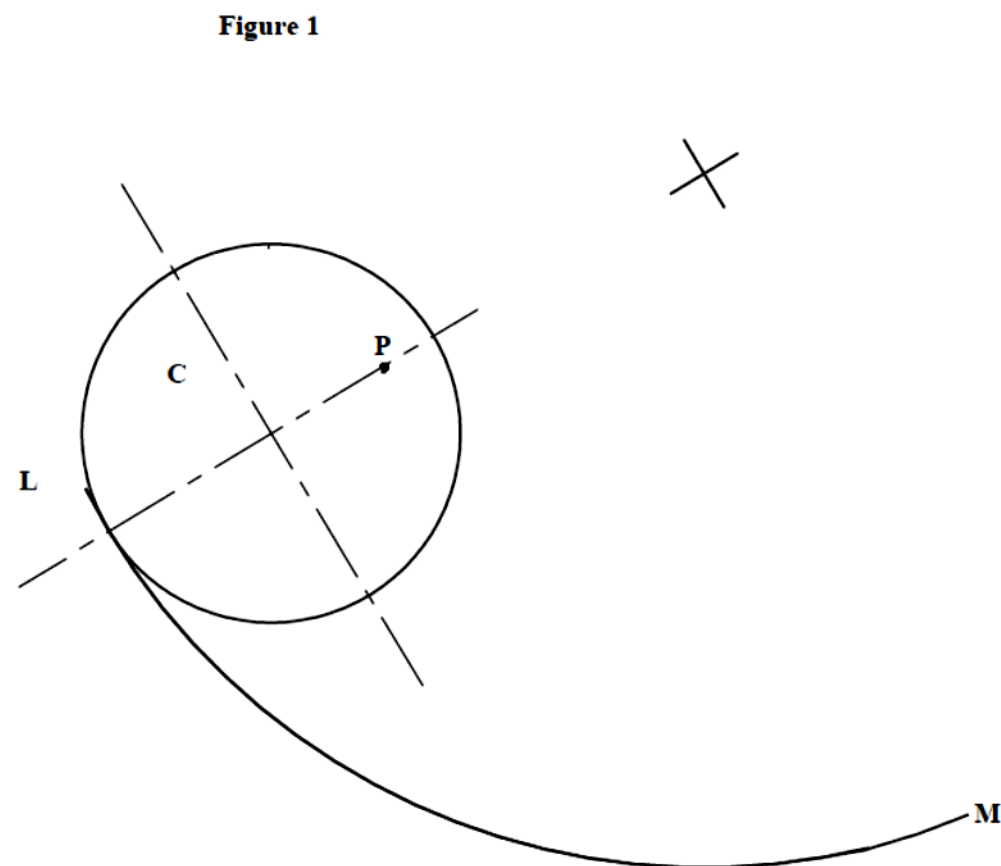
+ S

b) Draw a Hyperbolic curve passing through point 'K' given the asymptotes PQR. (4 marks)



(b) **Given:** A circle 'C' rolls on the base arc LM as shown below. Point 'P' is inside circle 'C' traces a curve as circle 'C' makes $\frac{3}{4}$ revolution on the base circle.

Required: (i) Draw the path traced by point 'P' for $\frac{3}{4}$ revolution. (5 marks)
 (ii) Name the curve produced: _____ (1 mark)



