

JASPER WILLIAMS HIGH SCHOOL YEAR 12 TECHNICAL DRAWING ANNUAL EXAMINATION - 2020 QUESTION AND ANSWER BOOK

Index Number:

Time allowed: 3 Hours
(An extra 10 minutes is allowed for reading this paper)

INSTRUCTIONS

1. Write your **Index Number** in the space provided on each sheet.
2. Use the drawing sheets provided for your answers including drawings.
3. Extra question/answer sheets will not be provided.
4. Do all your work in pencil. Do not use ink.
5. All construction lines should be drawn lightly but clearly.
6. All dimensions are in millimetres except where stated otherwise. Where no dimensions are given, you may use your own discretion.
7. A calculator may be used provided it is silent, battery-operated and non-programmable.
8. At the end of the examination, tie all the sheets which have your solutions, including **SHEET 1**, loosely together in numerical order.
9. Put a tick (✓) alongside each of the five questions you have answered in **Section B** and the question you have answered in **Section C**, on the table provided on the right.
10. There are **three** sections in this paper. **Section A** is compulsory. Note the options in **Sections B** and **C**.

Note: Do not fold the sheets.

SUMMARY OF QUESTIONS

SECTION	QUESTION TYPE	MARK	SUGGESTED TIME
A	There are twenty multiple-choice questions. All the questions are compulsory.	20	20 minutes
B	There are six questions. Answer any four questions.	60	100 minutes
C	There are three design questions. Answer only one question.	20	60 minutes
TOTAL		100	180 minutes

Mark Gained:

CANDIDATE'S USE			MARKER'S USE	
Put a tick alongside the question answered.			MARK GAINED	CHECK MARK
A	Questions 1 - 20	✓		
B	QUESTION 1			
	QUESTION 2			
	QUESTION 3			
	QUESTION 4			
	QUESTION 5			
	QUESTION 6			
C	QUESTION 1			
	QUESTION 2			
	QUESTION 3			
TOTAL MARK				

SECTION A MULTIPLE-CHOICE QUESTIONS

[20 marks]

Index Number:

The multiple-choice questions in this section are all compulsory. Each question is worth 1 mark.

INSTRUCTIONS FOR MULTIPLE-CHOICE QUESTIONS

1. Circle the letter which represents the best answer in the Answer grid provided on SHEET 4. If you change your mind, put a line through your first choice and circle the letter of your choice.

For example:

(1)	A	B	C	D
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2. If you change your mind again and like your first answer better, put a line through the second circle and tick (✓) your first answer.

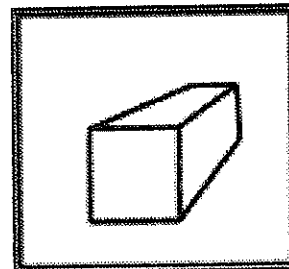
For example:

(1)	A	B ✓	C	D
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3. No mark will be given if you circle more than one letter for a question.

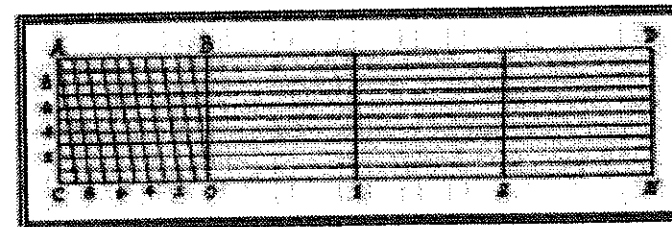
1. The shaped block shown on the right is drawn in

- A. oblique projection.
B. cavalier projection.
C. isometric projection.
D. one point perspective.



2. The diagram on the right shows a

- A. plain scale.
B. diagonal scale.
C. reduction scale.
D. enlargement scale.

Source: <http://www.4mechtech.blogspot.com>

3. An engineer who designs and maintains roads, bridges, dams and similar structures is a

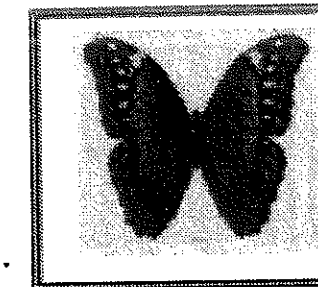
- A. Mechanical Engineer.
B. Structural Engineer.
C. Electrical Engineer.
D. Civil Engineer.

4. The last stage in design process is

- A. investigation and research.
B. problem identification.
C. testing and evaluation.
D. implementation.

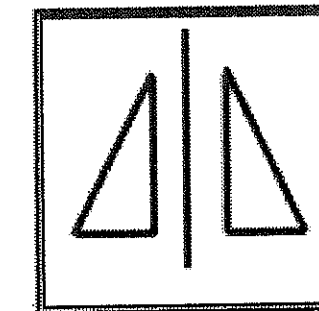
5. Which principle of design does the diagram on the right represent?

- A. Balance
B. Rhythm
C. Contrast
D. Harmony



6. The name given to the CAD symbol on the right is a/an

- A. mirror.
B. stretch.
C. intersection.
D. perpendicular.



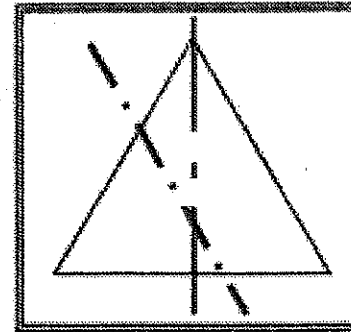
7. A curve in which the distance between adjacent coils, measured radially from the center is constant

- A. evolute.
B. involute.
C. logarithmic spiral.
D. archimedean spiral.

Index Number:

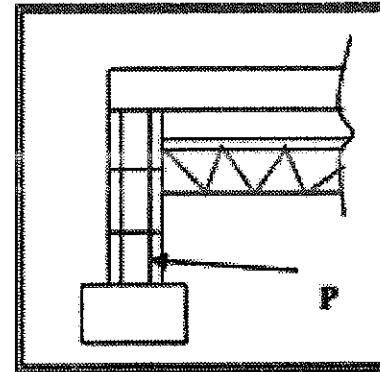
8. The diagram on the right will produce the true shape of a/an

- A. circle.
- B. ellipse.
- C. parabola.
- D. hyperbola.



9. The building part labelled P is

- A. footing.
- B. concrete.
- C. block wall.
- D. foundation.



