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EASTERN CAPE EDUCATION DEPARTMENT
OOS-KAAP ONDERWYSDEPARTEMENT

NATIONAL SENIOR CERTIFICATE

GRADE 12

GRDSE2

ENGINEERING GRAPHICS AND DESIGN P2

SEPTEMBER 2026

PREPARATORY EXAMINATION

MARKS: 200

TIME: 3 hours

This question paper consists of 6 pages.

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INSTRUCTIONS AND INFORMATION

1. The question paper consists of FOUR questions.
2. Answer ALL the questions.
3. ALL drawings must be drawn to scale 1 : 1, unless otherwise stated.
4. ALL the questions must be answered on the answer sheets provided.
5. ALL the answer sheets must be re-stapled in numerical sequence and handed in irrespective of whether the question was attempted or not.
6. Careful time management is essential in order to complete all the questions.
7. Print your name in the block provided on every ANSWER SHEET.
8. ALL answers must be drawn accurately and neatly.
9. Any details or dimensions not given must be estimated in good proportion.
10. ALL drawings are in third angle orthographic projection, unless otherwise stated.

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					MODERATED MARK			
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TOTAL								
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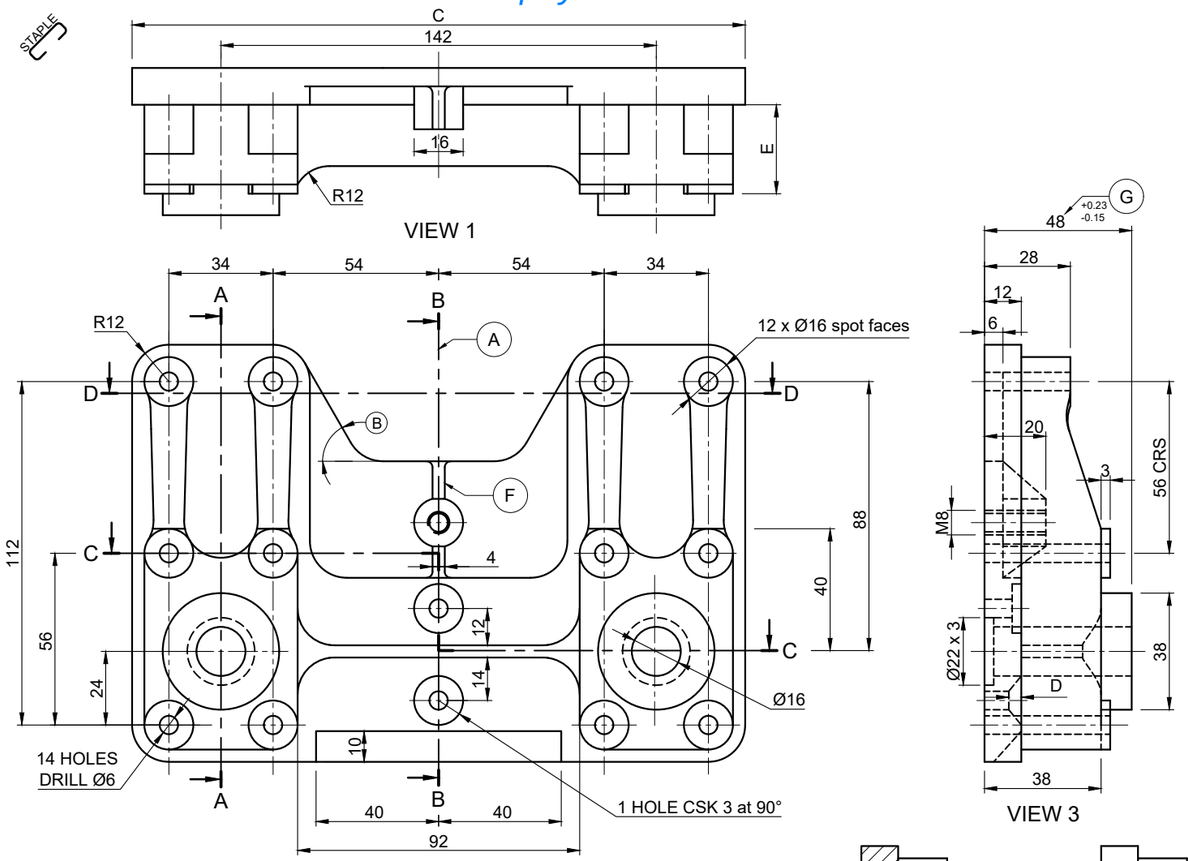
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EXAMINATION CENTRE
SCHOOL

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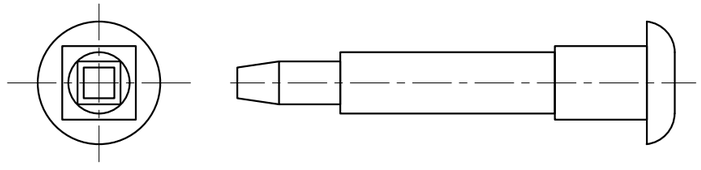
QUESTION 1: ANALYTICAL (MECHANICAL)

Given:
A detailed drawing of an aircraft bracket, a title block and table of questions. The drawings are not presented to the indicated scale.

