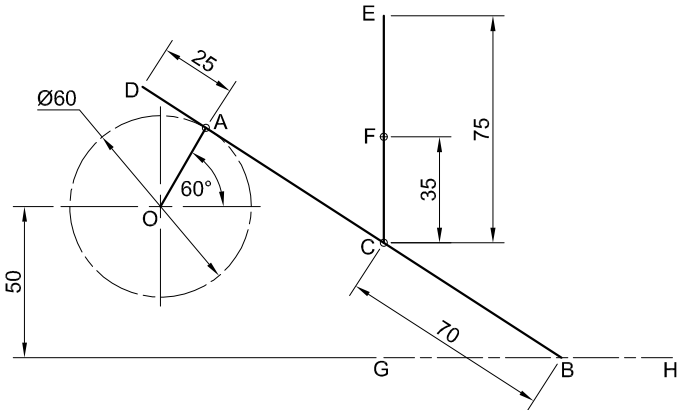


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QUESTION 2: LOCI

NOTE: Answer QUESTIONS 2.1 and 2.2.

2.1 MECHANISM

Given:

- A schematic drawing of a mechanism consisting of crank OA, sliding rod DB, horizontal groove GH, swivel guide F and rod CE in its vertical position
- The position of centre point O on the drawing sheet

Specifications:

- The positions of centre point O, swivel guide F and horizontal groove GH are fixed.
- Rod DB = 165.
- Sliding rod DB is pin-jointed to crank OA at A.
- Rod CE passes through swivel guide F, and is pin-jointed to sliding rod DB at C.

Motion:

As crank OA rotates, point B of sliding rod DB reciprocates along groove GH and rod CE slides through swivel guide F.

Instructions:

- Draw, to scale 1:1, the given schematic drawing of the mechanism.
- Trace the loci generated by point D and by point E for ONE complete rotation of crank OA.
- Show ALL construction. [25]

ASSESSMENT CRITERIA 2.1					
1	GIVEN + LABELS + CL	6			
2	CONSTRUCTION	5			
3	LOCI OF D AND E	14			
PENALTIES (-)					
SUBTOTAL		25			

2.2: CAM

Given:

- The position of corner P on the drawing sheet

Motion:

A cam imparts the following motion to a follower:

- It is at rest for the first 60°.
- It rises 80 mm with uniform acceleration and retardation over the next 150°.
- It returns to its original position with uniform motion over the rest of the rotation.

Instructions:

- From corner P, draw, to a rotational scale of 10 mm = 30° and a displacement scale of 1 : 1, the complete displacement graph for the required motion.
- Label the displacement graph and include the rotational scale.
- Show ALL construction. [12]

ASSESSMENT CRITERIA 2.2					
1	GRAPH CONSTRUCTION	5			
2	POINTS + CURVE	6			
3	LABELS	1			
PENALTIES (-)					
SUBTOTAL 2.2		12			
SUBTOTAL 2.1		25			
TOTAL		37			



EXAMINATION NUMBER	
EXAMINATION NUMBER	3



QUESTION 2: LOCI

NOTE: Answer QUESTIONS 2.1 and 2.2.

2.1 MECHANISM

Given:

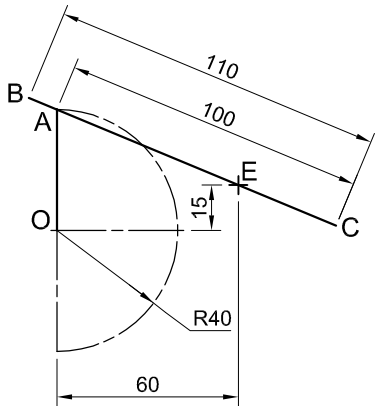
- A schematic drawing of a mechanism consisting of crank OA, connecting rod BC and swivel guide E
- The position of centre point O on the drawing sheet

Specifications:

- The positions of centre point O and swivel guide E are fixed.
- Connecting rod BC is pin-jointed to crank OA at A.

Motion:

Crank OA oscillates through 180° on centre point O as connecting rod BC slides freely through swivel guide E.



Instructions:

- Draw, to scale 1 : 1, the given schematic drawing of the mechanism.
- Trace the loci generated by point B and by point C for ONE oscillation of crank OA.
- Show ALL construction. [20]

ASSESSMENT CRITERIA 2.1					
1	GIVEN	4			
2	CONSTRUCTION	2			
3	POINTS + CURVE	14			
SUBTOTAL		20			

2.2 CAM

Motion:

A cam, starting at its **maximum** displacement and rotating at constant velocity, imparts the following motion to a follower:

- It descends 10 mm with uniform motion over the first 60°.
- It descends a further 80 mm to the **minimum** displacement with simple harmonic motion over the next 90°.
- There is a dwell period for 30°.
- It rises 60 mm with uniform acceleration and retardation over the next 90°.
- There is a dwell period for 30°.
- It returns to its original position with uniform motion over the rest of the rotation.

Instructions:

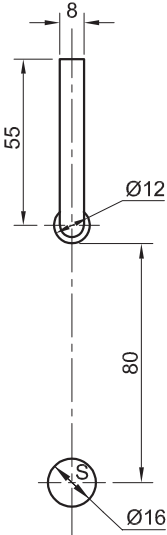
- Draw, to a displacement scale of 1 : 1 and a rotational scale of 144 mm = 360°, the complete displacement graph for the required motion.
- Label the displacement graph and indicate the rotational scale.
- Show ALL construction. [18]



ASSESSMENT CRITERIA 2.2					
1	CONSTRUCTION	6			
2	POINTS + CURVE	11			
3	LABELS	1			
PENALTIES (-)					
2.2 SUBTOTAL		18			
2.1 SUBTOTAL		20			
TOTAL		38			
EXAMINATION NUMBER					
EXAMINATION NUMBER					3



S



ROLLER-FOLLOWER AND CAMSHAFT DETAIL

QUESTION 2: LOCI (CAM)

Given:

- The detail of a camshaft and a roller-follower at the maximum distance from the camshaft centre
- The position of centre point S on the drawing sheet

Specifications:

- The roller-follower reciprocates along the vertical centre line that passes through the centre of the camshaft
- The **minimum** distance from the **circumference** of the roller of the follower to the centre of the camshaft = 14 mm
- Rotation = anti-clockwise

Motion:

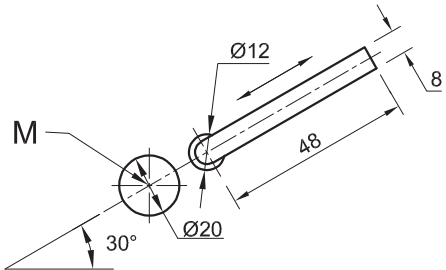
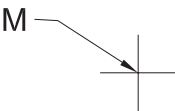
- The cam imparts the following motion to the roller-follower:
- There is a dwell period for the first 45°
 - It then descends 22 mm with uniform motion over the next 45°
 - It descends to its minimum distance with simple harmonic motion over the next 90°
 - It returns to its original position with uniform acceleration and retardation over the remainder of the rotation

Instructions:

- Using centre point S on the drawing sheet, draw, to scale 1 : 1, the camshaft and roller-follower in the given position.
- Draw to a rotational scale of 30° = 8 mm and a displacement scale of 1 : 1, the complete displacement graph for the required motion.
- Project and draw the cam profile from the displacement graph.
- Show the direction of rotation on the cam profile.
- Show ALL construction and projection. [38]

ASSESSMENT CRITERIA				
1	GIVEN + MINIMUM DISTANCE + CL	5		
2	GRAPH CONSTRUCTION	6		
3	PLOTTING GRAPH + GRAPH CURVES	8 1/2		
4	CAM CONSTRUCTION	5		
5	PLOTTING + CAM PROFILE	13 1/2		
PENALTIES (-)				
TOTAL		38		
EXAMINATION NUMBER				
EXAMINATION NUMBER				3





ROLLER-FOLLOWER AND
CAMSHAFT DETAIL

QUESTION 2: LOCI (CAM)

Given:

- The detail of a camshaft and a roller-follower at the minimum distance from the camshaft centre
- The position of centre point M on the drawing sheet

Specifications:

- The roller-follower reciprocates on a 30° centre line that passes through the centre of the camshaft
- The minimum distance from the centre of the roller of the follower to the centre of the camshaft = 22 mm
- Rotation = clockwise

Motion:

The cam imparts the following motion to the roller-follower:

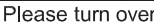
- It moves 48 mm outwards from its given position with uniform motion over the first 60°
- There is a dwell period for the next 45°
- It moves a further 12 mm outwards with uniform motion over the next 75°
- It returns to its original position with uniform acceleration and retardation over the remainder of the rotation

Instructions:

- Draw, to scale 1 : 1, the camshaft and the roller-follower in the given position.
- Draw, to a rotational scale of 30° = 8 mm and a displacement scale of 1 : 1, the complete displacement graph for the required motion.
- Label the displacement graph and include the rotational scale.
- Using the given position of the roller-follower as the 0° axis, project and draw the cam profile from the displacement graph.
- Show the direction of rotation on the cam profile.
- Show ALL construction and projection. [38]

ASSESSMENT CRITERIA				
1	GIVEN + MINIMUM DISTANCE + CENTRE LINES	5		
2	GRAPH CONSTRUCTION	5 1/2		
3	DISPLACEMENT GRAPH	6		
4	CAM CONSTRUCTION	6		
5	CAM + CURVE QUALITY	15 1/2		
PENALTIES				
TOTAL		38		
EXAMINATION NUMBER				
EXAMINATION NUMBER				3







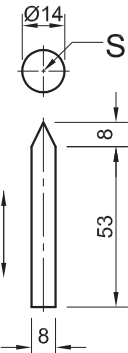
QUESTION 2: LOCI (CAM)