10. The labeling of forces in a clockwise direction of a beam using the graphical method is

- A. load line.
- B. shear force.
- C. link polygon.
- D. bow's notation.

11. Which of the following rolling wheels best describes a point lying inside the generating circle which rolls inside the base circle?

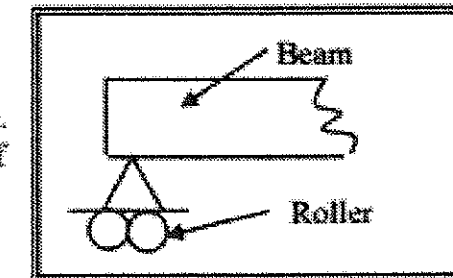
- A. Superior Hypotrochoid
- B. Inferior Hypotrochoid
- C. Superior Epitrochoid
- D. Inferior Epitrochoid

12. The renewable energy source that is used to generate electricity using solar power is

- A. sun.
- B. wind.
- C. water.
- D. biogas.

13. The function of a roller support on the beam shown in the diagram given below is

- A. subjected to a couple at any point.
- B. subjected to a force to be in equilibrium.
- C. capable of resisting a force in only one specific line.
- D. capable of resisting forces acting in any direction of the plane.



14. The centroid of an L shape is found by

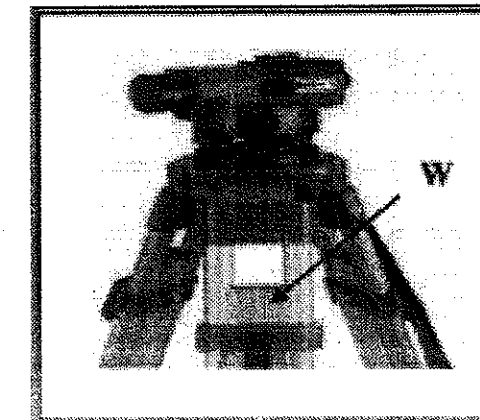
- A. dividing the L shape into two rectangles and finding the volume of both.
- B. dividing the the L shape into two rectangles and finding the area of both.
- C. dividing one rectangle of the L shape.
- D. drawing the diagonals.

15. Which of the following best describes the locus of a point that moves around the cylindrical object?

- A. Helix
- B. Involute
- C. Logarithmic spiral
- D. Archimedian spiral

16. The part labelled W in the diagram below is

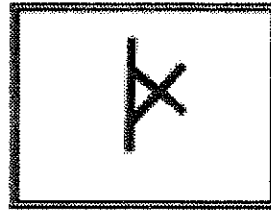
- A. staff.
- B. stand.
- C. theodolite.
- D. tripod stand.



Index Number:

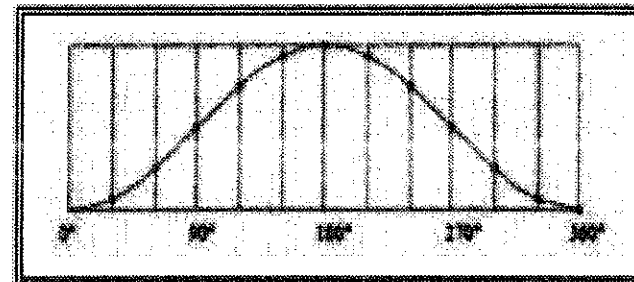
17. The electrical symbol on the right is for a

- A. wall mounted lamp.
 B. one way switch.
 C. two way switch.
 D. flood light.



18. The diagram on the right shows the

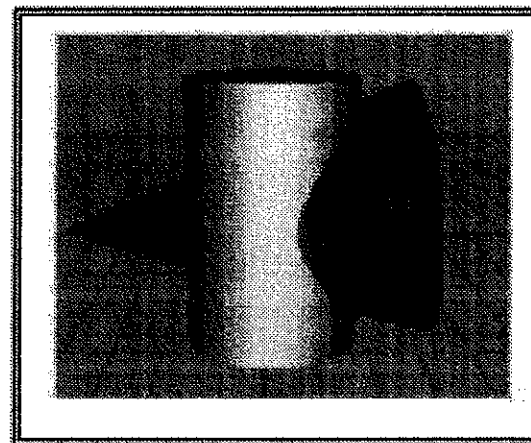
- A. dwell.
 B. uniform velocity.
 C. simple harmonic motion.
 D. uniform acceleration and retardation.



Source: Year 12 Technical Drawing, Ministry of Education, 2017

19. The intersection of the solid on the right is a

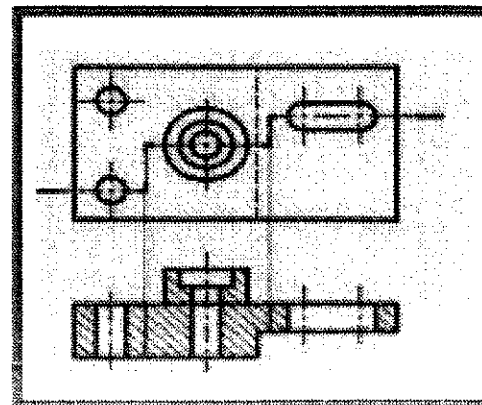
- A. cone to prism.
 B. cone to cylinder.
 C. cylinder to cylinder.
 D. cylinder to rectangle.



Source: Year 12 Technical Drawing, Ministry of Education, 2017

20. The type of sectioning shown on the right will produce a view of the object in

- A. full section.
 B. offset section.
 C. quarter section.
 D. aligned section.



Circle the letter that represents the best answer.

1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D
11	A	B	C	D
12	A	B	C	D
13	A	B	C	D
14	A	B	C	D
15	A	B	C	D
16	A	B	C	D
17	A	B	C	D
18	A	B	C	D
19	A	B	C	D
20	A	B	C	D

SECTION B

[60 marks]

Index Number:

There are six questions in this section. Answer any four questions.
Each question is worth 15 marks.