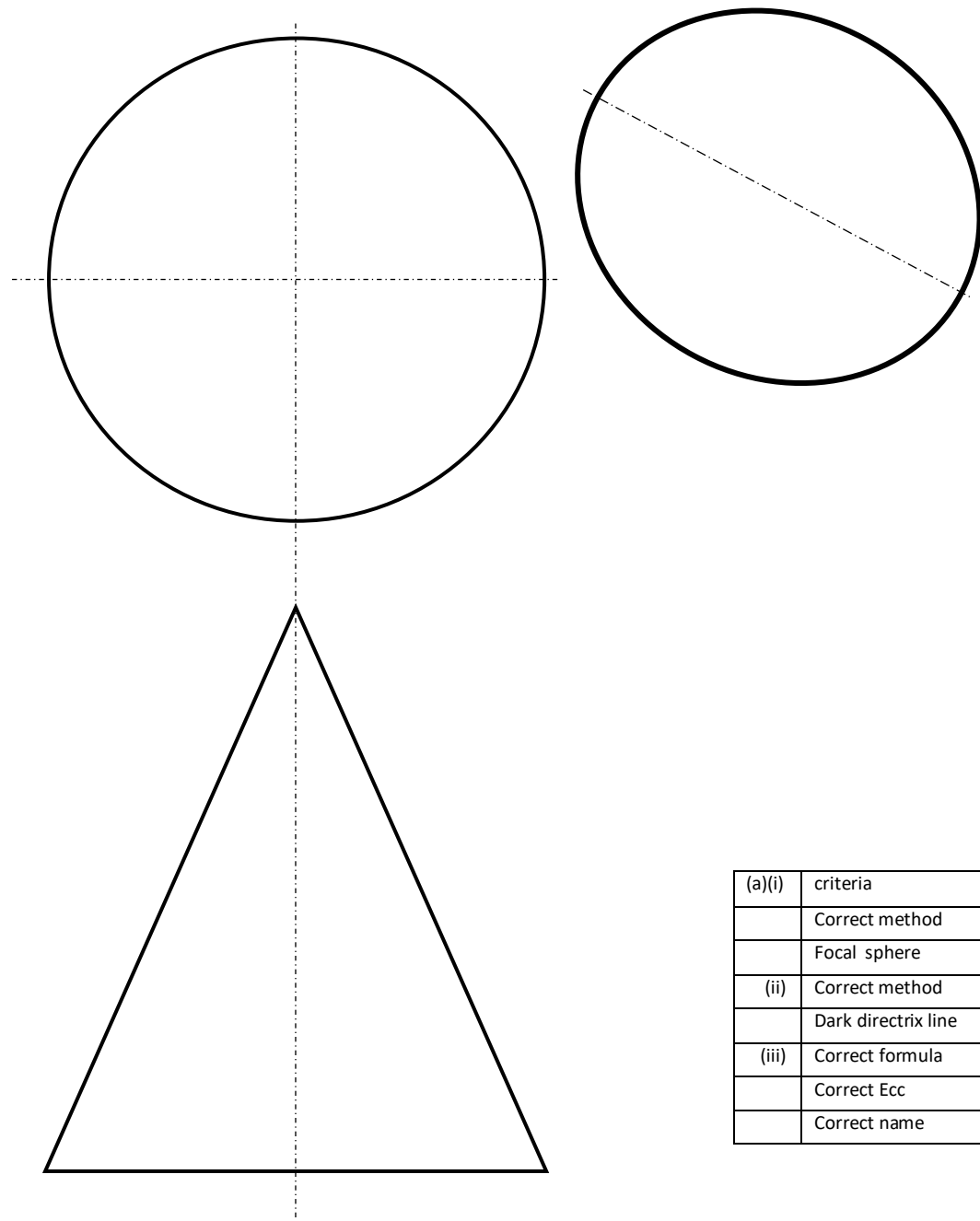
NAME:

QUESTION 2

(15 marks)

(a) Given : The incomplete plan , elevation of a cone and the incomplete true shape.

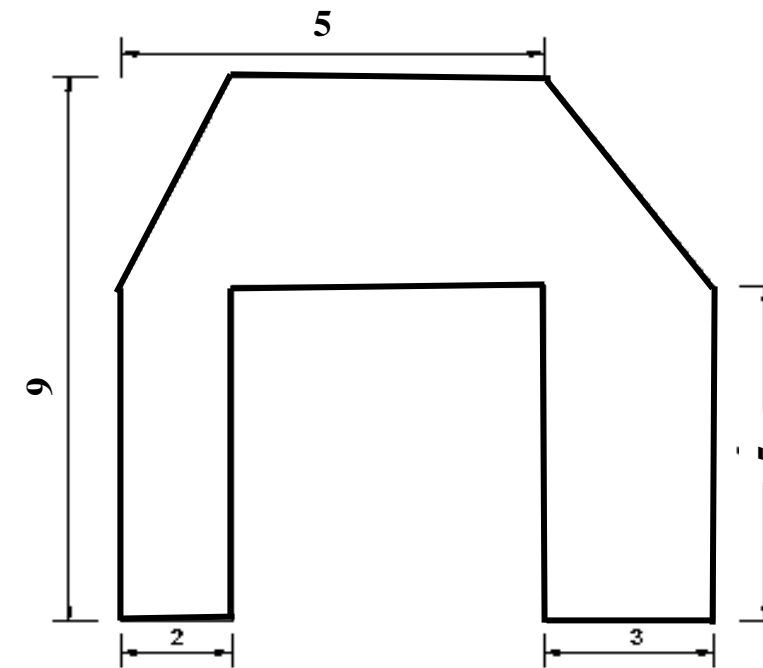
- Required :**
- (i) Find the cutting plane. (1 mark)
 - (ii) Draw the focal sphere and find the directrix and vertex. (2 marks)
 - (iii) Project the sectional plan and complete the True shape (5 marks)