- Given:**
- The detail of a wedge-shaped follower and the camshaft
 - The position of centre point S on the drawing sheet

- Specifications:**
- The follower reciprocates on the vertical centre line of camshaft
 - The minimum distance from the follower to the centre of the camshaft = 17 mm
 - Rotation = anti-clockwise

- Motion:**
- The cam imparts the following motion to the follower:
- It descends 56 mm with uniform acceleration and retardation over the first 180°
 - It rises 20 mm with uniform motion over the next 45°
 - There is a dwell period for the next 45°
 - It returns to its original position with simple harmonic motion over the rest of the rotation

- Instructions:**
- Draw, to scale 1 : 1, the given camshaft and the wedge-shaped follower at the minimum distance.
 - Draw to a rotational scale of 30° = 8 mm and a displacement scale of 1 : 1, the complete displacement graph for the required motion.
 - Label the displacement graph and include the scale.
 - Project and draw the cam profile from the displacement graph.
 - Show the direction of rotation on the cam profile.
 - Show ALL construction and projection. **[38]**



FOLLOWER AND CAMSHAFT DETAIL

ASSESSMENT CRITERIA				
1	GIVEN + MINIMUM DISTANCE + CENTRE LINES	5		
2	GRAPH CONSTRUCTION	7		
3	DISPLACEMENT GRAPH	9		
4	CAM CONSTRUCTION	6		
5	CAM + CURVE QUALITY	11		
PENALTY (-)				
TOTAL		38		
EXAMINATION NUMBER				
EXAMINATION NUMBER				3



QUESTION 2: LOCI

NOTE: Answer QUESTIONS 2.1 and 2.2.

2.1 MECHANISM

Given:

- A schematic drawing of a mechanism consisting of crank AB, connecting rod BC, connecting rod CD and crank DE.
- The position of centre point A on the drawing sheet

Specifications:

- The positions of A and E are fixed
- Connecting rod BC is pin-jointed to crank AB at B
- Connecting rod CD is pin-jointed to connecting rod BC at C
- Connecting rod CD is pin-jointed to crank DE at D

Motion:

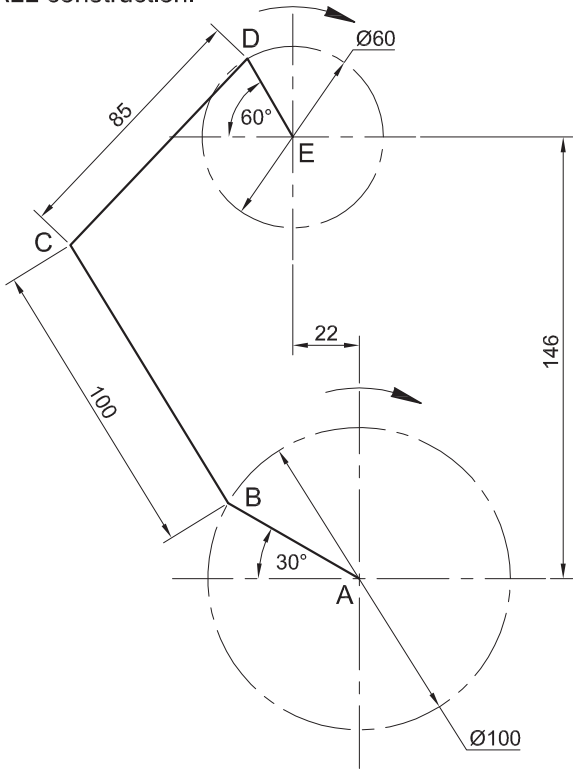
During the motion, both crank AB and crank DE rotate in a clockwise direction and at the same velocity.

Instructions:

- Draw, to scale 1 : 1, the given schematic drawing of the mechanism.
- Trace the locus generated by point C for ONE complete rotation of the two cranks.

Show ALL construction.

[19]



ASSESSMENT CRITERIA 2.1					
1	GIVEN	7			
2	CONSTRUCTION	5			
3	POINTS + CURVE	7			
PENALTIES					
TOTAL		19			



QUESTION 2.2: CHUTE (HELIX)

Given:

- The top view and incomplete front view showing the starting position, mid-position and end position of a chute
- The centre lines for the top view and the front view of the chute

Specifications:

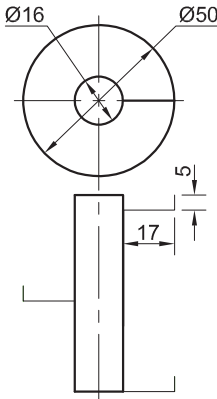
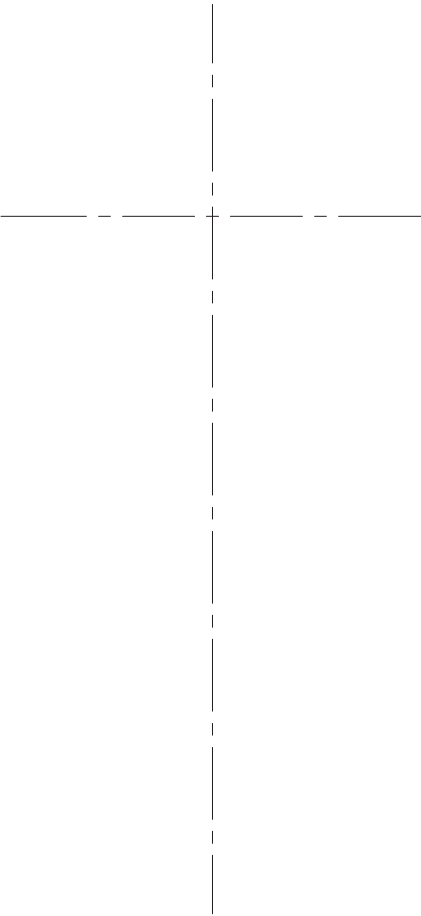
- Pitch: 60 mm
- Turns: ONE
- Rotation: LEFT HAND

Instructions:

Using the given centre lines, draw, to scale 1 : 1, the given top view and complete front view of the chute.

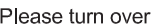
- NO hidden detail is required.
- Show ALL construction.

[19]



ASSESSMENT CRITERIA 2.2					
1	GIVEN TOP VIEW	1 1/2			
2	CONSTRUCTION	5			
3	OUTER HELIX	9			
4	INNER HELIX + SHAFT	3 1/2			
PENALTIES					
2.2 SUBTOTAL		19			
2.1 SUBTOTAL		19			
TOTAL		38			
EXAMINATION NUMBER					
EXAMINATION NUMBER					

3





0°

QUESTION 2: LOCI

NOTE: Answer QUESTIONS 2.1 and 2.2.

2.1 CAM

Given:

The position of the bottom left corner of the displacement graph on the drawing sheet

Motion:

The cam imparts the following motion to a follower:

- It descends 54 mm with simple harmonic motion over the first 90°.
- It descends a further 18 mm with uniform motion over the next 60°.
- There is a dwell period for the next 30°.
- It returns to its original position with uniform acceleration and retardation over the rest of the rotation.

Instructions:

- Draw, to a rotational (horizontal) scale of 360° = 126 mm and a displacement scale of 1 : 1, the complete displacement graph for the required motion.
- Label the graph and include the scale.
- Show ALL construction.

[18]

ASSESSMENT CRITERIA					
1	CONSTRUCTION	7 1/2			
2	POINTS + CURVE	9 1/2			
3	LABELS	1			
SUBTOTAL 2.1		18			

2.2 COIL SPRING (HELIX)

Given:

- The right view of a coil spring with DE indicating the starting position
- The position of centre point C on the drawing sheet

Specifications:

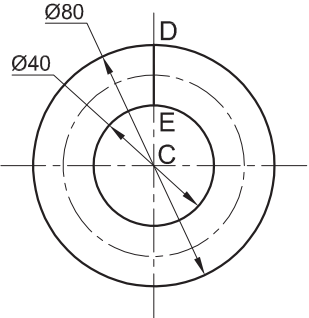
- Spring profile : Ø20
- Pitch : 108 mm
- Turn : ONE
- Direction : Right-handed

Instructions:

- Draw, to scale 1 : 1, the given right view and the complete front view of the coil spring.
- Show ALL construction.
- NO hidden detail is required.

[21]

C



ASSESSMENT CRITERIA					
1	GIVEN + CENTRE LINES	3			
2	CONSTRUCTION	6			
3	FRONT VIEW	12			
2.2 SUBTOTAL		21			
2.1 SUBTOTAL		18			
PENALTIES (-)					
TOTAL		39			
EXAMINATION NUMBER					
EXAMINATION NUMBER					3





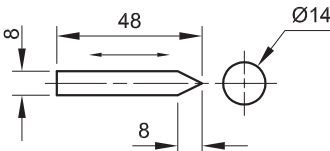
QUESTION 2: LOCI (CAM)

Given:
The detail of a wedge-shaped follower and the camshaft

- Specifications:**
- The follower reciprocates on the horizontal centre line of the camshaft
 - The minimum distance from the follower to the centre of the camshaft = 14 mm
 - Rotation = clockwise

- Motion:**
The cam imparts the following motion to the follower:
- It moves left with uniform acceleration and retardation for 40 mm over the first 180°
 - It moves further left with uniform motion for 15 mm over the next 90°
 - It moves right with simple harmonic motion back to the original position for the rest of the rotation.