QUESTION 1

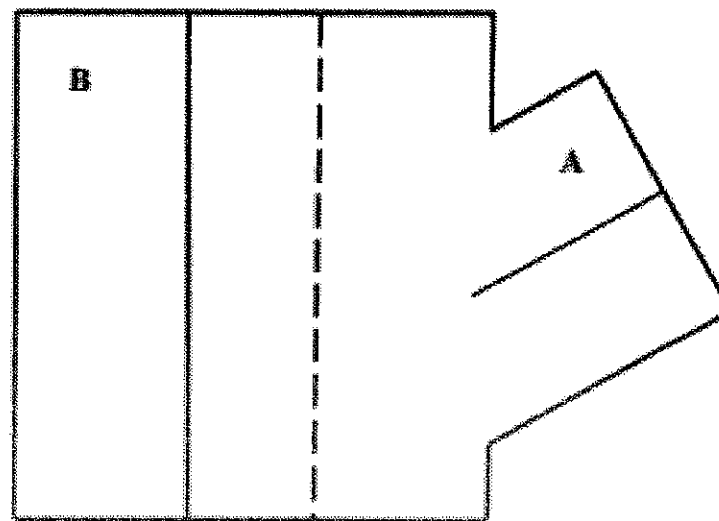
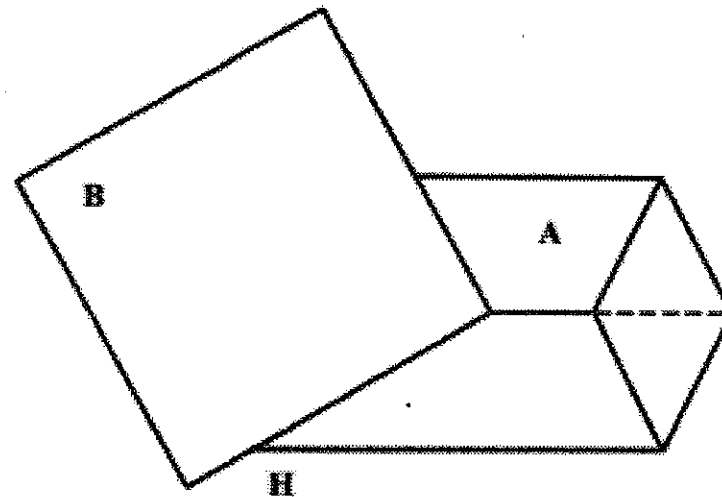
(15 marks)

PART A

(5 marks)

Given: A prism A intersecting a prism B drawn to full size in a 3rd angle projection.

Required: Complete the elevation by showing the line of intersection between the two solids on the elevation.



PART B

(10 marks)

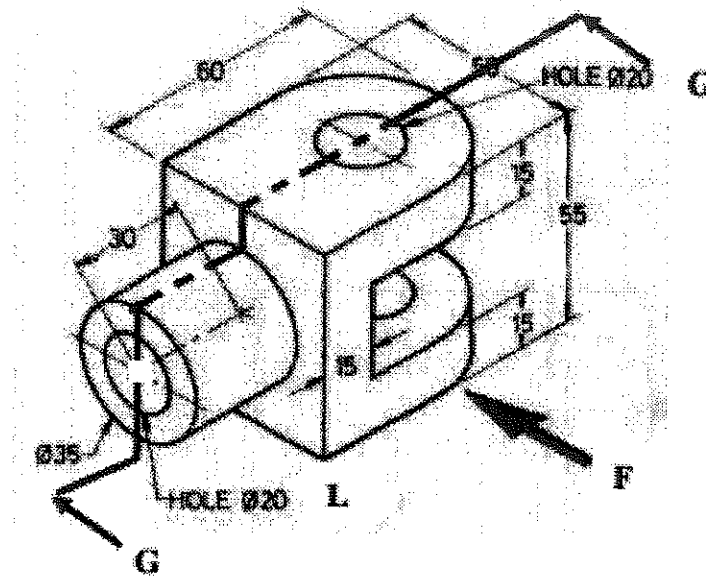
Given: A pictorial view of a Tool Rack is shown not to scale.

Required: (i) Draw the End Elevation (3 marks)

(ii) Draw the Sectional Elevation of cutting plane G-G. (7 marks)

Use the starting point L for both the views.

(7 marks)



END ELEVATION

L

SECTIONAL ELEVATION

QUESTION 2

(15 marks)

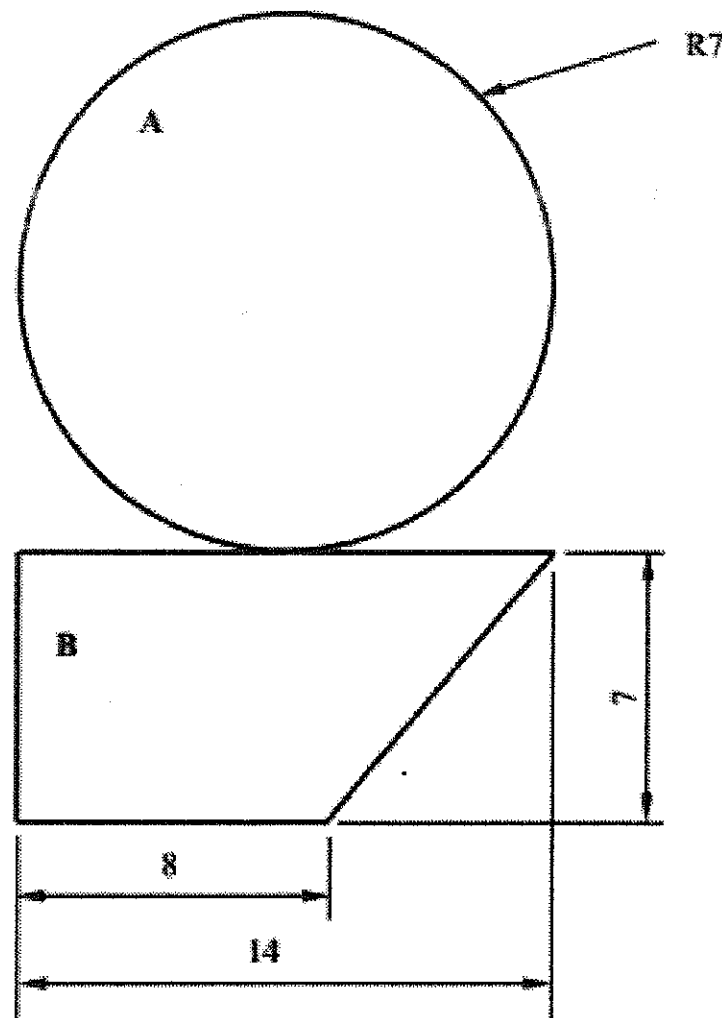
PART A

(7 marks)

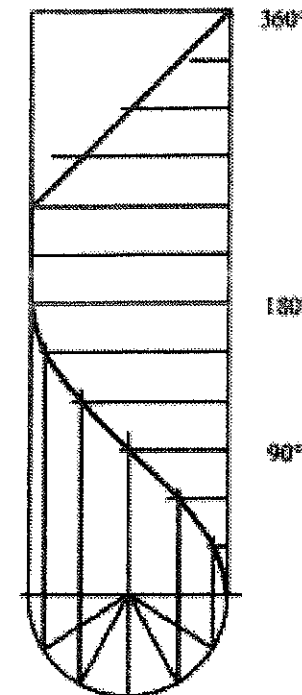
Index Number:

Given: A composite geometrical shape of circle A and trapezium B.