(a)(i)	criteria	mk
	Correct method	1
	Focal sphere	1
(ii)	Correct method	0.5
	Dark directrix line	0.5
(iii)	Correct formula	0.5
	Correct Ecc	0.5
	Correct name	1

(b) Given : A shaped block

- Required :** Find the centroid using the area/ratio method. (7 marks)



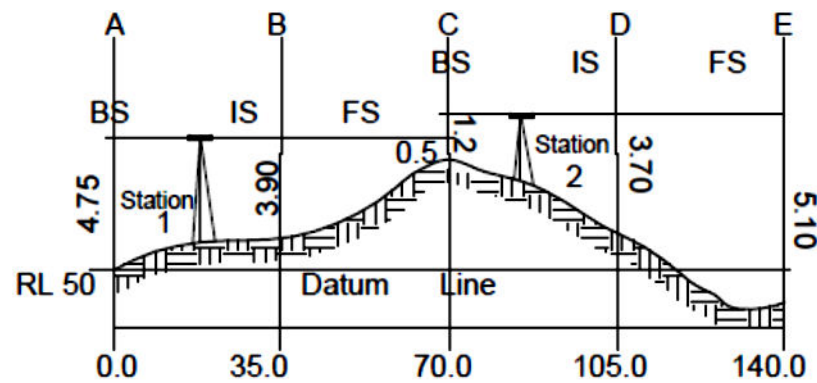
	criteria	mk
(c)	Trapezium area	0.5
	Rec area	0.5
	A:B	0.5
	centre	0.5
	AB:C	0.5
	Correct cent	2
	neatness	0.5

QUESTION 3

(15 marks)

(b) Given : A Landscape of a proposed highway is given below. The positions and readings which were taken are also shown in the diagram.

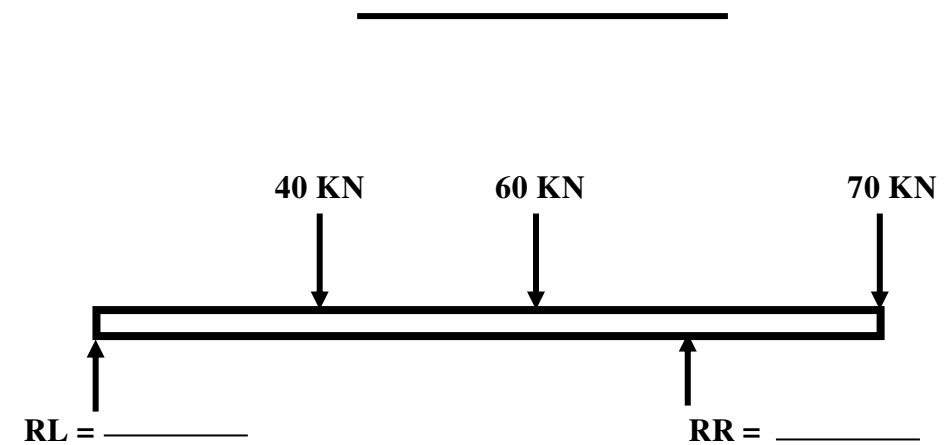
Required : Using the information to complete the **LEVEL BOOK**.
(8 marks)



LEVEL BOOK							
BS	IS	FS	Rise	Fall	RL	Distance	Remarks
							CHECK

(b) Given : The space diagram of a beam supported at the ends with point loads to a scale of **1: 50**.

- Required:**
- (i) Label the space diagram using **Bow's Notation**. (1 mark)
 - (ii) Determine the magnitude of **RL** and **RR**. (4 marks)
 - (iii) Draw the line of equilibrant force. (1 mark)
 - (iv) Draw the **shear force diagram**. (2 marks)
 - (v) Find the **maximum bending moment**. (2 marks)



Load Line
Scale : 1mm = 2 KN

QUESTION 4

(15 marks)