- Instructions:**
- Draw, to scale 1 : 1, the given camshaft and the wedge-shaped follower at the minimum distance.
 - Draw, to a rotational scale of 30° = 8 mm and a displacement scale of 1 : 1, the complete displacement graph for the required motion.
 - Label the displacement graph and include the scale.
 - Project and draw the cam profile from the displacement graph.
 - Show the direction of rotation on the cam profile.
 - Show ALL construction. **[40]**



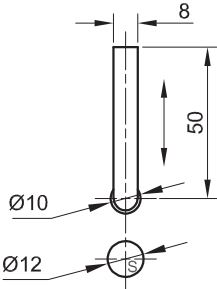
ASSESSMENT CRITERIA					
1	GIVEN + MINIMUM DISTANCE + CL	5			
2	GRAPH CONSTRUCTION	7			
3	PLOTTING POINTS + GRAPH CURVES	11			
4	CAM CONSTRUCTION	6			
5	PLOTTING OF CAM	7			
6	CAM PROFILE	4			
PENALTIES (-)					
TOTAL		40			
EXAMINATION NUMBER					
EXAMINATION NUMBER					3





+

S



QUESTION 2: LOCI (CAM)

- Given:**
- The detail of a roller-ended follower and the cam shaft
 - The position of centre point S on the drawing sheet

- Specifications:**
- The follower reciprocates on the vertical centre line of the cam shaft
 - The minimum distance from the follower to the centre of the cam shaft = 15 mm
 - Roller = Ø10 mm
 - Rotation = anti-clockwise

- Motion:**
- The cam imparts the following motion to the follower:
- It rises with uniform motion for 25 mm over the first 45°
 - There is a dwell period for the next 30°
 - It rises with uniform motion for 24 mm over the next 30°
 - It rises with uniform motion a further 7 mm over the next 45°
 - There is a dwell period for the next 30°
 - It descends with simple harmonic motion to the original position over the rest of the rotation.

- Instructions:**
- Draw, to scale 1 : 1, the given camshaft and the roller-ended follower at the minimum distance.
 - Draw, in the correct position and to a rotational (horizontal) scale of 30° = 8 mm and a displacement scale of 1 : 1, the complete displacement graph for the required motion.
 - Label the displacement graph and include the scale.
 - Project and draw the cam profile from the displacement graph.
 - Show the direction of rotation on the cam profile.
 - Show ALL construction and projection. [38]

ASSESSMENT CRITERIA					
1	GIVEN + MINIMUM DISTANCE + CL	5			
2	GRAPH CONSTRUCTION	7			
3	PLOTTING POINTS + CURVE	8			
4	CAM CONSTRUCTION	5			
5	PLOTTING	7			
6	CAM PROFILE	6			
TOTAL		38			
EXAMINATION NUMBER					
EXAMINATION NUMBER					3





P

QUESTION 2: LOCI
NOTE: Answer QUESTIONS 2.1 and 2.2.

2.1 LOCI (HELIX)

- Given:
- A front view and left view of the shaft of an auger with Q indicating the starting position
 - The position of point P on the drawing sheet



AUGER SHAFT DETAIL

- Specifications:
- Nominal diameter : Ø74 mm
 - Pitch : 72 mm
 - Turns : ONE AND A HALF
 - Direction : Left-handed

Instructions:
Draw, to scale 1 : 1, the complete front view and left view of the auger.

- Show ALL construction.
- NO hidden detail is required.

[23]

ASSESSMENT CRITERIA 2.1				
1	GIVEN + CENTRE LINES	3		
2	CONSTRUCTION	8		
3	OUTER HELIX	5 1/2		
4	INNER HELIX + SHAFT	4 1/2		
5	CURVE QUALITY	2		
PENALTIES (-)				
SUBTOTAL		23		

2.2 CAM

Given:
The bottom left 0° starting position of the displacement graph on the answer sheet

- Motion:
- The follower rises with uniform motion for 15 mm over the first 30° of rotation.
 - There is a dwell period for the next 15°.
 - The follower rises with simple harmonic motion for 65 mm over the next 135°, to the maximum displacement of 80 mm.
 - There is a dwell period for the next 90°.
 - The follower returns with uniform acceleration and retardation to the original position over the rest of the rotation.

Instructions:
Draw, to a displacement scale of 1 : 1 and a horizontal scale of 360° = 180 mm, the complete displacement graph for the required motion.

- Label the graph and indicate the horizontal scale.
- Show ALL construction.

[16]

ASSESSMENT CRITERIA 2.2				
1	CONSTRUCTION	6		
2	POINTS + CURVES	9		
3	LABELS	1		
PENALTIES (-)				
2.2 SUBTOTAL		16		
2.1 SUBTOTAL		23		
TOTAL		39		
EXAMINATION NUMBER				
EXAMINATION NUMBER				3





O+

QUESTION 2: LOCI

NOTE: Answer QUESTIONS 2.1 and 2.2.

2.1 MECHANISM

Given:

- A schematic drawing of a mechanism consisting of crank OA, connecting rod AB, swivel guide C, sliding rod DE, pin F and horizontal groove GH
- The position of centre point O on the drawing sheet

Specifications:

- The positions of O, C and groove GH are fixed
- Connecting rod AB is pin joined to crank OA at A
- Sliding rod DE is pin-joined to connecting rod AB at D
- Pin F is fixed to sliding rod DE
- AB = 120 mm
- DE = 120 mm
- AD = 40 mm
- DF = 40 mm

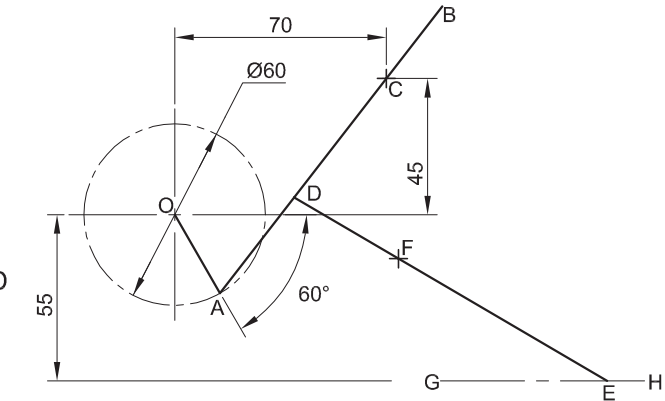
Motion:

As crank OA rotates in a clockwise direction, connecting rod AB freely slides through swivel guide C. Point E of sliding rod DE reciprocates along groove GH during the rotation.

Instructions:

- Draw, to scale 1:1, the given schematic drawing of the mechanism.
- Trace the locus generated by point F for ONE complete rotation of crank OA.

Show ALL necessary construction.



ASSESSMENT CRITERIA 2.1				
1	GIVEN	5		
2	CONSTRUCTION	7		
3	POINTS + CURVE	8		
SUBTOTAL		20		

[20]

R+

2.2 AUGER (HELIX)

Given:

- The incomplete front view and the left view of an auger with PQ indicating the starting position
- The position of centre point R on the drawing sheet

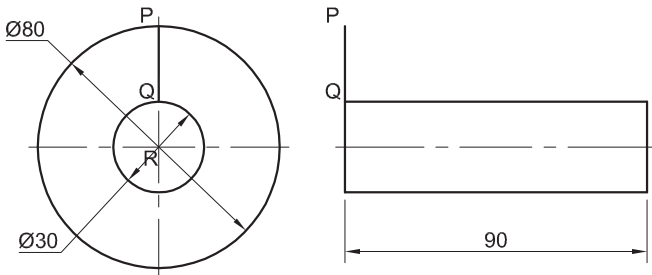
Specifications:

- Pitch : 60 mm
- Turns : ONE AND A HALF
- Direction : Right-handed

Instructions:

Draw, to scale 1 : 1, the given left view and the complete front view of the auger.

- Show ALL necessary construction.
- No hidden detail is required.



ASSESSMENT CRITERIA 2.2				
1	GIVEN + CENTRE LINES	4		
2	CONSTRUCTION	6		
3	OUTSIDE HELIX + CURVE QUALITY	8		
4	INSIDE HELIX + SHAFT	4		
SUBTOTAL 2.2		22		
SUBTOTAL 2.1		20		
TOTAL		42		
EXAMINATION NUMBER				
EXAMINATION NUMBER				3

[22]





S

QUESTION 2: LOCI (HELIX)

Given:

- The core and the profile of the incomplete front view as well as the right view of a shaft with a unique single-start right-handed thread
- The position of S on the drawing sheet

Specifications:

- Pitch = 96
- Turns = ONE and a HALF
- Direction = Right-handed

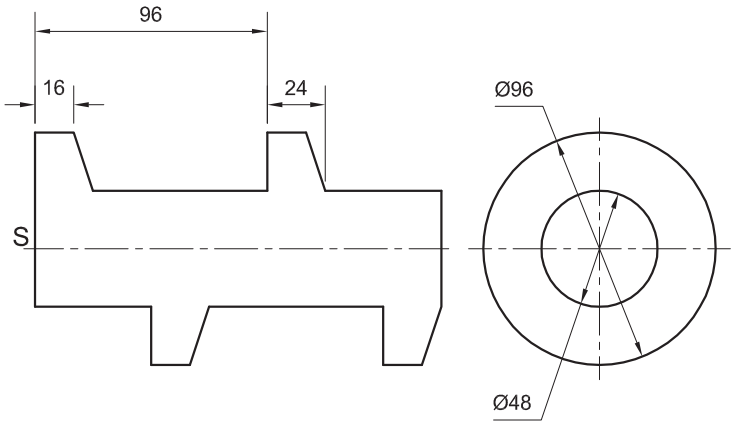
Instructions:

Draw, to scale 1 : 1, the following views of the shaft with a unique single-start right-handed thread:

- 2.1 The given right view
- 2.2 The complete front view

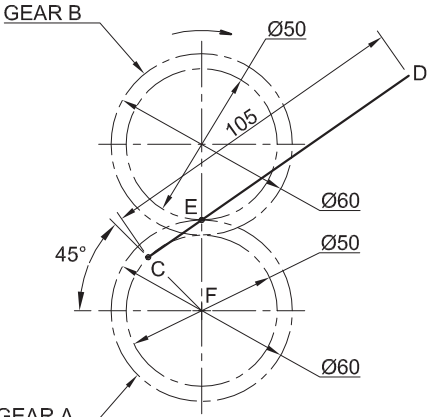
- Show ALL necessary construction.
- NO hidden detail is required.