Instructions:
Complete the table below by neatly answering the questions, which all refer to the accompanying drawings, the title block and mechanical content. **[28]**

	QUESTIONS	ANSWERS		
1	On what date was the drawing checked?		1	
2	What is the title of the drawing?		1	
3	Which drawing method was used to create these drawings?		1	
4	How many aircraft brackets need to be manufactured?		1	
5	What heat treatment is required?		1	
6	What tolerance is allowed on the dimensions?		1	
7	Name the feature at A.		1	
8	What would VIEW 3 be called?		2	
9	What does the abbreviation CSK stand for?		1	
10	What type of section resulted from cutting plane C-C?		1	
11	What type of section resulted from the combination of cutting A-A and B-B?		2	
12	Determine the complete dimensions at : B: C: D: E:		4	
13	Name the feature at F.		1	
14	What does the 3, in Ø22 x 3, refer to?		1	
15	What does the abbreviation CRS stands for?		1	
16	What thread size must a component have in order to be coupled to the bracket?		1	
17	What is the purpose of the spot face?		2	
18	What does the machining symbol ♀ mean?		1	
19	With reference to the tolerance, determine the minimum dimension at G.		2	
20	In the space below on the given shaft, draw, in neat freehand, the SANS convention for a square on a shaft, on the right view of the shaft below.		2	
		TOTAL	**28**	

ANSWER 20



JNAR ENGINEERS	84 KNOT STREET MAYDAY SOUTH END www.jnarengineers.co.za ☎ 046 821 4911	
TITLE: **AIRCRAFT BRACKET**		
ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SPECIFIED. TOLERANCES ON DIMENSIONS ARE ±0,25.	SCALE: 1 : 2	ALL UNSPECIFIED RADII ARE R3, AND ALL SURFACE TEXTURE FINISHES ARE: ♀
PROGRAMME: AUTOCAD 2026		MATERIAL: CAST IRON
FILE NAME: AIR2026-199630.dwg		HEAT TREATMENT: HARDENING
DRAWING NO: BRACKET/630/2026		PATENTED: 1989
DRAWING SET: 1 OF 5		QUANITY: 30 000

4.		
3. ADD MACHINING SYMBOLS		2026/02/08
2. INCREASE TOLERANCE RANGE		2026/04/14
1. INSERT SPOT FACE		2026/03/07
REVISION		**DATE**
DRAWN:	CINDY	2026/01/08
CHECKED:	KAREN	2026/02/21
APPROVED:	LUVO	2026/08/07

NAME	
NAME	2

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C

QUESTION 2: LOCI (CAM)

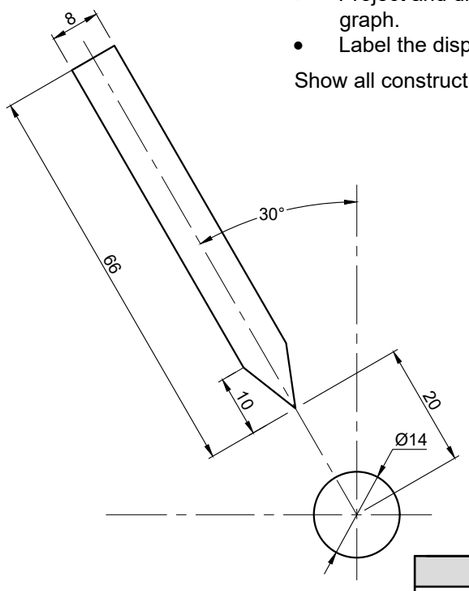
Given:
- The details of the camshaft and a wedge-shaped follower in the starting position.
- Reference point C on the answer sheet.

Specifications:
- Camshaft = Ø14 mm.
- The minimum from the cam profile to the center of the camshaft = 20 mm.
- Rotation = clockwise.

Motion:
The cam imparts the following motion to the follower:
- 0° to 30°, follower rises 44,5 mm with uniform motion.
- 30° to 60°, follower rises a further 16 mm with uniform motion.
- 60° to 90°, dwell period.
- 90° to 180°, follower falls a 26 mm with simple harmonic motion.
- 180° to 210°, follower falls a further 29 mm with uniform motion.
- 210° to 270°, follower rises 22 mm with acceleration.
- 270° to 315°, follower rises 16,5 mm with retardation.
- 315° to 330°, dwell period.
- 330° to 345°, follower falls 29 mm with uniform motion.
- 345° to 360°, follower returns to original position with uniform motion.

Instructions:
- Draw to scale 1 **:** 1, the given camshaft and the wedge-shaped follower.
- Show the direction of rotation on the cam profile.
- Draw to a rotational scale of 360° = 132 mm and a displacement scale of 1 **:** 1, the displacement graph for the required motion.
- Project and draw the cam profile from the displacement graph.
- Label the displacement graph and the scale.

Show all construction and projection. **[38½]**



CAM AND FOLLOWER DETAIL

ASSESSMENT CRITERIA			
1	GIVEN + MINIMUM DISTANCE + CL	4½	
2	GRAPH CONSTRUCTION	5	
3	DISPLACEMENT GRAPH	13	
4	CAM CONSTRUCTION	4	
5	CAM PROFILE + CURVE QUALITY	12	
PENALTY (-)			
	TOTAL	**38½**	

NAME
NAME 3

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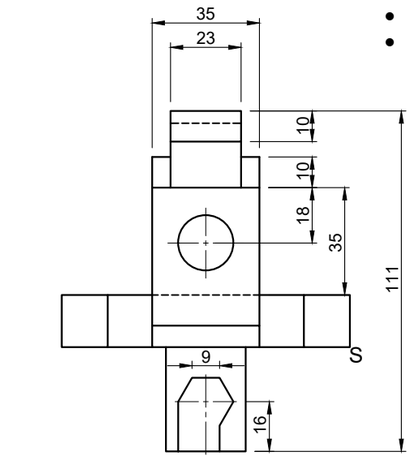
QUESTION 3: ISOMETRIC