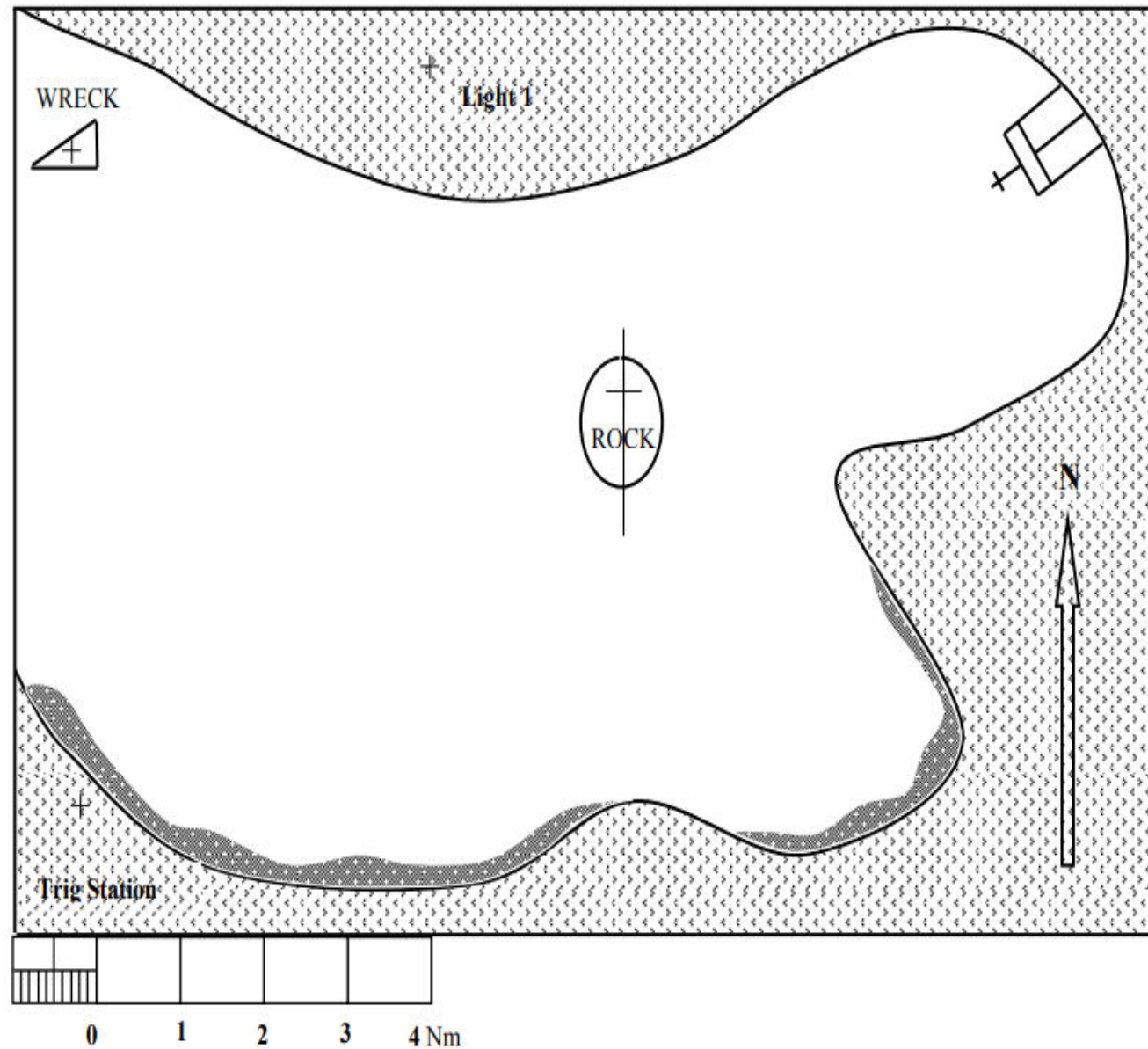
(a) Plot the following course on the given chart showing the direction of travel.

Leg 1: The ship RAS departs jetty to clear the rock to starboard by 1 Nm and travels on this leg for 6 Nm.

Leg 2: She changes course and travels on the bearing of 270° until Trig Station and Light 1 are in transit.