Required: Locate the centroid by using a ratio method.
(Use $\pi = 22/7$)



BQ2A		
1	Correct calculation of circle A area	1
2	Correct calculation of trapezium B area	1
3	Correct simplified ratio	1
4	Accuracy- correct position of C of circle A	1
5	Accuracy- correct position of C of trapezium B	1
6	Accuracy- Correct position of C	1
7	Correct method	1
BQ2B(i)		
8	Correct data filled	2
BQ2B(ii)		
9	Correct division of circle	1
10	Correct tangents drawn	1
11	Correct method used to construct the cam	1
12	Correct shape of the cam	2
13	Correct line work	1



PART B

(8 marks)

Given: A cam shaft, labelled A, which rotates clockwise, a roller follower labelled B, the performance graph and an incomplete cam data.

Required: (i) Complete the cam data for 0°-180° and 240°-360°. (2 marks)

(ii) Draw the cam profile using the given information. (6 marks)

DATA

Performance required:

Start from the inside circle

0° - 180°: Lift with SHM

180° - 240°:

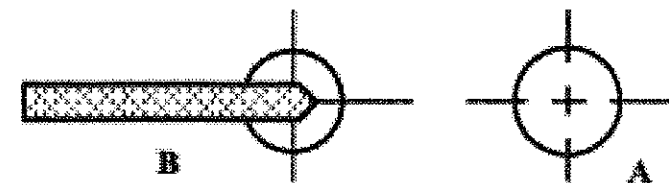
240° - 360°:

Calculations

Area A

Area B

Simplified Ratio A : B



QUESTION 3

(15 marks)

Index Number:

PART A

(10 marks)

PART B

(5 marks)

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.

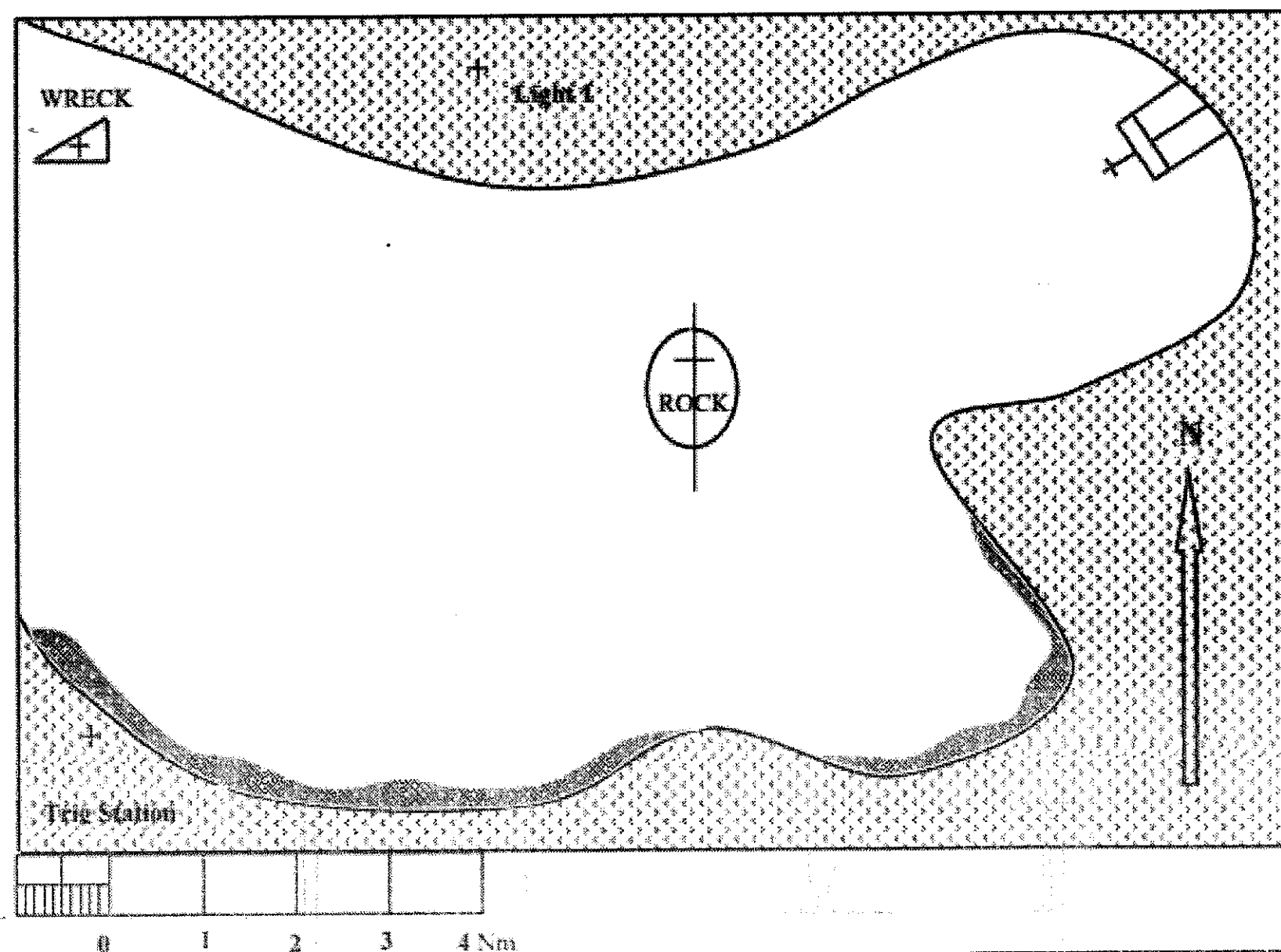
Leg 2: She changes course and travels on the bearing of 270° until Trig Station and Light 1 are in transit.