[32]



ASSESSMENT CRITERIA					
1	RIGHT VIEW + CENTRE LINES	5			
2	CONSTRUCTION	5			
3	OUTER CURVE POINTS	10			
4	INNER CURVE POINTS	5			
5	CURVE QUALITY	4			
6	STRAIGHT LINES	3			
TOTAL		32			
EXAMINATION NUMBER					
EXAMINATION NUMBER					3





SCHEMATIC DRAWING

QUESTION 2: LOCI

NOTE: Answer QUESTIONS 2.1 and 2.2.

2.1 MECHANISM

Given:

- A schematic drawing of a mechanism consisting of gear A and gear B as well as a slotted bar CD, attached at C to gear A
- The position of pin E on gear B
- The position of centre point F

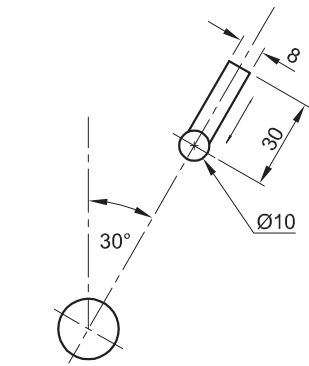
Motion:

As gear A rotates in an anti-clockwise direction, it drives gear B in a clockwise direction. The slotted bar CD slides over pin E during the rotation.

Instructions:

- Draw, to scale 1 : 1, the given schematic drawing of the mechanism.
- Trace the locus generated by point D for ONE complete revolution of the mechanism.
- Show ALL necessary construction.

[19]



FOLLOWER DETAIL

2.2 CAM

Given:

- The detail of a roller-ended follower, drawn to a reduced scale
- The displacement graph and the cam shaft, drawn to scale 1 : 1, in the correct position

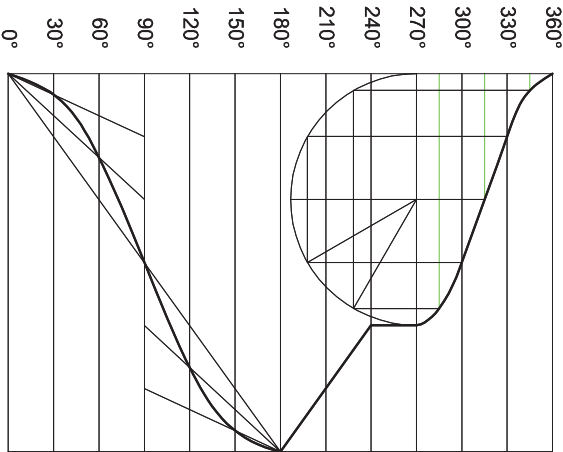
Specifications:

- The follower reciprocates along the 30° centre line that runs through the centre of the cam shaft
- Rotation = clockwise

Instructions:

- Draw, to scale 1 : 1, the roller-ended follower in its correct position.
- Project and draw the cam profile from the given displacement graph.
- Show the direction of rotation on the cam profile.
- Show ALL necessary construction.

[21]



DISPLACEMENT GRAPH
SCALE 6 mm = 30°

ASSESSMENT CRITERIA 2.1				
1	GIVEN + CENTRE LINES	5		
2	CONSTRUCTION	6		
3	POINTS + CURVE	8		
SUBTOTAL 2.1		19		
ASSESSMENT CRITERIA 2.2				
1	CONSTRUCTION + FOLLOWER + DIRECTION	8		
2	PLOTTING	7		
3	CAM PROFILE	6		
SUBTOTAL 2.2		21		
PENALTIES (-)				
TOTAL		40		
EXAMINATION NUMBER				
EXAMINATION NUMBER				
EXAMINATION NUMBER				3





T

QUESTION 2: LOCI

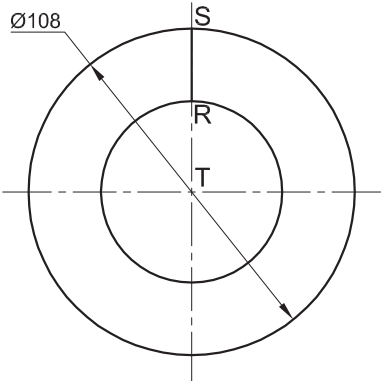
HELIX

- Given:**
- The left view of a square spring with RS indicating starting position
 - The position of centre point T on the drawing sheet

- Specifications:**
- Pitch = 72
 - Spring profile = 24 x 24
 - Direction = Right-handed

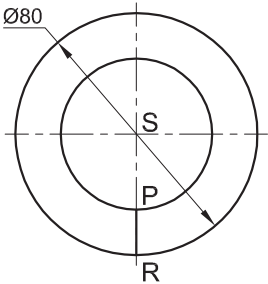
- Instructions:**
- Draw, to scale 1 : 1, the following:
- 2.1 The given left view with point T as reference
- 2.2 The front view for TWO turns of the square spring

- Show ALL necessary construction.
 - No hidden detail is required.
- [37]



ASSESSMENT CRITERIA					
1	GIVEN + CENTRE LINES + STARTING POINT	4 ½			
2	CONSTRUCTION	8			
3	OUTSIDE POINTS + CURVE + QUALITY	14 ½			
4	INSIDE POINTS + CURVE + QUALITY	10			
PENALTIES (-)					
TOTAL		37			
EXAMINATION NUMBER					
EXAMINATION NUMBER					3





QUESTION 2: LOCI

NOTE: Answer QUESTIONS 2.1 and 2.2.

2.1 COIL SPRING (HELIX)

Given:

- The right view of a coil spring with PR indicating the starting position
- The position of centre point S on the drawing sheet

Specifications:

- Pitch = 100
- Outer diameter = Ø80
- Inner diameter = Ø48
- Spring profile = Ø16
- Direction = Right-handed

Instructions:

- Draw, to scale 1 : 1, the given right view and the front view for ONE turn of the coil spring.
- Show ALL necessary construction.
- No hidden detail is required.

[21]

ASSESSMENT CRITERIA					
1	GIVEN + CENTRE LINES	3			
2	CONSTRUCTION	6			
3	POINTS + CURVES	12			
PENALTIES (-)					
SUBTOTAL 2.1		21			

2.2 CAM

Motion:

- The follower rises with uniform motion for 20 mm over the first 60° of the rotation.
- There is a dwell period for 30°.
- The follower rises with simple harmonic motion for 50 mm over the next 90° of the rotation, to the maximum displacement of 70 mm.
- The follower descends with uniform acceleration and retardation to the original position over the rest of the rotation.

Instructions:

- Draw, to a horizontal scale of 130 mm = 360° and a displacement scale of 1 : 1, the complete displacement graph for the required motions.
- Label the graph and indicate the scale.

[17]

ASSESSMENT CRITERIA					
1	CONSTRUCTION	6 ¹ / ₂			
2	POINTS + CURVES	9 ¹ / ₂			
3	LABELS	1			
PENALTIES (-)					
2.2 SUBTOTAL		17			
2.1 SUBTOTAL		21			
TOTAL		38			
EXAMINATION NUMBER					
EXAMINATION NUMBER					3



S

QUESTION 2: LOCI

CAM

Given:

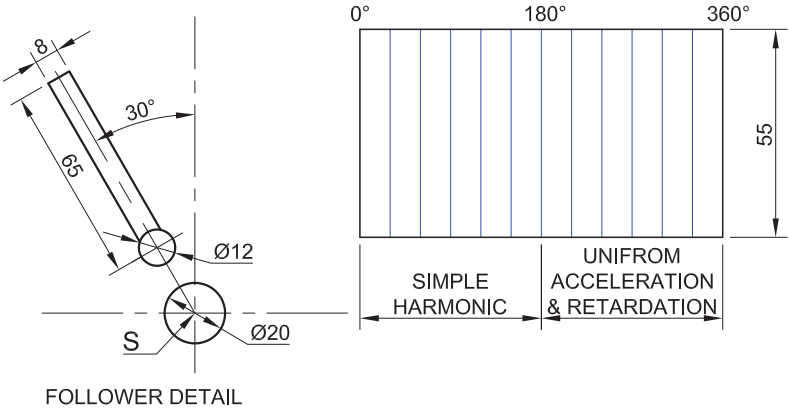
- The detail of a roller-ended follower and the cam shaft
- The incomplete displacement graph
- The position of point S on the answer sheet

Specifications:

- The minimum distance from the cam profile to the centre of the camshaft = 19 mm
- The follower reciprocates along the 30° centre line which passes through the centre of the camshaft
- Rotation = clockwise

Instructions:

- Draw, to scale 1 : 1, the given follower and camshaft.
- Draw, to a horizontal scale of 8 mm equal to 30° and a displacement scale of 1 : 1, the complete displacement graph for the required motions. Label the graph.
- Project and draw the cam profile from the displacement graph.
- Show the direction of rotation on the cam profile.
- Show ALL necessary construction and projection. [40]



ASSESSMENT CRITERIA					
1	PLACEMENT, GRAPH DIVISIONS + CONSTRUCTION FOR MOVEMENT + LABEL	7 ½			
2	PLOTTING POINTS & CURVE	10 ½			
3	FOLLOWER + MIN. DIST' C'LINES+ CAMSHAFT+ DIRECTION	9			
4	CONSTRUCTION	3			
5	PLOTTING	6			
6	PROFIEL	4			
TOTAL		40			
EXAMINATION NUMBER					
EXAMINATION NUMBER					3



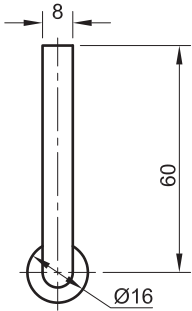
QUESTION 2: LOCI

Given:
The detail of the roller-ended follower for a disc cam.