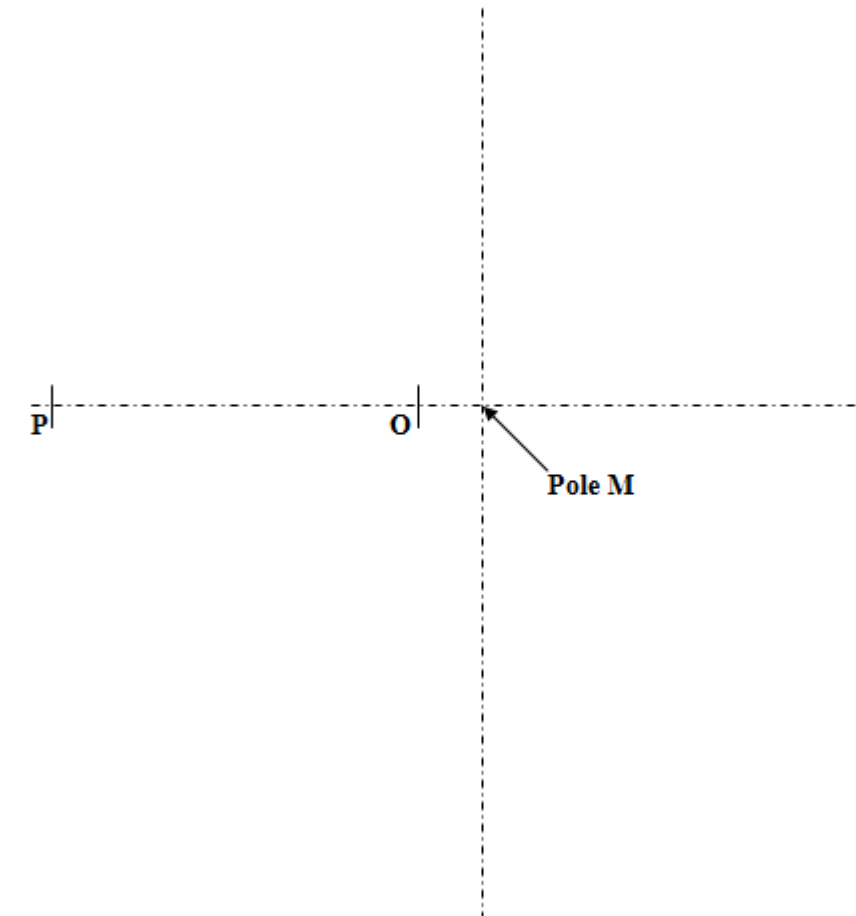
Leg 3: She alters course and sails towards the Wreck until it is Abeam to Light 1.

Leg 4: Finally, she decides to establish a good fishing sport then two bearing fix are taken Light 1 bears 360° and Trig Station bears 230° where she finally anchors to fish. **(8 marks)**



(b). Given are the pole **M**, first vector **MO** and the final vector **OP** of a locus that moves uniformly around a circle towards its centre. The vector angle is 30 degrees.

Required: Draw the curve so that point **O** unwinds in an anticlockwise direction about pole **M** for $3/4$ revolution. **(7½ marks)**



QUESTION 5

(15 marks)

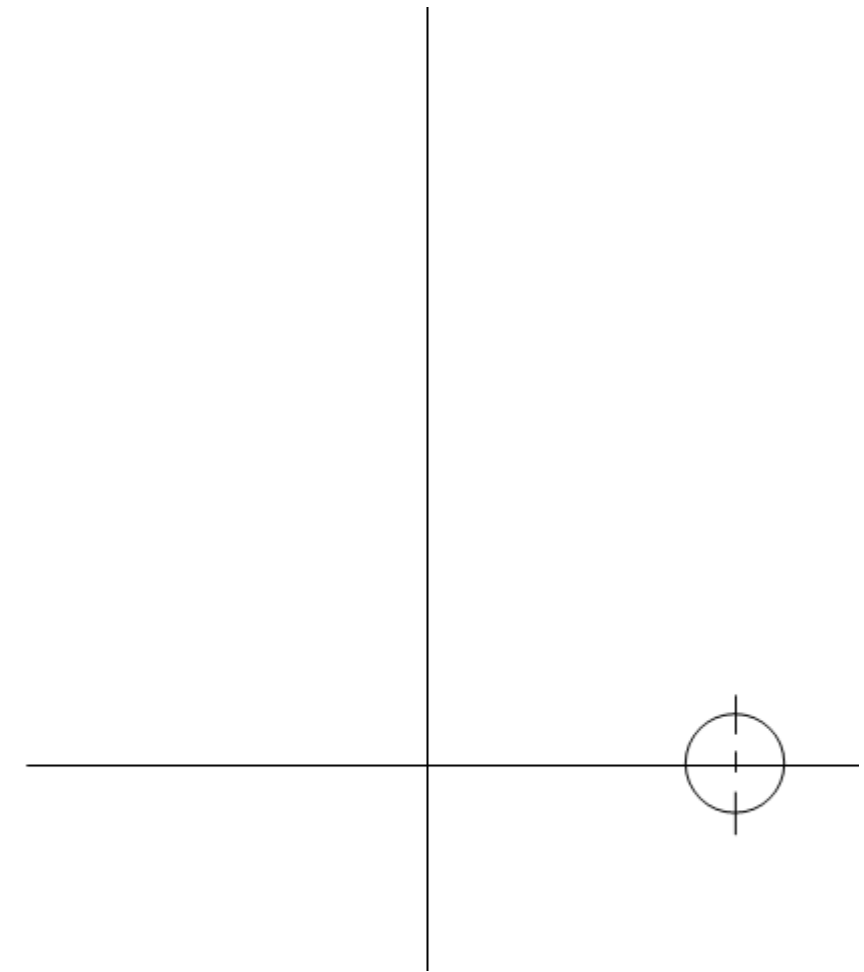
An **incomplete** elevation of a single start, **left –hand circular spring** is given on the right.