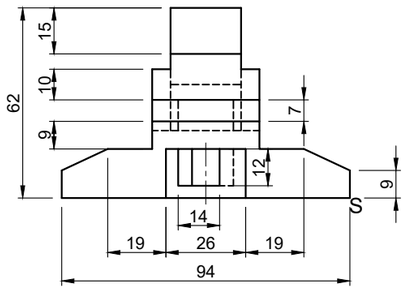
Given:

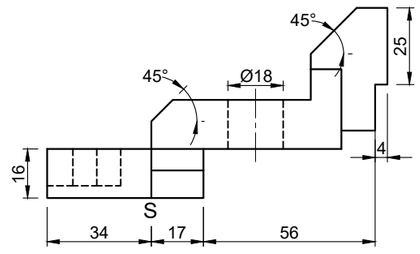
- Three views of a SUPPORT BRACKET in third angle orthographic projection.
- Starting point S.

Instructions:

- Draw, to scale 1 : 1, a isometric view of the SUPPORT BRACKET.
- Make point S the lowest point of the drawing.
- Show ALL necessary construction.
- NO hidden detail is required. **[44]**







S

ASSESSMENT CRITERIA			
1	AUX VIEW + PLACEMENT	$22\frac{1}{2}$	
2	LOWER PORTION	$21\frac{1}{2}$	
3	UPPER PORTION	15	
4	CIRCLES + CL'S	5	
	TOTAL	**44**	

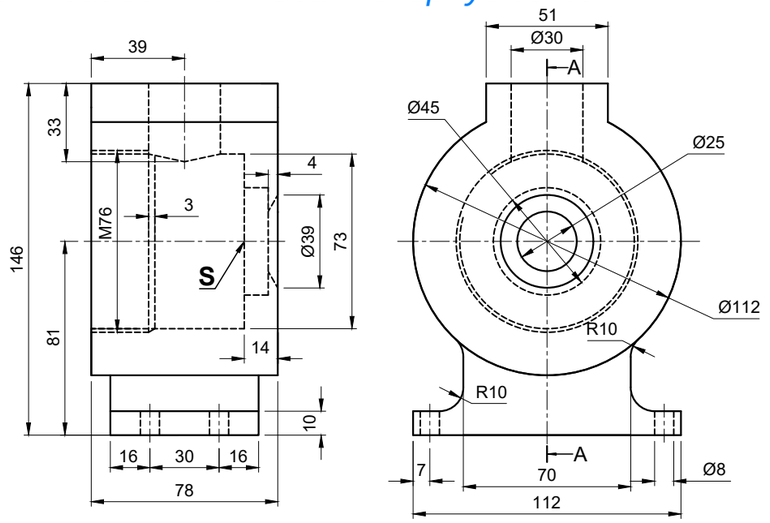
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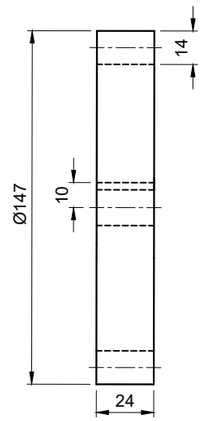
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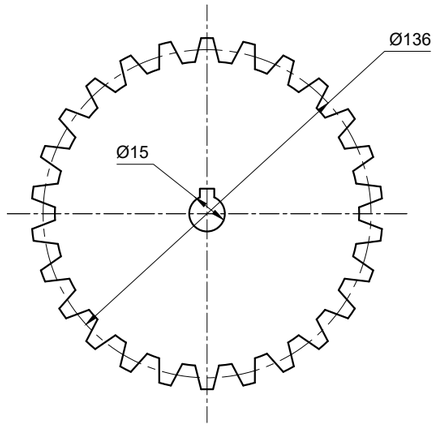
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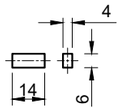
HOUSING (6)



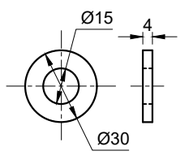
NOTE: GEARS HAVE BEEN OMITTED FOR THE PURPOSE OF CLARITY



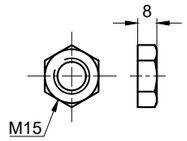
SPUR GEAR (9)



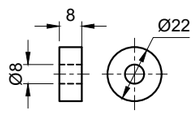
KEY (10)



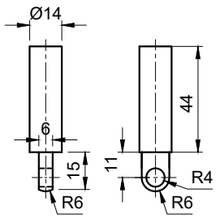
WASHER (11)



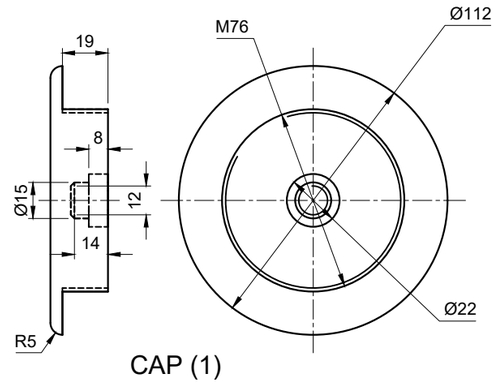
M15 NUT (12)