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

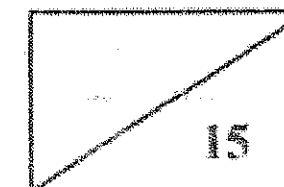
Leg 4: Finally she decide to establish a good fishing sport then two bearing fix are taken Light 1 bears 360° and Trig Station bears 230° where she finally anchors to fish.

Given: An axis, vertex, focal point and a ratio of eccentricity of 2:3 of a conic section.

Required: Locate the directrix and construct the conic section.



BQ3A			
1	Correct clearance course	2	
2	Accuracy Leg 1	1	
3	Correct 270° course	1	
4	Accuracy Leg 2	1	
5	Correct Transit bearing	2	
6	Correct Abeam bearing	2	
7	Accuracy of Leg 3	1	
BQ3B			
8	Correct method used to find directrix	2	
9	Correct method	2	
10	Correct line used	1	



QUESTION 4

(15 marks)

PART A

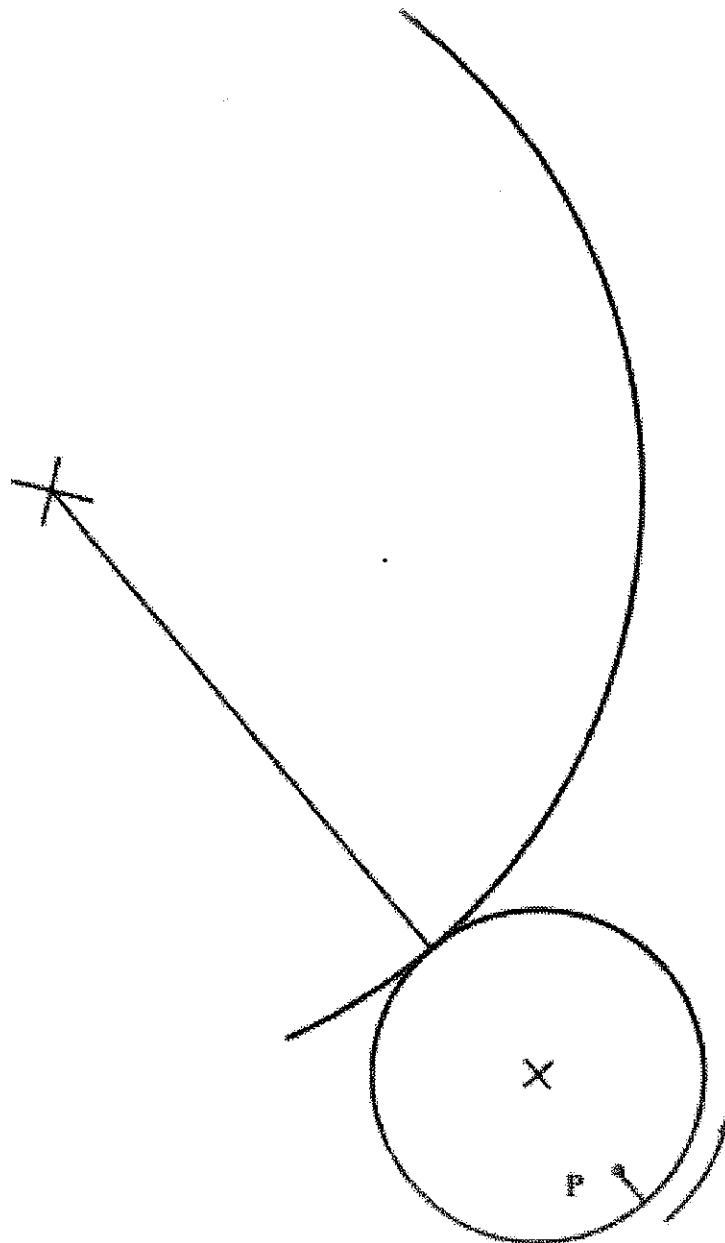
(8 marks)

Given: A rolling circle moving along a curved path in an anti-clockwise direction.

Required: (i) Draw the locus of point P as the rolling circle rolls for $\frac{1}{4}$ revolution. (7 marks)

(ii) Name the curve formed: _____ (1 mark)

BQ4A(i)			
1	Correct division of circle	1	
2	Correct divisions on rolling circle and labels shown	1	
3	Correct generating lines or method	1	
4	Accuracy of C ₁ to C ₂ locations	1	
5	Accuracy of P ₁ to P ₂ locations	1	
6	Correct shape of locus	2	