- Specifications:**
- The minimum distance from the centre of the cam shaft to the cam profile = 20 mm
 - Camshaft = Ø 20 mm
 - Rotation = clockwise

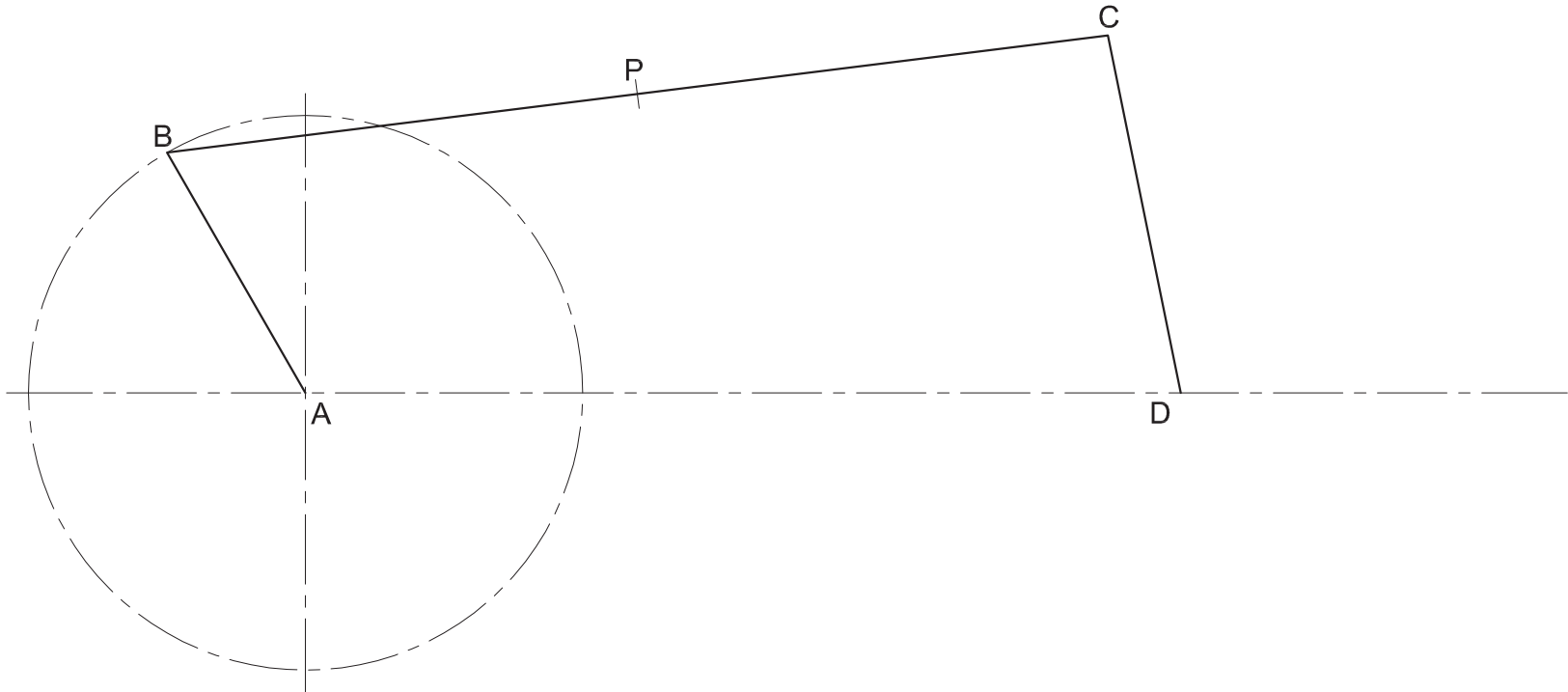
- Motion:**
The disc cam rotates at constant velocity imparting the following uniform motion to the roller-ended follower:
- Over the first 60° the follower is at rest.
 - Over the next 60° the follower rises to a height of 57 mm.
 - There is a dwell period for the next 45°.
 - Over the next 45° the follower falls 20 mm.
 - There is a dwell period for the next 60°.
 - Over the final 90° the follower returns to its original position.

- Instructions:**
- Using a horizontal scale of 30° equal to 8 mm and a displacement scale of 1 : 1, draw the displacement graph for the given motion.
 - Label the displacement graph and include the scale.
 - Draw, to scale 1 : 1, the given roller-ended follower in the correct position.
 - Project and draw the cam profile from the displacement graph.
 - Show the direction of rotation on the cam profile.
 - Show ALL necessary construction. **[36]**



ASSESSMENT CRITERIA					
1	DISPLACEMENT GRAPH	10			
2	FOLLOWER, ARROW, SHAFT + CENTRE LINES + MIN DIST. + ROTATION	9			
3	CONSTRUCTION	4			
4	ROLLER + PROFILE	13			
TOTAL		36			
EXAMINATION NUMBER					
EXAMINATION NUMBER					3





QUESTION 2: LOCI
NOTE: Answer QUESTIONS 2.1 and 2.2.

2.1 MECHANISM

Given:
A schematic diagram of crank AB, connecting rod BC and rocker CD.
A and D are fixed points.

Motion:
As crank AB rotates in an anticlockwise direction, rocker CD oscillates back and forth.

Instructions:
Using the given diagram, trace the locus generated by point P for ONE revolution.

Show ALL necessary construction. **[14]**

ASSESSMENT CRITERIA					
1	CONSTRUCTION	6			
2	LOCUS OF P	8			
SUBTOTAL		14			

2.2 CHUTE

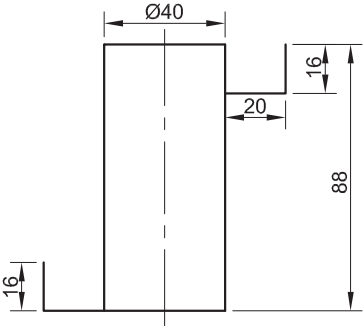
Given:
The front view of the shaft of a chute with the profile of the chute in the start and end positions.

Specification:

- Direction: left-hand
- Turns: ONE AND A HALF

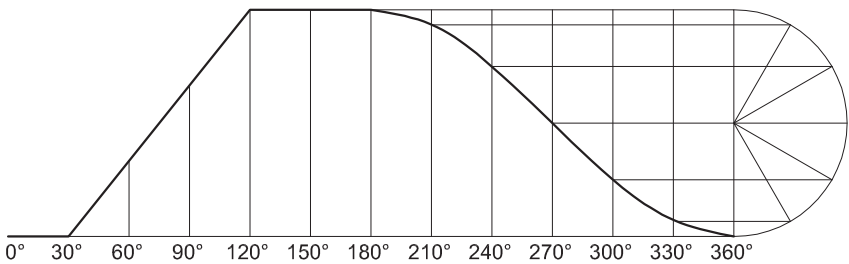
Instructions:
Draw, to scale 1 : 1, the chute around the shaft.

Show ALL necessary construction. **[20]**

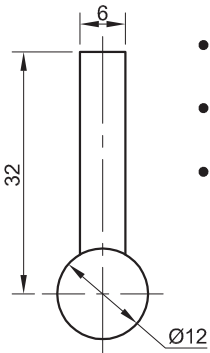


ASSESSMENT CRITERIA					
1	CL + CONSTRUCTION	8			
2	CHUTE	12			
SUBTOTAL		20			
TOTAL		34			
EXAMINATION NUMBER					
EXAMINATION NUMBER					3





DISPLACEMENT GRAPH
SCALE 8 mm = 30°



FOLLOWER DETAIL

QUESTION 2: LOCI
NOTE: Answer QUESTIONS 2.1 AND 2.2.

2.1 CAM

Given:

- The displacement graph showing uniform motion and simple harmonic motion
- The detail of a roller-ended follower

Specifications:

- The minimum distance from the cam profile to the centre of the camshaft = 19 mm
- Camshaft = Ø16 mm
- Rotation = clockwise

Instructions:

- Draw, to scale 1 : 1 and in the correct position, the given follower so that it will reciprocate along the vertical centre line of the camshaft.
- Project and draw the cam profile from the given displacement graph.
- Show the centre lines and the direction of rotation on the cam profile.
- Show ALL necessary construction.

[19]

ASSESSMENT CRITERIA					
1	FOLLOWER + MIN. DIST' C'LINES + CAMSHAFT	5			
2	CONSTRUCTION	3			
3	PLOTTING + DIRECTION	7			
4	CURVE	4			
	SUBTOTAL	19			

2.2 HELICAL SQUARE SPRING

Given:

- The right view of a left-hand square spring, showing the starting position
- The position of centre point O on the answer sheet

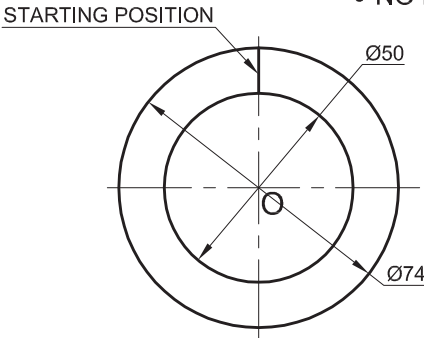
Specifications:

- Pitch = 48 mm
- Spring profile = 12 x 12 mm

Instructions:

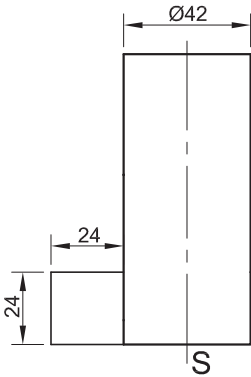
- Draw, to scale 1 : 1, the front view and right view of the left-hand square spring.
- Show ONE AND A HALF turns ONLY.
- Show ALL necessary construction.
- NO hidden detail is required.