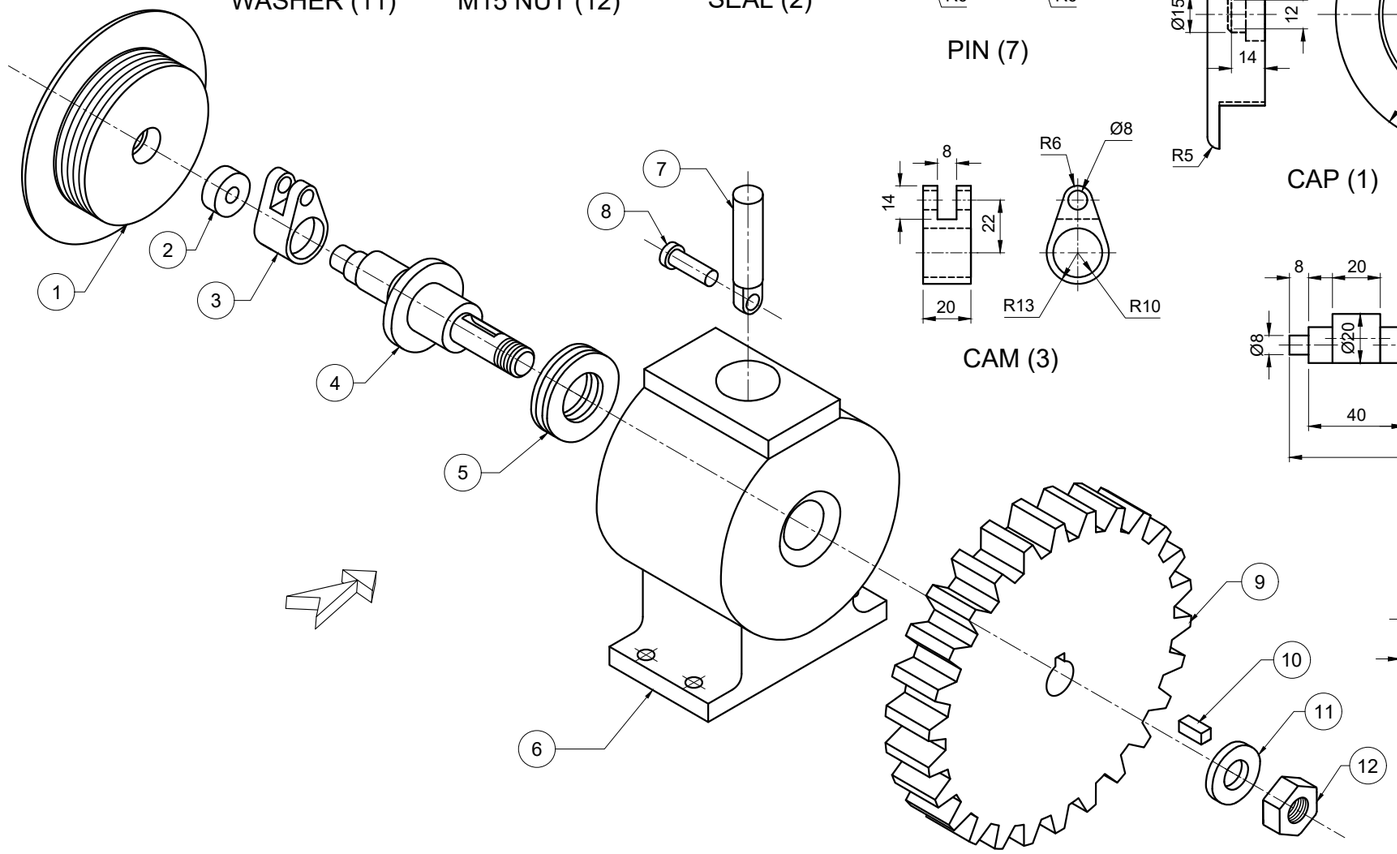
SEAL (2)



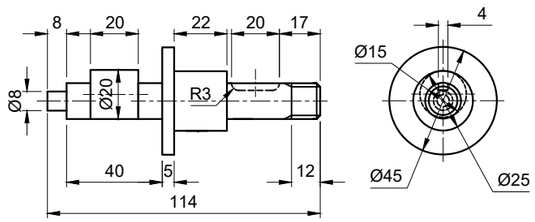
PIN (7)



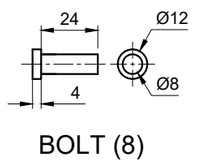
CAP (1)



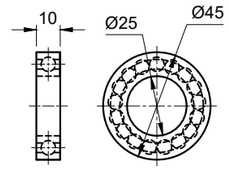
CAM (3)



SHAFT (4)



BOLT (8)



BEARING (5)

QUESTION 4: MECHANICAL ASSEMBLY

Given:

- Orthographic views of each of the parts of the transfer box.
- The exploded isometric drawing of the parts of a transfer box assembly, showing the position of each part relative to the others.
- Point S in the front view of the housing.
- Starting point S on the answer sheet, page 6.

Instructions:

- Answer this question on page 6.
- Draw, to scale 1 : 1 and in third angle orthographic projection, the following views of the assembled parts of the transfer box.
  - 4.1 **The sectional front view**, on cutting plane A-A, as seen from the direction of the arrow shown on the exploded isometric drawing. The cutting plane is shown on the right view of the housing (part 6).
  - 4.2 **The right view.**

NOTE:

1. Starting point S is indicated on the front view of the housing (part 6).
2. Show THREE faces of the M15 nut (part 12) in the sectional front view.
3. Draw the conventional representation of the spur gear (part 9) and the bearing (part 5) in both views.
4. Show ALL construction.
5. NO hidden detail is required.
6. All drawings must comply with the guidelines contained in *SANS 10111*.