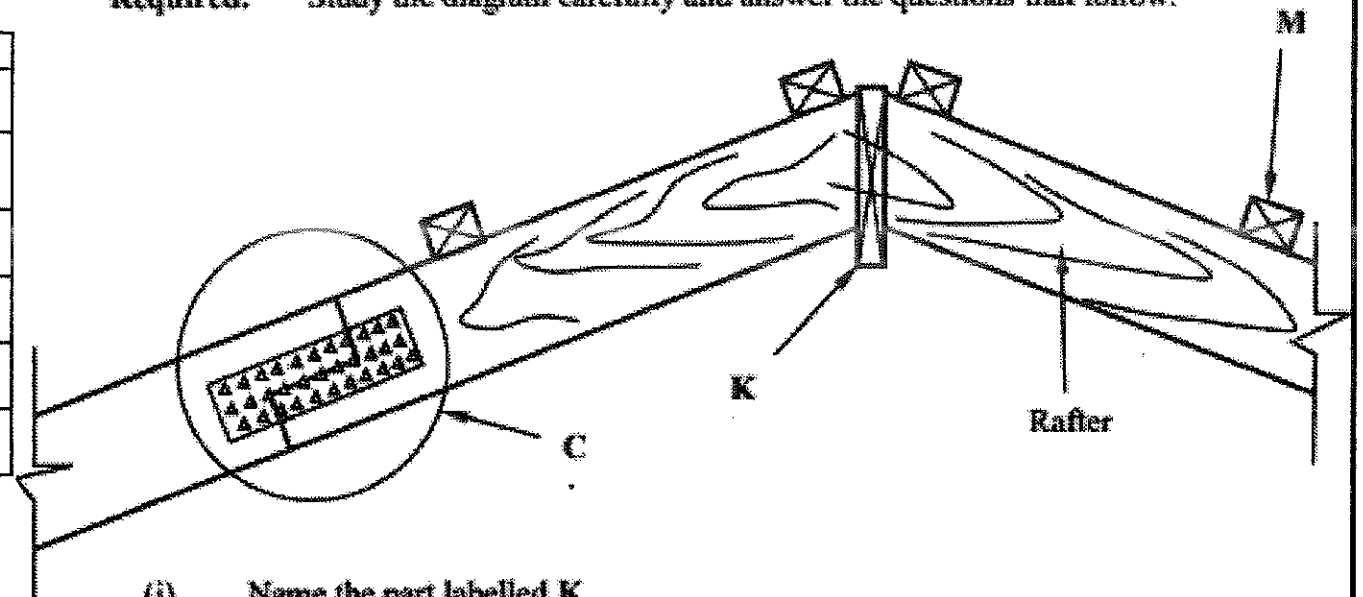


PART B

(7 marks)

Given: A detail of a building drawn not to scale.

Required: Study the diagram carefully and answer the questions that follow.



(i) Name the part labelled K.

(1 mark)

(ii) On the above drawing, illustrate how the member M will be secured to the rafter.

(2 marks)

(iii) Name a material which is placed in between the roofing iron and the purlin which prevents the heat from entering the house.

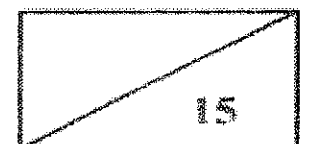
(1 mark)

(iv) Name the hardware used to join the rafters together at C.

(1 mark)

(v) Explain why there is a need to use a ridge cap in building.

(2 marks)



QUESTION 5

(15 marks)

PART A

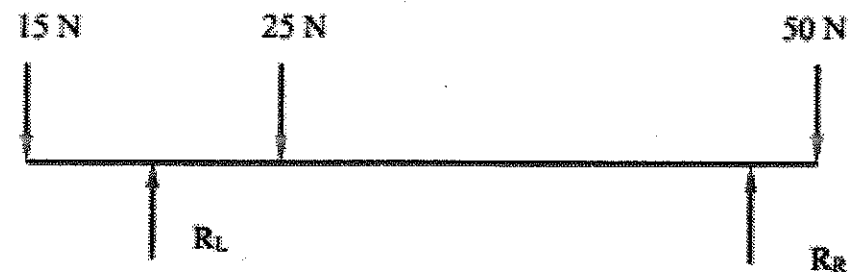
(8 marks)

Index Number:

Given: A space diagram of a beam drawn to a scale of 1:100.

Required: (i) Complete the space diagram using Bow's Notation. (1 mark)

(ii) Draw the shear force diagram. (7 marks)



BQ5A(i)		
1	Correct Bow's Notation used	1/5
2	Correct no. of labels shown	1/5
BQ5A(ii)		
3	Accuracy - load line	1
4	Correct polar diagram	1
5	Correct funicular polygon	2
6	Correct shear force diagram	3
BQ5C		
7	Correct division of circle	1
8	Correct 12 division of the radius	1
9	Correct projection lines	1

Load line scale: 10 mm = 10 N

PART B

(4 marks)

Given: An incomplete level book.

Required: Complete the Level Book by filling in the missing values and missing remark.

LEVEL BOOK

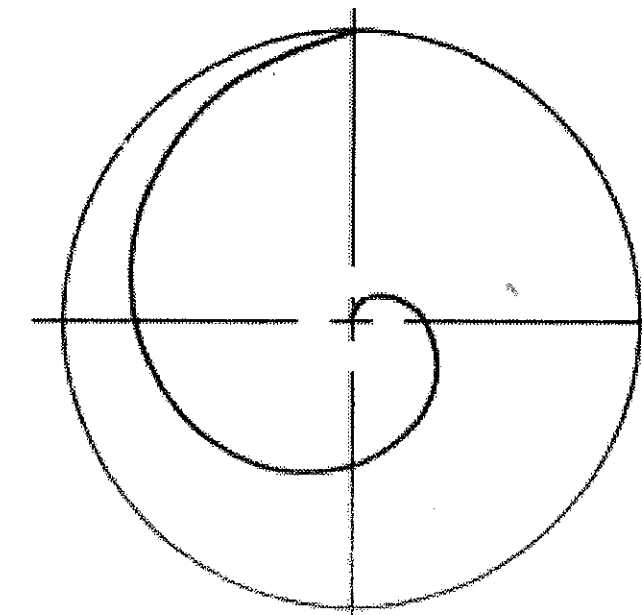
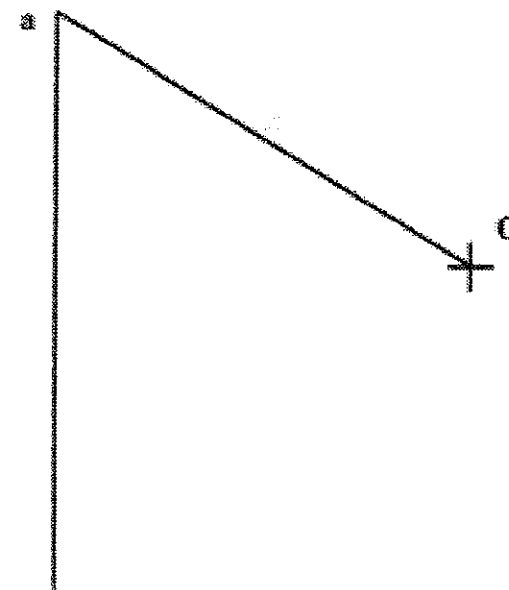
Back sight	Inter sight	Fore sight	Rise	Fall	Reduce Level (m)	Station	Distance (m)	Remarks
					50	K	0	Start
		1.00	2.00		52	L	23	Change Point
	1.00		2.00		54	M	45	Manhole
1.00		1.00				N	51	Change Point
	2.00			1.00	53	O	75	Manhole
		3.00		1.00	52	P	79	

PART C

(3 marks)

Given: An Archimedean spiral with centre lines.

Required: Show all the construction lines.