[21]



ASSESSMENT CRITERIA					
1	CONSTRUCTION	5			
2	POINTS + CURVE	16			
	SUBTOTAL	21			
	TOTAL	40			
EXAMINATION NUMBER					
EXAMINATION NUMBER					3





QUESTION 2: LOCI

NOTE: Answer QUESTIONS 2.1 AND 2.2.

2.1 Thread

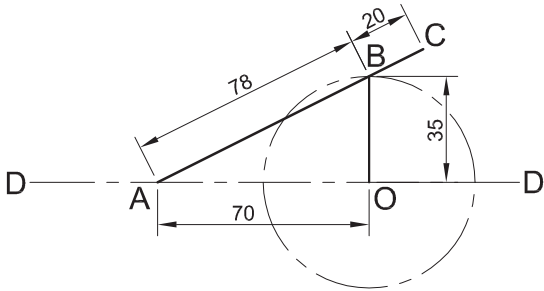
Given:

- The profile of a single-start right-hand square thread in the starting position
- The complete core
- The position of S on the drawing sheet

Instructions:

- Draw, to scale 1 : 1, ONE AND A HALF turns of the single-start right-hand square thread.
- Show ALL necessary construction.
- NO hidden detail is required.

[24]



2.2 Mechanism

Given:

- A schematic diagram of a mechanism consisting of a crank OB, which is attached to a connecting rod AC at point B
- The position of centre point O on the drawing sheet

Motion:

As crank OB rotates in a clockwise direction, point A moves to and fro along axis D-D.

Instructions:

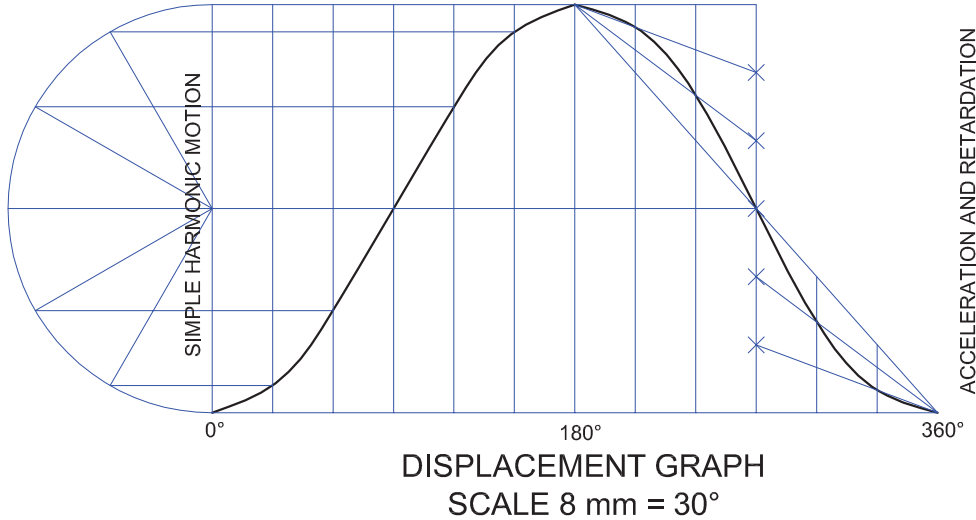
- Draw, to scale 1 : 1, the given schematic drawing of the mechanism.
- Trace the locus generated by point C for ONE complete revolution of the mechanism.
- Show ALL necessary construction.

[18]

ASSESSMENT CRITERIA				
1	CENTRE LINES + CONSTR'	6		
2	HELICES + SHAFT + DIRECTION	18		
SUBTOTAL		24		

ASSESSMENT CRITERIA				
1	GIVEN	4		
2	CONSTRUCTION	6		
3	LOCUS + CURVE	8		
SUBTOTAL		18		
TOTAL		42		
EXAMINATION NUMBER				
EXAMINATION NUMBER				3





QUESTION 2: LOCI
NOTE: Answer QUESTIONS 2.1 AND 2.2.

2.1 CAM

Given:

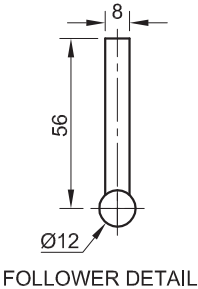
- The detail of a roller-ended follower and a displacement graph showing simple harmonic motion and uniform acceleration and retardation
- The vertical centre line of the cam profile

Specifications:

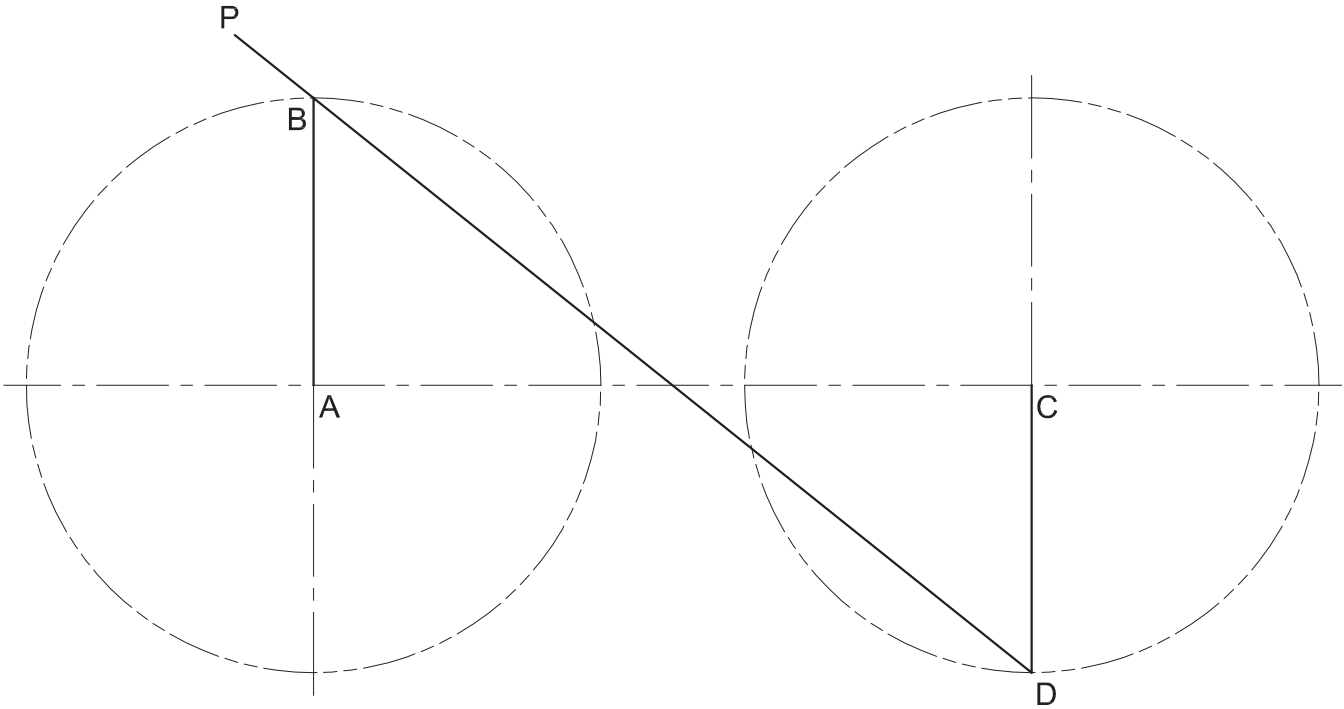
- Camshaft = Ø14 mm
- Minimum distance from the cam profile to the centre of the camshaft = 10 mm
- Rotation = clockwise

Instructions:

- Draw, to scale 1 : 1, the given follower detail so that it will reciprocate along the given centre line.
- From the given displacement graph, project and draw the cam profile.
- Show the centre line and the direction of rotation on the cam profile.
- Show ALL necessary construction. **[19]**



ASSESSMENT CRITERIA				
1. FOLLOWER + MIN. DIST' + CENTRE LINE + CAMSHAFT	6			
2. CONSTRUCTION	3			
3. PLOTTING + DIRECTION	6			
4. CURVE	4			
SUBTOTAL	19			



2.2 MECHANISM

Given:

A schematic diagram of a linked crank mechanism consisting of two cranks, AB and CD, joined by a rod, DP, which is fixed at D and slides through B.

Motion:

As crank AB rotates in an anticlockwise direction, crank CD rotates in a clockwise direction at the same velocity.

Instructions:

- Using the given diagram, trace the locus generated by point P for ONE complete revolution of the mechanism.
- Show ALL necessary construction. **[19]**

ASSESSMENT CRITERIA				
1. CONSTRUCTION	5			
2. LOCUS OF P	14			
SUBTOTAL	19			
TOTAL	38			
EXAMINATION NUMBER				
EXAMINATION NUMBER				3



⊕
O

QUESTION 2: LOCI

NOTE: Answer QUESTIONS 2.1 AND 2.2.

2.1 AUGER

Given:

- The front view and left view of the shaft of an auger
- A reference point, labelled O, to help with the placement of the answer

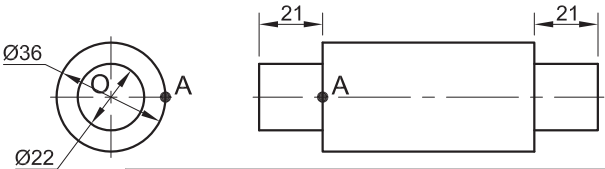
Specifications:

- The pitch (ONE full turn) is 35 mm.
- The outer diameter of the auger is Ø80.