Add the following features on the drawing:

- The construction method for the M15 nut.

[89½]

TITLE:

TRANSFER BOX

PORTFOMATION INC.	14 SUPIRO RD. BUPIROBAN 9347 ☎ 045 730 5901
ALL DIMENSIONS ARE IN MILLIMETRES.	
ALL UNSPECIFIED RADII ARE R2.	

LIST OF PARTS

PART	MATERIAL	QUANTITY
1. CAP	MILD STEEL	1
2. SEAL	RUBBER	1
3. CAM	STAINLESS STEEL	1
4. SHAFT	STAINLESS STEEL	1
5. BEARING	MILD STEEL	1
6. HOUSING	MILD STEEL	1
7. PIN	CAST IRON	1
8. BOLT	MILD STEEL	1
9. SPUR GEAR	STAINLESS STEEL	1
10. KEY	STAINLESS STEEL	1
11. WASHER	MILD STEEL	1
12. M15 NUT	MILD STEEL	1

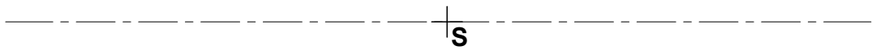
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PENALTIES		
1	WRONG SCALE	
2	PARTS NOT ASSEMBLED	
3	WRONG HATCHING	
	TOTAL PENALTIES (-)	

ASSESSMENT CRITERIA			
RIGHT VIEW			
1	HOUSING	$3\frac{1}{2}$	
2	PIN AND SPUR GEAR	3	
3	WASHER AND NUT	3	
4	SHAFT	$1\frac{1}{2}$	
	SUB-TOTAL	**11**	
SECTIONAL FRONT VIEW			
1	HOUSING	13	
2	CAP	$8\frac{1}{2}$	
3	SEAL	$3\frac{1}{2}$	
4	CAM	6	
5	PIN	7	
6	BOLT AND SPUR GEAR	$9\frac{1}{2}$	
7	SHAFT, KEY AND BEARING	$12\frac{1}{2}$	
8	WASHER AND NUT	$5\frac{1}{2}$	
	SUB-TOTAL	**$65\frac{1}{2}$**	
GENERAL			
1	CL	2	
2	ASSEMBLY	11	
	SUB-TOTAL	**13**	
	TOTAL	**$89\frac{1}{2}$**	
	PENALTIES (-)		
	GRAND TOTAL	**$89\frac{1}{2}$**	

NAME	
NAME	6

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GRADE 12

ENGINEERING GRAPHICS AND DESIGN P2

SEPTEMBER 2026

PREPARATORY EXAMINATION
MARKING GUIDELINE

MARKS: 200

This marking guideline consists of 7 pages.

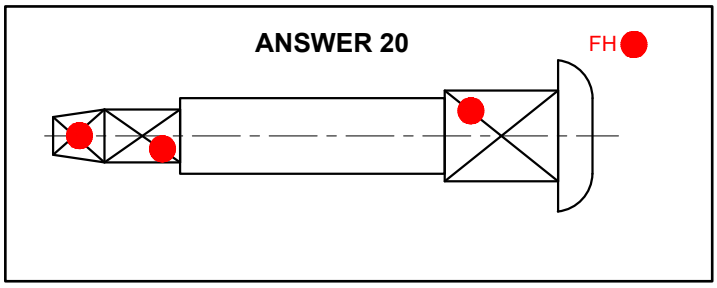
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QUESTION 1: ANALYTICAL (MECHANICAL)

ANSWERS		
1	2026/02/21	1
2	AIRCRAFT BRACKET	1
3	CAD	1
4	30 000	1
5	HARDENING	1
6	±0,25	1
7	CUTTING PLANE	1
8	RIGHT VIEW	2
9	COUNTERSINK	1
10	MULTIPLANE / OFFSET / STAGGERED	1
11	SUCCESIVE	2
12	B = 60° , C = 200 mm , D = 3 mm , E = 29 mm	4
13	WEB / RIB	1
14	DEPTH	1
15	CENTERS	1
16	8 x 0,1 = 0,8 mm	1
17	ATTACHMENT SURFACE FOR FASTERNERS	2
18	NO MACHINING REQUIRED	1
19	48 - 0,15 = 47,85 mm	2
20	SEE BELOW	2
	TOTAL	**28**