(a) Draw **1¼ turns** of the required thread which has a pitch of **54mm**.
Do not show any hidden details. **(10 marks)**

(b) Determine the **true helix angle** and the **true length of the helix**. **(5 marks)**

Angle : _____

True length : _____ cm



QUESTION 6

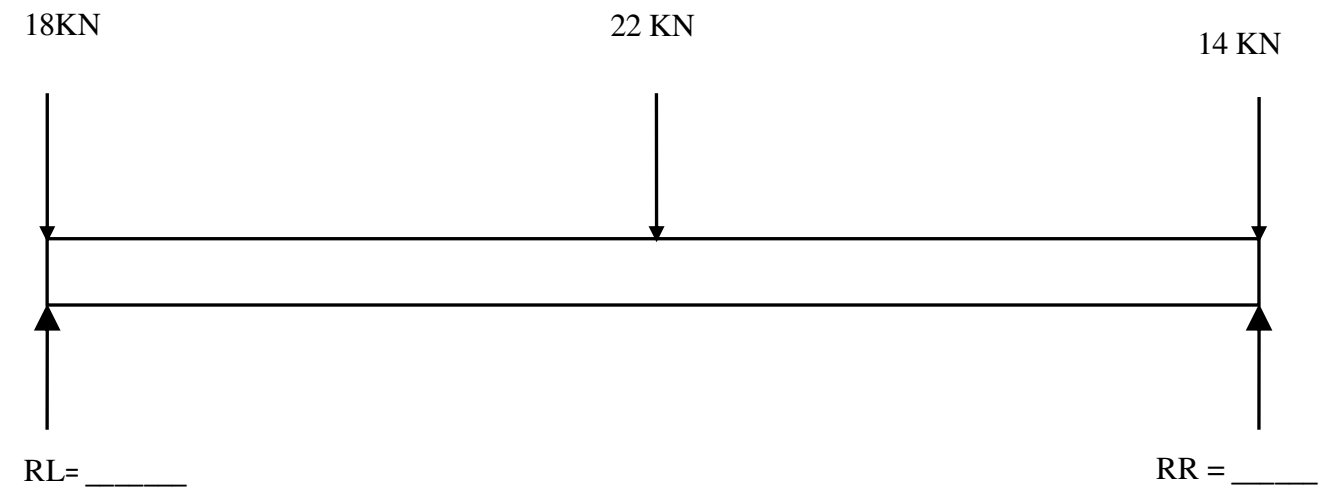
(15 marks)

GIVEN: The simply loaded beam shown below has three point loads acting on it.

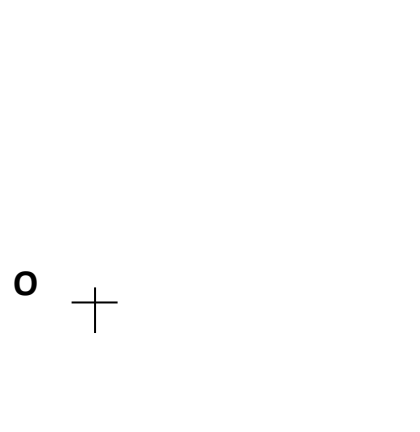
REQUIRED:

1. Draw the **Load line diagram/Polar polygon** to the given scale. (3 marks)
2. Draw the **Shear Force diagram** (3 marks)
3. Draw the **Link/Funicular/Bending moment diagram** (3 marks)
4. State the reactions **RL** and **Rr** (2 marks)
5. Locate the position of the **resultant/equilibrium** (1 mark)
6. State the magnitude of the **maximum** bending moment (2 marks)
7. Sketch a simple **section** of a beam (1 mark)

Space Diagram



Load Line Diagram Scale = 1kn : 1mm



QUESTION 7

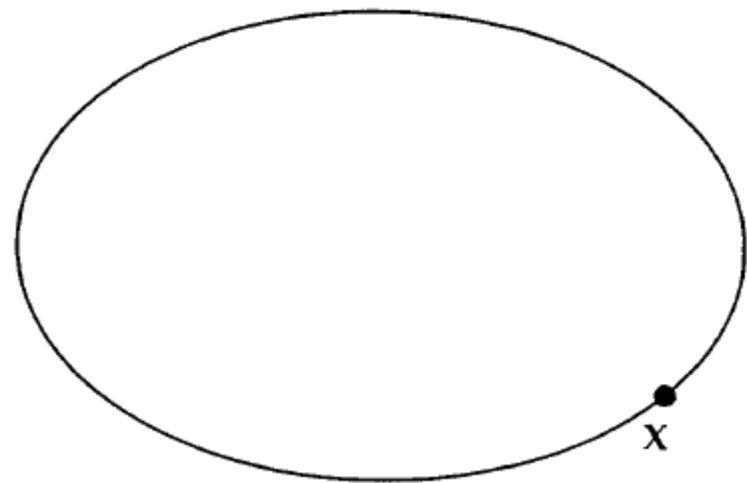
(15marks)