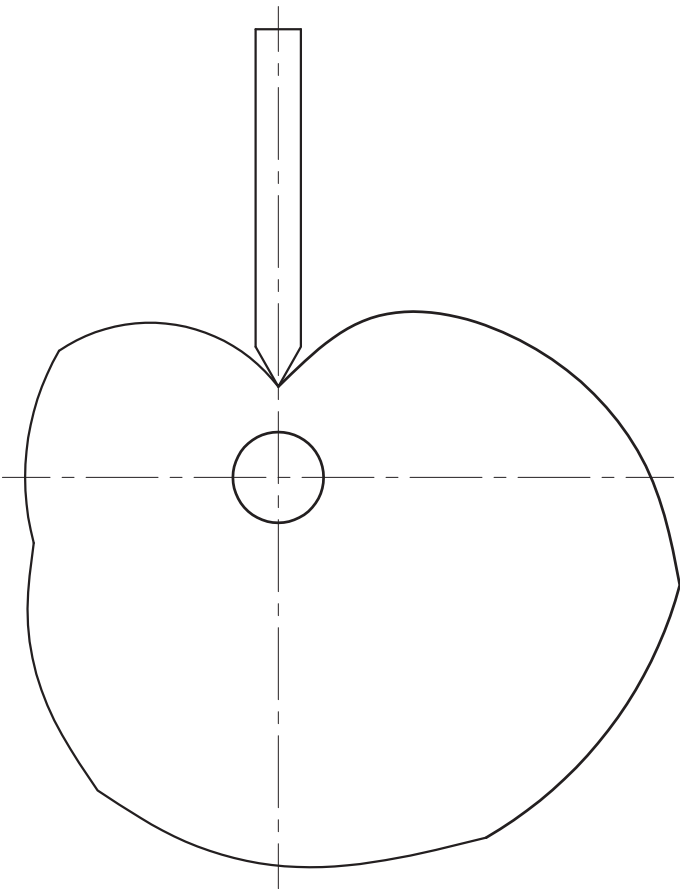
Instructions:

- Starting at point A, draw, to scale 1 : 1, TWO turns of a right-hand auger on the given views of the shaft.
- Show ALL necessary construction.
- NO hidden detail is required.

[27]



ASSESSMENT CRITERIA				
GIVEN	5			
CENTRE LINES + CONSTR'	5			
HELIX/AUGER	17			
SUBTOTAL	27			



2.2 CAM

Given:

A cam profile with a wedge-ended follower

Specifications:

The cam rotates with constant velocity in a clockwise direction, imparting uniform motion to the follower.

Instructions:

- Draw the displacement graph for the cam, using a horizontal scale of 8 mm equal to 30°.
- Indicate the direction of rotation on the cam profile.
- Label the displacement graph and indicate the scale used.
- Show ALL necessary construction.

[12]

ASSESSMENT CRITERIA				
DISPLACEMENT GRAPH	7			
CONSTRUCTION	3			
LABELS + ARROW	2			
SUBTOTAL	12			
TOTAL	39			
EXAMINATION NUMBER				
EXAMINATION NUMBER				3





A
B

QUESTION 2: LOCI (HELIX)

A manufacturing company designed a single-start square threaded worm gear with the following specifications:

- Right handed
- One and a half revolutions
- Outside diameter = 120 mm
- Core diameter = 80 mm
- Pitch = 60 mm

Given:

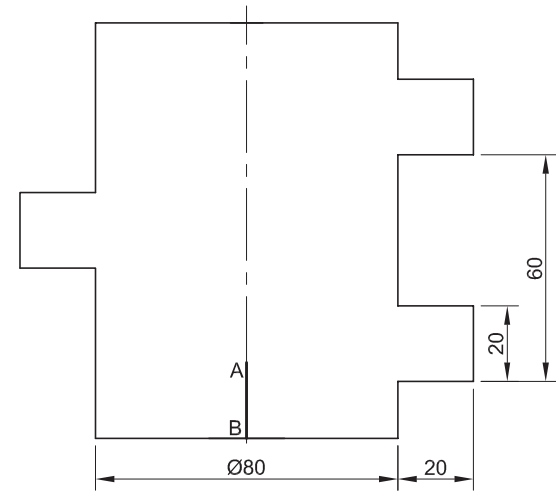
- The incomplete front view of the worm gear showing the profile of the thread and the starting position AB, at the centre front of the shaft
- The centre line and starting position AB as a reference on the drawing sheet

Instructions:

Draw, to scale 1 : 1, the complete front view of the worm gear using the given centre line and starting position AB.

- Show ALL necessary construction.
- NO hidden detail is required.

[39]



ASSESSMENT CRITERIA				
1. CONSTRUCTION	8½			
2. OUTSIDE CURVES + LINES	15½			
3. INSIDE CURVES	6			
4. QUALITY OF CURVES	4			
5. SHAFT	5			
TOTAL	39			
EXAMINATION NUMBER				
EXAMINATION NUMBER				3



QUESTION 2: LOCI (CAM)

Given:

- The shaft and follower detail of an industrial cam with the follower shown at its furthest position to the left
- The vertical centre line of the camshaft as a reference on the drawing sheet

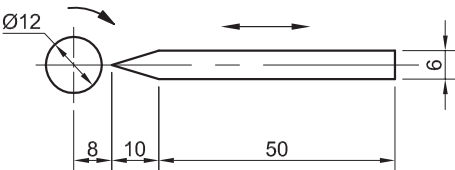
The specifications for the movement are as follows:

- The cam rotates clockwise at constant velocity and imparts uniform motion to the follower.
- Over the first 60° the follower moves 20 mm to the right.
- There is a dwell period for the next 30°.
- Over the next 30° the follower moves a further 20 mm to the right.
- Over the next 60° the follower moves a further 20 mm to the right.
- There is a dwell period for the next 45°.
- Over the next 45° the follower moves 50% of the displacement to the left.
- There is a dwell period for the next 30°.
- Over the final 60° the follower returns to its original position.

Instructions:

- 2.1 Draw, to scale 1 : 1, the given view of the camshaft and the follower using the given vertical centre line as reference. The arrow indicating the direction of rotation must be shown.
- 2.2 Draw the displacement graph with a rotational scale of 30° equal to 8 mm and a displacement scale of 1 : 1 for the given motion. Label the graph.
- 2.3 Project and draw the cam profile that would generate the given motion.

- Show ALL necessary construction. [33]



CAMSHAFT AND FOLLOWER DETAIL

ASSESSMENT CRITERIA				
1. GRAPH	11			
2. FOLLOWER + SHAFT + ARROW	5			
3. CONSTRUCTION	4			
4. CAM POINTS	7			
5. CURVE + QUALITY	6			
TOTAL	33			
EXAMINATION NUMBER				
EXAMINATION NUMBER				3



QUESTION 2: LOCI (MECHANISMS)

Given:

- A mechanism consisting of a movable slider DF and a T-piece ABC
- FIGURE 1: An oblique drawing of the mechanism
- FIGURE 2: A schematic drawing of the mechanism
- Point G as the reference point on the drawing sheet

Motion:

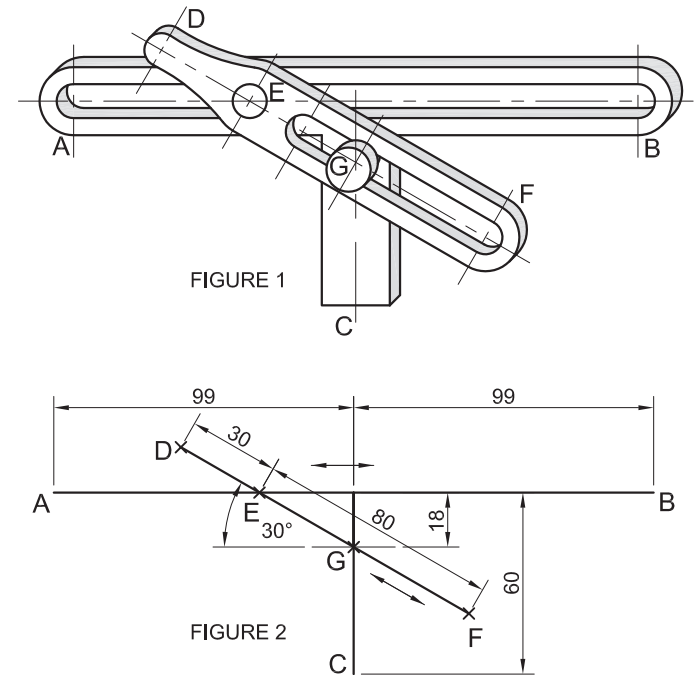
Pin E, located on slider DF, slides freely in groove AB to its furthest position on the left, then to its furthest position on the right. Slider DF moves freely around a fixed pin G located on the T-piece ABC.

Instructions:

- 2.1 Draw, to scale 1:1, the given schematic drawing using point G as the reference point. Include ALL labels.
- 2.2 Trace the locus of point D for the complete movement of the slider.
- 2.3 Trace the locus of point F for the complete movement of the slider.

- Show ALL necessary construction. [33]

G+



ASSESSMENT CRITERIA				
GIVEN + LABELS	6			
CONSTRUCTION	6			
LOCUS D + CURVE	11			
LOCUS F + CURVE	10			
TOTAL	33			
EXAMINATION NUMBER				
EXAMINATION NUMBER				3



O+

QUESTION 2: LOCI (MECHANISMS)

Given:
A mechanism consisting of a crank OP that is pin-jointed to a slotted link AB. The slotted link AB slides over a fixed pin R that is located on the circumference of a wheel, centre Q.
FIGURE 1: A detailed drawing of the mechanism
FIGURE 2: A schematic drawing of the mechanism

Motion:
Crank OP rotates in an anti-clockwise direction while the wheel, centre Q, rotates at the same speed in a clockwise direction. The slotted link AB slides over pin R during the rotation.