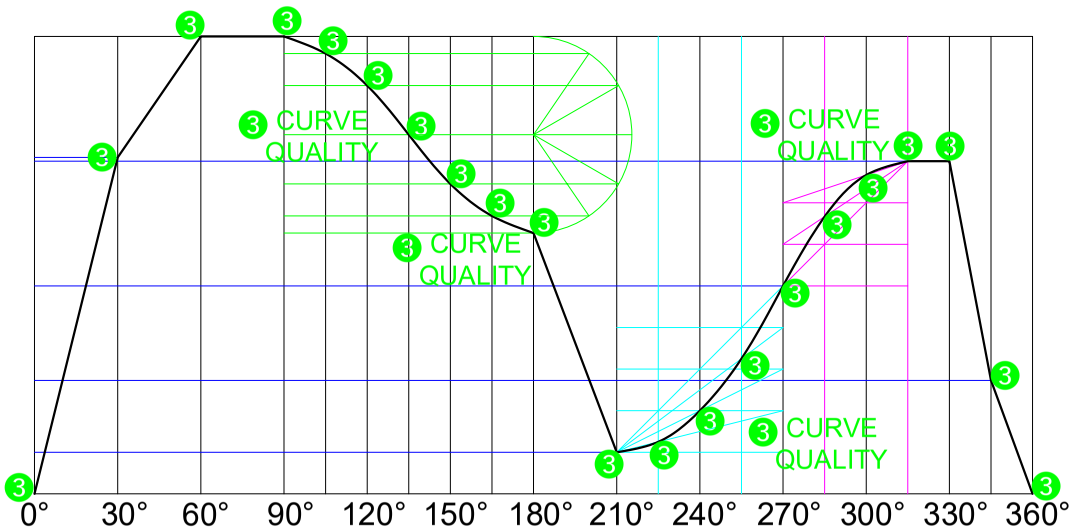


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QUESTION 2: LOCI (CAM)



DISPLACEMENT GRAPH
SCALE 360° = 132 mm

2. CONSTRUCTION OF DIAGRAM

• BASE LENGTH 132 mm	0,5
• 12 DIVISIONS	0,5

UNIFORM ACCELERATION + RETARDATION

• HEIGHT DIVISION	0,5
• FIRST HALF CONSTRUCTION	0,5
• SECOND HALF CONSTRUCTION	0,5
• 15° SUBDIVISIONS	0,5

SIMPLE HARMONIC MOTION

• SEMI CIRCLE	0,5
• CIRCLE DIVISION	0,5
• 15° SUBDIVISION	0,5
• PROJECTION	0,5
TOTAL	**5**

	ASSESSMENT CRITERIA		
1	1	GIVEN + MINIMUM DISTANCE + CL	$4\frac{1}{2}$
2	2	GRAPH CONSTRUCTION	5
3	3	DISPLACEMENT GRAPH	13
4	4	CAM CONSTRUCTION	4
5	5	CAM PROFILE + CURVE QUALITY	12
		TOTAL	**$38\frac{1}{2}$**

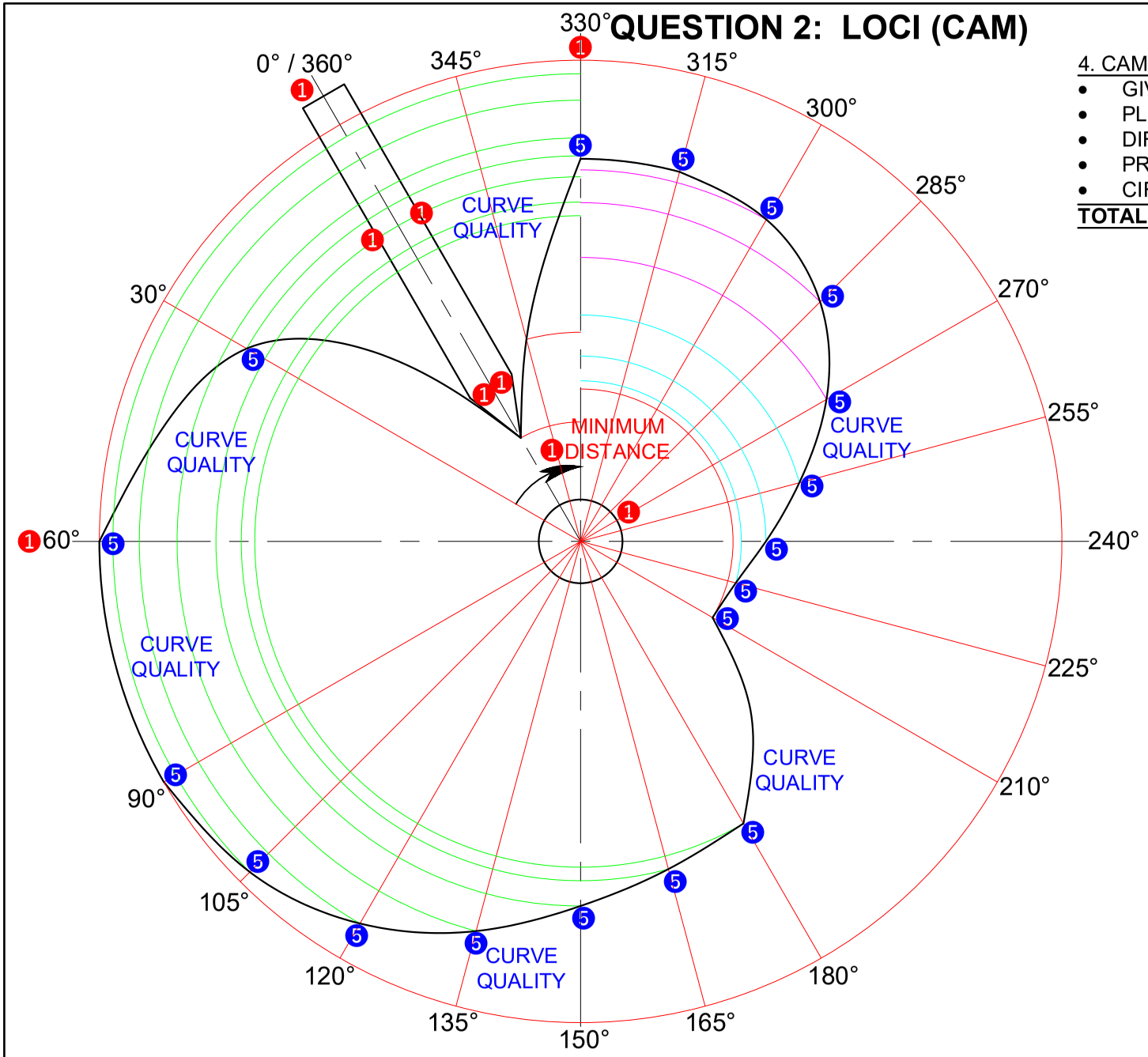
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QUESTION 2: LOCI (CAM)