- (a). Draw the involute of the given pentagon when it starts from point **W** and moves in a clockwise direction for one revolution. **(2 marks)**



- (b) Construct the following :

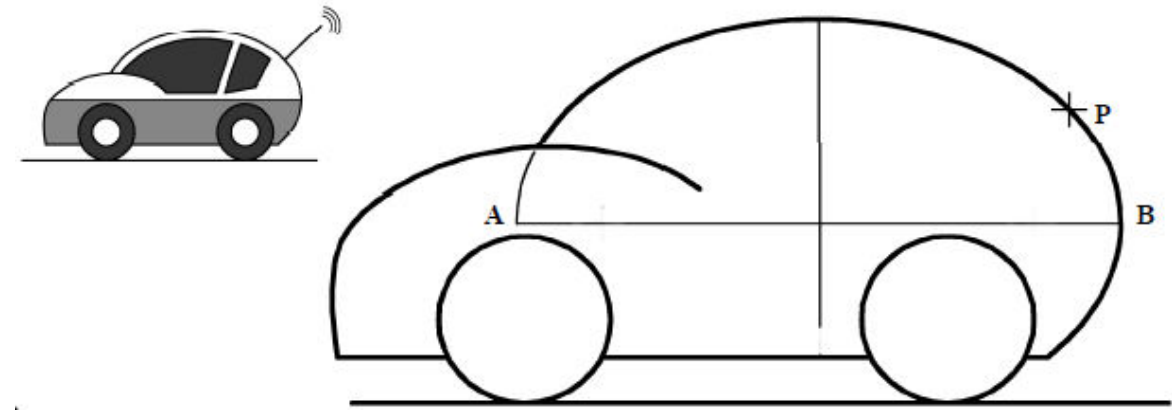
- (i) the Major and Minor axis of the given ellipse. **(5 marks)**
 (ii) a tangent and normal to the ellipse at point **X**.



Given: The figure shows the design of a remote control car. Also shown is a small graphic of the car and aerial. **AB** is the major axis of the ellipse and the aerial is a normal to the ellipse at **P**.

Required:

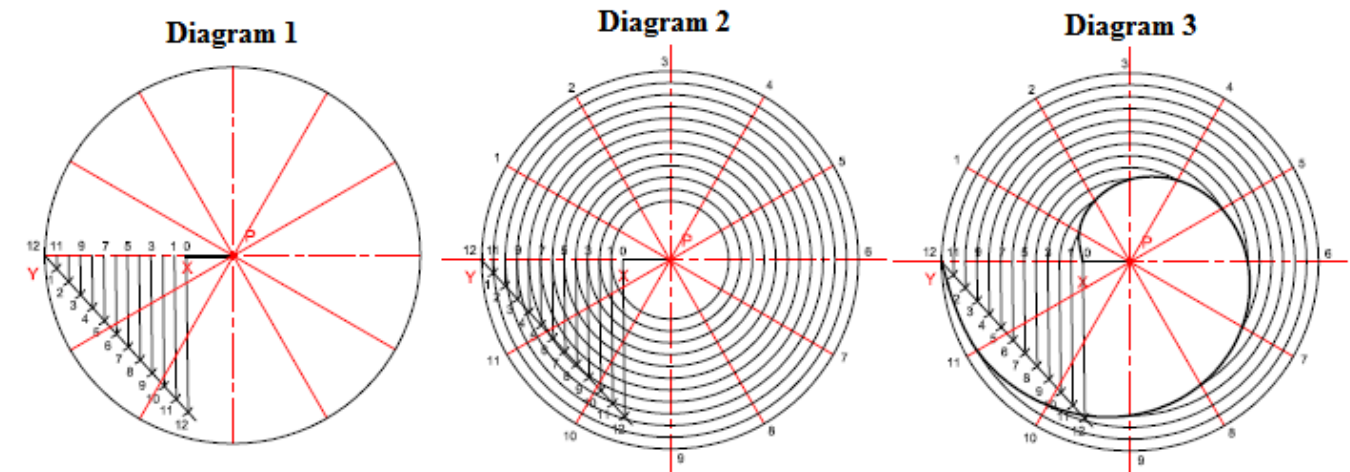
- i. Determine the focal points of the ellipse **(1 mark)**
 ii. Draw the aerial at **P**. **(2 marks)**



Part C

(3 marks)

Given below is a spiral with full construction method shown.