- Instructions:**
- 2.1 Draw, to scale 1:1, the given schematic drawing using point O as a reference point. Include ALL the labels.
 - 2.2 Trace the locus generated by point A of the slotted link for one revolution.
 - 2.3 Trace the locus generated by point B of the slotted link for one revolution.

• Show ALL necessary construction. [33]

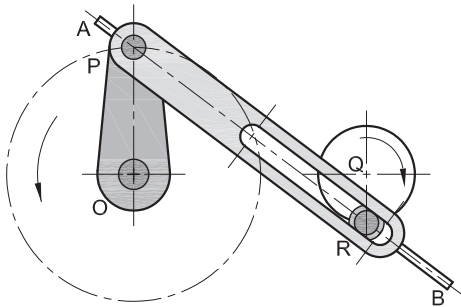


FIGURE 1

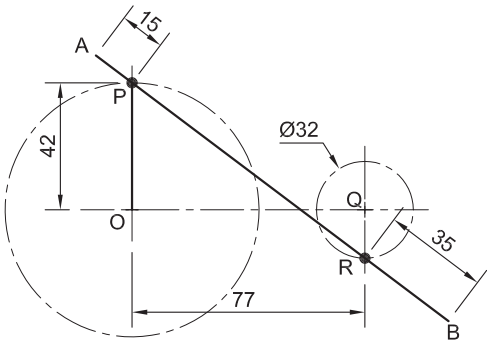


FIGURE 2

ASSESSMENT CRITERIA				
GIVEN + LABELS	5			
CONSTRUCTION	8			
LOCUS A + CURVE	10			
LOCUS B + CURVE	10			
TOTAL	33			
EXAMINATION NUMBER				
EXAMINATION NUMBER				3



QUESTION 2: LOCI (MECHANISMS)

A manufacturing company designed a mechanism to open and close a mechanical gate on an assembly line in a bottling plant.

The mechanism consists of a crank, OA, attached to a shaft which rotates clockwise at a constant speed about a centre point O. Rod AB, attached to the crank at A, slides freely through a fixed point at C. AB rotates freely about point A.

During the design process the loci generated by points B and E on the moving parts of the mechanism had to be established.

Given:
FIGURE 1: A drawing showing the assembled parts of the mechanism.
FIGURE 2: A schematic drawing of the moving parts of the mechanism.

- Instructions:**
- 2.1 With point O as a reference, draw FIGURE 2 full size.
 - 2.2 Trace the locus generated by point B located on the rod AB.
 - 2.3 Trace the locus generated by point E located on the rod AB.
- Show ALL necessary construction. [33]

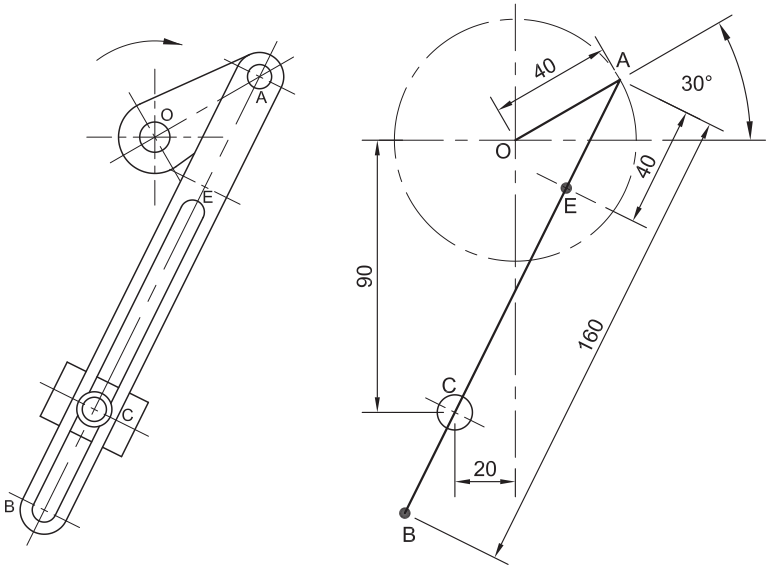


FIGURE 1

FIGURE 2

ASSESSMENT CRITERIA	
GIVEN FIGURE	4
CONSTRUCTION	3
LOCUS B	13
LOCUS E	13
TOTAL	33

EXAMINATION NUMBER	
EXAMINATION NUMBER	3



QUESTION 2: LOCI (CAM)

A toy manufacturing company wishes to design a toy car that when it is pushed along the ground, the body of the car rises and falls. This can be achieved by attaching a cam to the inside of the wheel with a roller-follower attached to the body of the car.

The specifications for the movement are as follows:

- The car rises with uniform motion to a height of 23mm over the first 90°
- There is a dwell period for the next 60°
- It then rises a further 37mm over the next 75°
- There is another dwell period for the next 60°
- The car returns to its original position over the final 75°

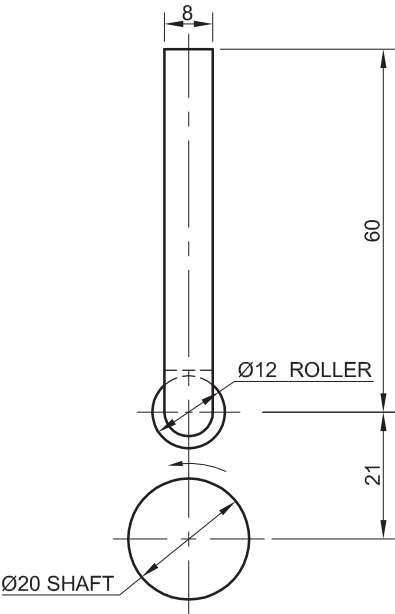
Given:

The cam shaft and the follower detail in its lowest position. The cam rotates in an anti-clockwise direction as shown by the arrow.

Instruction:

- Copy the camshaft and follower detail. Show the arrow indicating the direction of rotation.
- Draw a displacement graph with a horizontal scale of 30° equal to 8mm and a vertical scale of 1:1 for the given motion. Label the graph and include a scale.
- Project and draw the cam profile that would generate the given motion.

[36]



CAMSHAFT AND FOLLOWER DETAIL

ASSESSMENT CRITERIA

GRAPH	9
GIVEN INFO: FOLLOWER, MIN HEIGHT	
DIRECTION ARROW	
SHAFT and CL,s	11
CONSTRUCTION	4
ROLLER POSITIONS + CURVE QUALITY	12
TOTAL	36

EXAMINATION NUMBER

EXAMINATION NUMBER

3



QUESTION 2: LOCI (HELIX)

A manufacturing company has its packaging division located on the first floor of its factory. An open chute was installed to move the packed boxes from the first floor to the ground floor.

Given:

- The incomplete front view of the chute showing the start and the end points
- The top view of the chute
- The profile of the chute

Instructions:

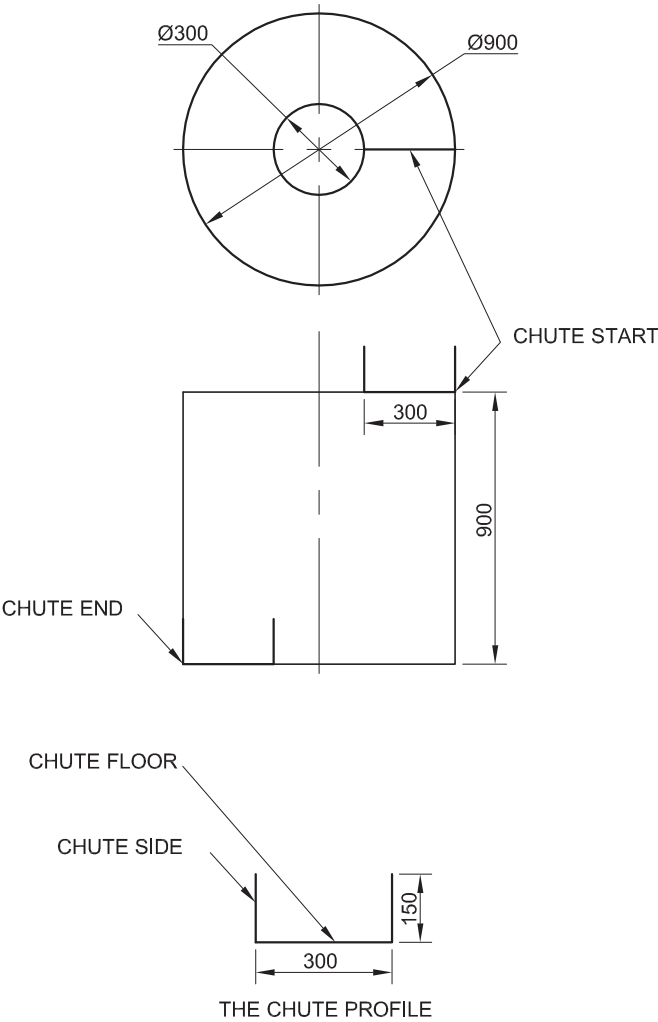
Draw, to scale 1:10, the complete front view and the top view of the chute according to the following specifications:

- Right-hand helical chute
- The chute floor drops 900 mm over 1½ turns
- The sides of the chute are 150 mm high
- The chute floor is 300 mm wide

Note:

NO hidden detail is required.
Study the given diagrams carefully before you start drawing.

[45]



ASSESSMENT CRITERIA	
CONSTRUCTION	= 6
TOP VIEW	= 2
DIRECTION	= 4
CENTRE LINES	= 2
HELIX	= 31
TOTAL	= 45

EXAMINATION NUMBER	
EXAMINATION NUMBER	3