4. CAM CONSTRUCTION

• GIVEN POSITION EQUALS 0°	0,5
• PLOT DIRECTION CLOCKWISE	1
• DIRECTION INDICATION BY ARROW	0,5
• PROJECTION / TRANSFER FROM GRAPH	1
• CIRCLE DIVISION	1
TOTAL	**4**

	ASSESSMENT CRITERIA		
1	1	GIVEN + MINIMUM DISTANCE + CL	$4\frac{1}{2}$
2	2	GRAPH CONSTRUCTION	5
3	3	DISPLACEMENT GRAPH	13
4	4	CAM CONSTRUCTION	4
5	5	CAM PROFILE + CURVE QUALITY	12
		TOTAL	**$38\frac{1}{2}$**

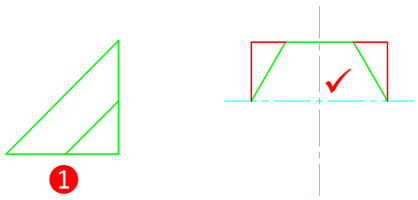
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QUESTION 3: ISOMETRIC



ASSESSMENT CRITERIA			
1	AUX VIEW+ PLACEMENT	$22\frac{1}{2}$	1 ✓
2	LOWER PORTION	$21\frac{1}{2}$	2
3	UPPER PORION	15	3
4	CIRCLE + CL'S	5	4 ✓
	TOTAL	**44**	

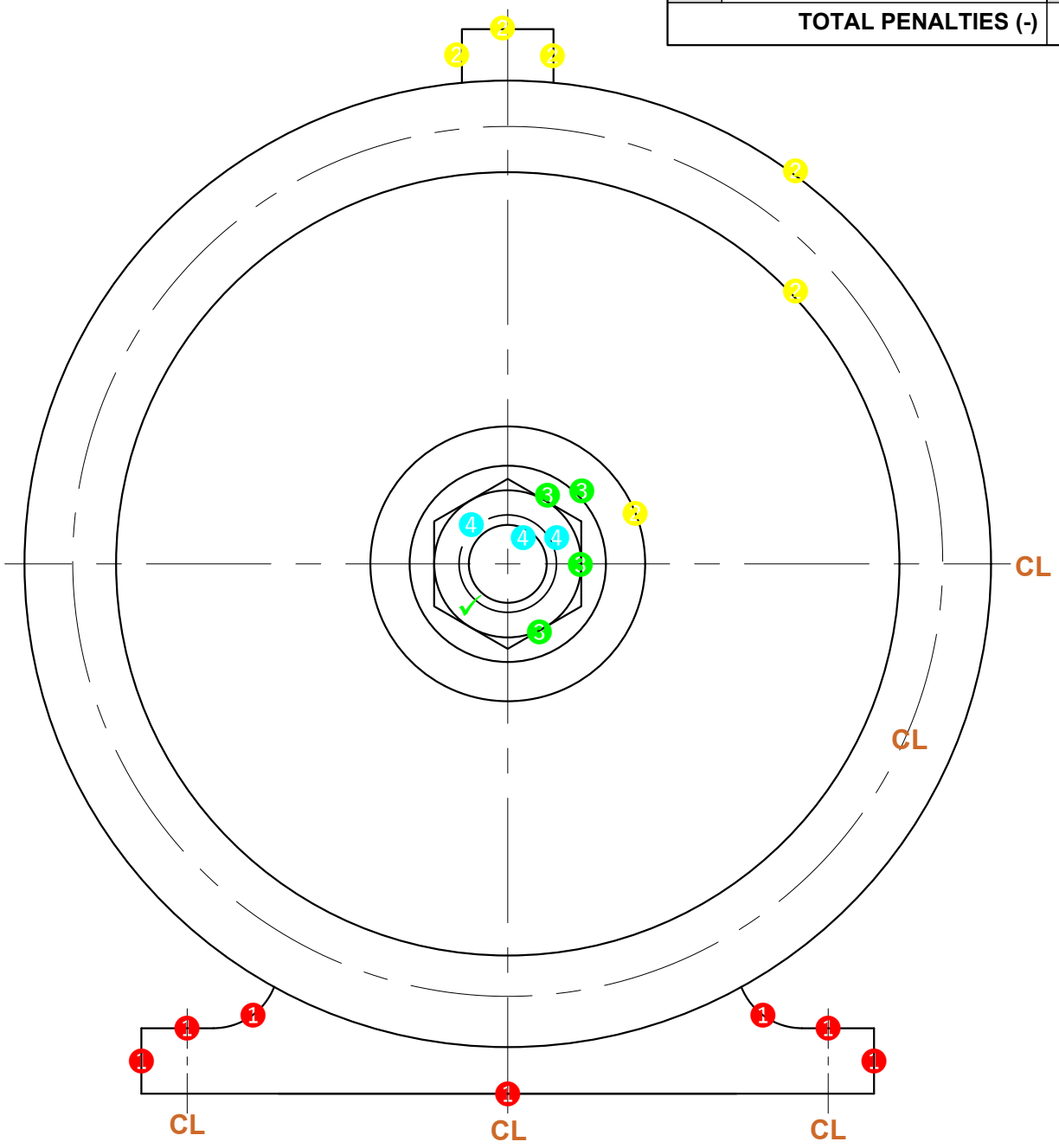
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QUESTION 4: MECHANICAL ASSEMBLY