Write down the steps demonstrated in each of the three diagrams.

Diagram 1: _____

Diagram 2: _____

Diagram 3: _____

DESIGN

(20 marks)

QUESTION 1

[20 marks]

Problem: Due to cyclone Winston, house were blown off uprooting the posts together with the house from the ground.

Brief: Design a solution to secure the post to the ground preventing it from uprooting.

Specification: The **unit** should be:

1. made from a combination of metal and plastic or wood;
2. relatively cheap and safe for the user;
3. strong enough to secure the house;
4. to last for at least 30 years.



Requirements:

- (a) Produce **two** freehand pictorial sketches to solve the problem. (8 marks)
- (b) Evaluate each sketch on the following criteria:
 - (i) materials
 - (ii) strength(4 marks)
- (c) Explain with the help of sketches how the post is made strong. (3 marks)
- (d) Draw a pencil-rendered or a colour-rendered pictorial sketch of the final solution. (5 marks)

QUESTION 2

(20 marks)

Problem: The current trolley design in supermarkets has only one big compartment which may result in the damage of fragile and light items when placed in the middle or at the bottom of the trolley.

Brief: Design a **trolley** which will ease the problem.

Specification: The **trolley** should be:

1. easily used, safe and comfortable for the user;
2. operated manually or mechanically powered;
3. made from a combination of metal and plastic or wood;
4. easily stored and accessible.

Requirements:

- (a) Produce **two** freehand pictorial sketches of the **trolley**. (8 marks)
- (b) Evaluate each sketch on the following criteria:
 - (i) materials
 - (ii) strength(4 marks)
- (c) Explain with the help of sketches how the **trolley** could be stored away easily. (3 marks)
- (d) Draw a pencil-rendered or a colour-rendered pictorial sketch of the final solution. (5 marks)

QUESTION 3

(20 marks)

Problem : A newly constructed hotel “**The Hexagon**” wants to construct an attractive entry point for visitors at the road front.

Brief: Design an attractive road frontage for “**THE HEXAGON**” hotel.

Specifications: The design must

1. be constructed out of any local available materials.
2. be modern looking and attractive.
3. be wide enough for two vehicles to pass through.



Requirements:

- (a) Produce **two** freehand pictorial sketches to solve the problem. (8 marks)
- (b) Evaluate each sketch on the following criteria:
 - (i) materials
 - (ii) strength(4 marks)
- (c) Explain with the help of sketches the attractive features of the design. (3 marks)
- (d) Draw a pencil-rendered or a colour-rendered pictorial sketch of the final solution. (5 marks)

QUESTION:1

DESIGN

[20 marks]

SHEET 11

NAME:

(a) Possible Solution 1 (4 marks)		Possible Solution 2 (4 marks)		(c) (3 marks)																																					
<table border="1"> <tr> <td>1</td> <td>Pictorial Crate/Box used</td> <td>1</td> <td>3</td> <td>Correct labels</td> <td>1</td> </tr> <tr> <td>2</td> <td>Correct line work</td> <td>1</td> <td>4</td> <td>Correct proportion</td> <td>1</td> </tr> </table>		1	Pictorial Crate/Box used	1	3	Correct labels	1	2	Correct line work	1	4	Correct proportion	1	<table border="1"> <tr> <td>1</td> <td>Pictorial Crate/Box used</td> <td>1</td> <td>3</td> <td>Correct labels</td> <td>1</td> </tr> <tr> <td>2</td> <td>Correct line work</td> <td>1</td> <td>4</td> <td>Correct proportion</td> <td>1</td> </tr> </table>		1	Pictorial Crate/Box used	1	3	Correct labels	1	2	Correct line work	1	4	Correct proportion	1	<table border="1"> <tr> <td>1</td> <td>Overall neatness and clarity of sketch (es)</td> <td>1</td> <td>3</td> <td>Evidence shown</td> <td>1</td> </tr> <tr> <td>2</td> <td>Relevant explanations and labels given</td> <td>1</td> <td></td> <td></td> <td></td> </tr> </table>		1	Overall neatness and clarity of sketch (es)	1	3	Evidence shown	1	2	Relevant explanations and labels given	1			
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QUESTION:2

<p>(a) Possible Solution 1 (4 marks)</p>	<p>Possible Solution 2 (4 marks)</p>	<p>(c) (3 marks)</p>																																																
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QUESTION:3

(a) Possible Solution 1 (4 marks)		Possible Solution 2 (4 marks)		(c) (3 marks)																																																	
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