QUESTION 6

(15 marks)

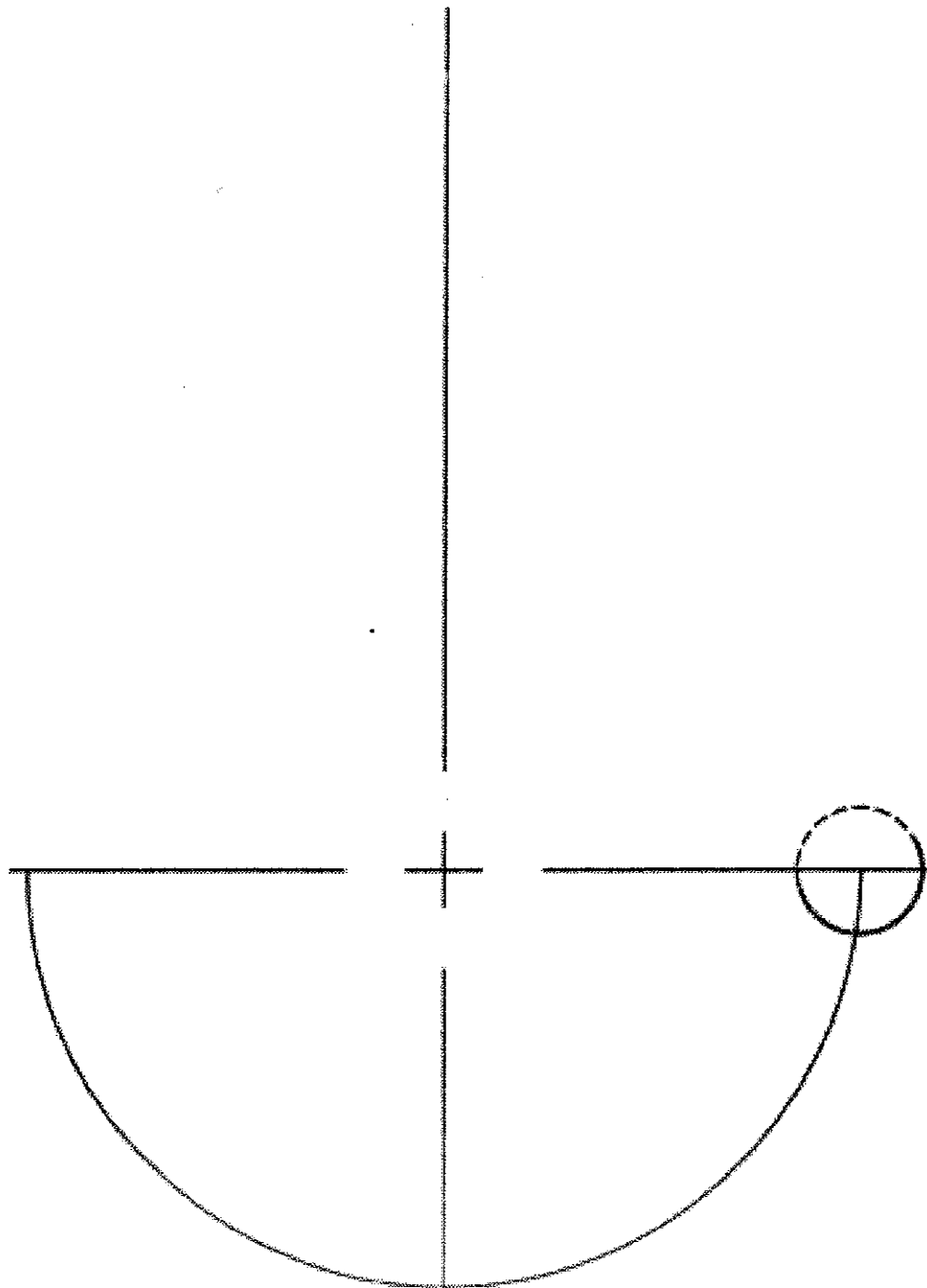
Index Number:

PART A

(6 marks)

Given: The centre line and the starting point of a round helix.

Required: Construct one revolution of round helix with pitch of 100 mm.

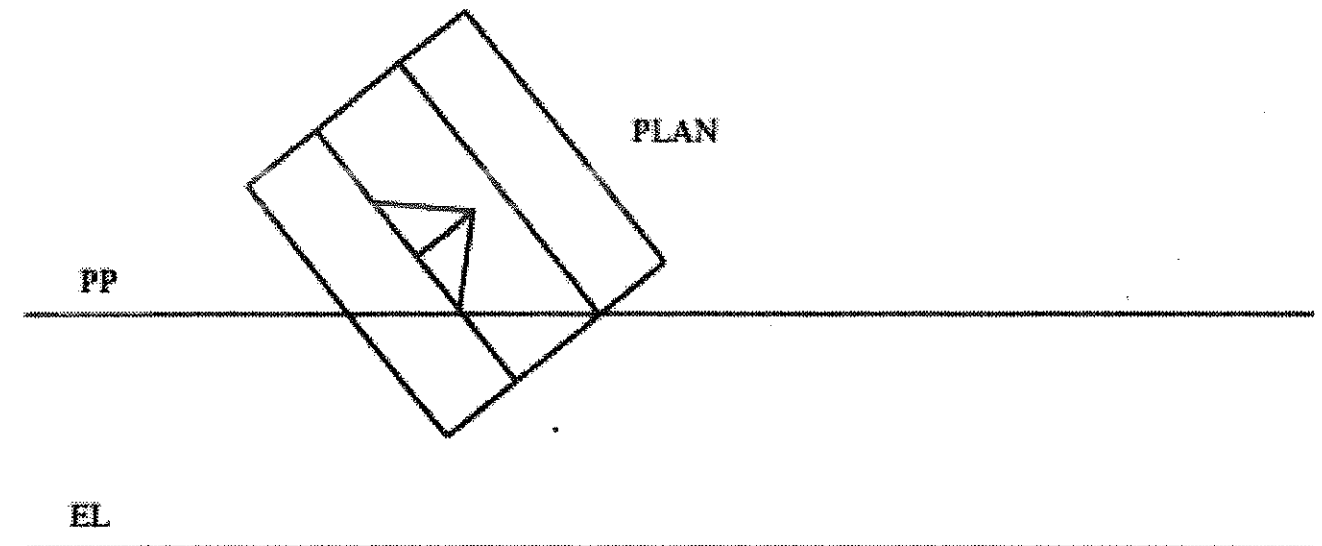


PART B

(9 marks)

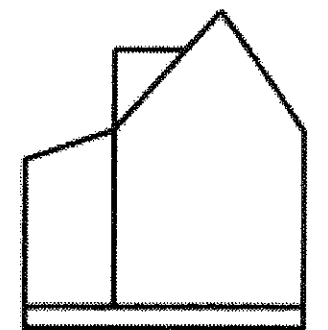
Given: The plan and elevation of a house.

Required: Draw an instrumental two point perspective drawing of the house.



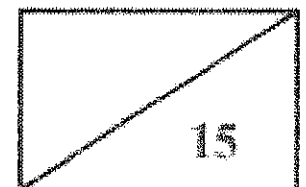
GL

+ SP



ELEVATION

BQ6A			
1	Correct division of circle	1	
2	Correct 12 divisions of pitch height	1	
3	Correct vertical projection lines	1	
4	Correct horizontal projection lines	1	
5	Correct helix drawn	1	
6	Correct line work	1	
BQ6B			
7	Correct VP ₁ and VP ₂	2	
8	Correct HL	1	
9	Correct method	2	
10	Correct shape drawn	2	
11	Accuracy as fit on shape	1	



15

SECTION C**[20 marks]**Index Number:

There are three questions in this section. Answer only one question.
Write the question number you have chosen in the box provided in SHEET 13.

EITHER**OR****QUESTION 1****(20 marks) QUESTION 2****(20 marks)**

Problem: Climate change is becoming a major concern in the world today with plastics identified as a major contributor of greenhouse gases which aggravates or worsens climate change. One way to reduce plastic pollution is through recycling.

Problem: Many hospital patients have trouble getting into and out of a standard bed. So, to assist patients in sitting up, lying down and getting in and out of bed, an adjustable hospital bed might be the best solution.

Brief: Design a manually operated plastic bottles recycling bin for sustainability.

Brief: Design a mechanism to elevate the bed according to a patient's height and reach.

Specification:**Specification:**

The bin should be designed to be:

The bed must conform to the following conditions:

1. rust proof;
2. strong and stable;
3. made up of combination materials;
4. large enough to collect plastic bottles.

1. relatively cheap to construct;
2. strong, portable and easy to operate;
3. made from a combination of materials;
4. elevated to a suitable height;
5. operated using human, mechanical, electrical or combination; of any two sources of power.

Requirements:**Requirements:**

(a) Produce two freehand pictorial sketches of the recycling bin.

(8 marks)

(a) Produce two freehand pictorial sketches of the elevated bed.

(8 marks)

(b) Evaluate each sketch on the following criteria:

- (i) safety.
- (ii) materials.

(4 marks)

(b) Evaluate each sketch on the following criteria:

- (i) safety.
- (ii) materials.

(4 marks)

(c) Explain with the help of sketches how it is secured.

(3 marks)

(c) Explain with the help of sketches how the bed be elevated to a suitable height.

(3 marks)

(d) Draw a pencil-rendered or a colour-rendered pictorial sketch of the final solution.

(5 marks)

(d) Draw a pencil-rendered or a colour-rendered pictorial sketch of the final solution.

(5 marks)

SECTION C (continued)

Index Number:

OR**QUESTION 3** (20 marks)

Problem: Tourism is very important for Fiji. A new hotel owner is seeking design for his hotel room.

Brief: Design a 2-dimensional interior design of a 1 bedroom suite for the new hotel.

Specification:

The 2-dimensional interior design should have:

1. an eye catching design;
2. king-size bed;
3. coffee table and a flower stand;
4. 4 lights.

Requirements:

- (a) Produce two freehand pictorial sketches of the elevation. (8 marks)
- (b) Evaluate each sketch on the following criteria:
- (i) safety.
 - (ii) materials.
- (4 marks)
- (c) Explain with the help of sketches how the local culture will be incorporated in the building. (3 marks)
- (d) Draw a pencil-rendered or a colour-rendered pictorial sketch of the final solution. (5 marks)

QUESTION

Index Number:

(a) Possible Solution 1 (4 marks)				Possible Solution 2 (4 marks)				(c) (3 marks)																																															
<table border="1"> <tr> <td>1</td> <td>Pictorial</td> <td>1</td> <td>3</td> <td>Correct labels</td> <td>1</td> <td></td> </tr> <tr> <td>2</td> <td>Correct line work</td> <td>1</td> <td>4</td> <td>Correct proportion</td> <td>1</td> <td></td> </tr> </table>				1	Pictorial	1	3	Correct labels	1		2	Correct line work	1	4	Correct proportion	1		<table border="1"> <tr> <td>1</td> <td>Pictorial</td> <td>1</td> <td>3</td> <td>Correct labels</td> <td>1</td> <td></td> </tr> <tr> <td>2</td> <td>Correct line work</td> <td>1</td> <td>4</td> <td>Correct proportion</td> <td>1</td> <td></td> </tr> </table>				1	Pictorial	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></td> <td>3</td> <td>Evidence shown</td> <td>1</td> <td></td> </tr> <tr> <td>2</td> <td>Relevant explanations and labels given</td> <td>1</td> <td></td> <td></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					
1	Pictorial	1	3	Correct labels	1																																																		
2	Correct line work	1	4	Correct proportion	1																																																		
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1	Overall neatness and clarity of sketch(es)	1		3	Evidence shown	1																																																	
2	Relevant explanations and labels given	1																																																					
(b) Criteria				Possible Solution 1 (2 marks)				Possible Solution 2 (2 marks)																																															
(i) Safety																																																							
(ii) Materials																																																							
								<table border="1"> <tr> <td>1</td> <td>Overall neatness and clarity of sketch</td> <td>1</td> <td></td> <td>3</td> <td>Correct standardizing shown</td> <td>1</td> <td></td> <td>3</td> <td>Correct line work</td> <td>1</td> <td></td> </tr> <tr> <td>2</td> <td>Correct labels</td> <td>1</td> <td></td> <td>4</td> <td>Correct proportion</td> <td>1</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>				1	Overall neatness and clarity of sketch	1		3	Correct standardizing shown	1		3	Correct line work	1		2	Correct labels	1		4	Correct proportion	1																									
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2	Correct labels	1		4	Correct proportion	1																																																	
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