PENALTIES		
1	WRONG SCALE	-2
2	PARTS NOT ASSEMBLED (-1 PER PART)	-10
3	WRONG HATCHING	-2
	TOTAL PENALTIES (-)	



RIGHT VIEW			
1	1	HOUSING	$3\frac{1}{2}$
2	2	PIN AND SPUR GEAR	3
3	3	WASHER AND NUT	3
4	4	SHAFT	$1\frac{1}{2}$
		SUB-TOTAL	11

6

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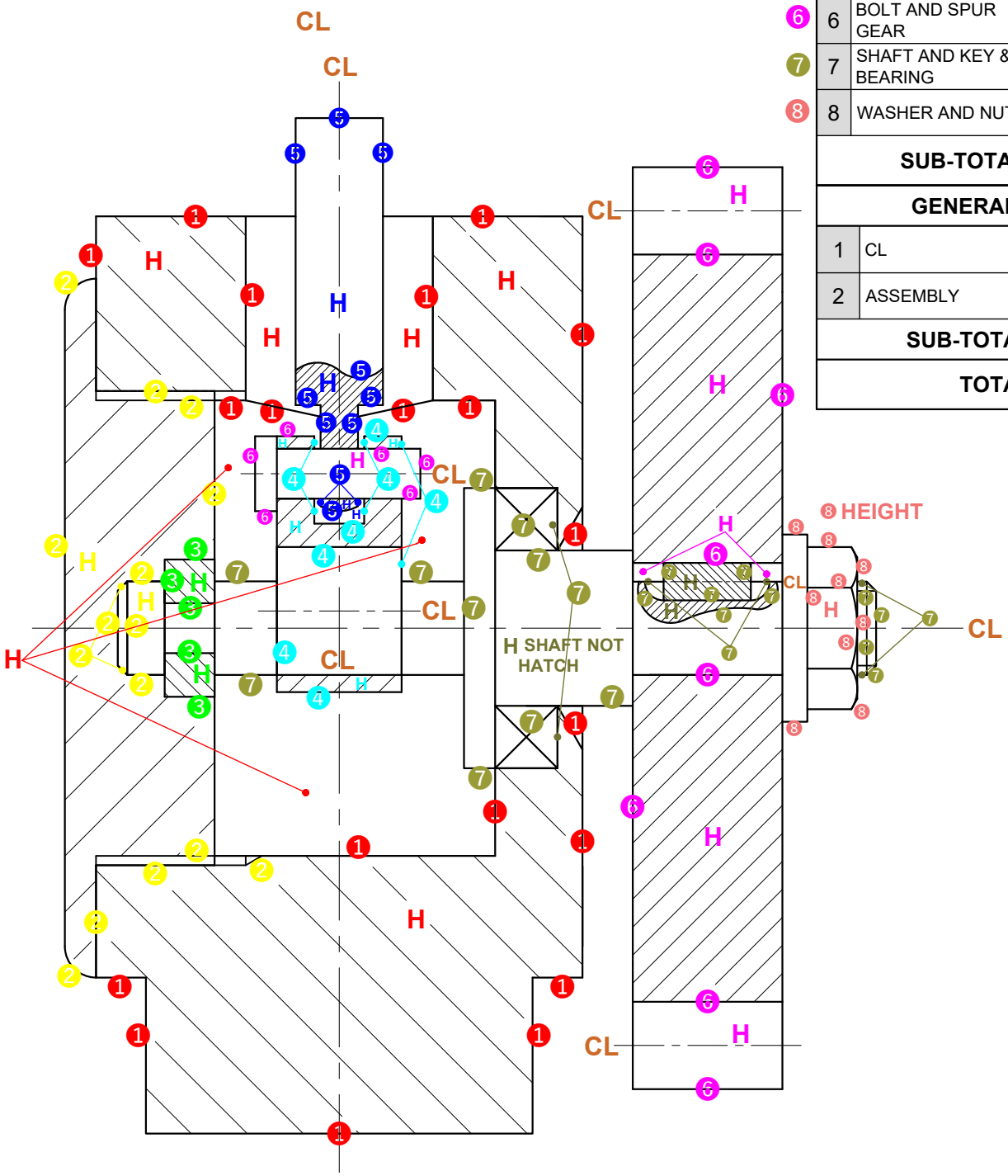
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QUESTION 4: MECHANICAL ASSEMBLY

SECTIONAL FRONT VIEW			
1	1	HOUSING	13
2	2	CAP	$8\frac{1}{2}$
3	3	SEAL	$3\frac{1}{2}$
4	4	CAM	6
5	5	PIN	7
6	6	BOLT AND SPUR GEAR	$9\frac{1}{2}$
7	7	SHAFT AND KEY & BEARING	$12\frac{1}{2}$
8	8	WASHER AND NUT	$5\frac{1}{2}$
		SUB-TOTAL	**$65\frac{1}{2}$**

GENERAL		
1	CL	2
2	ASSEMBLY	11
	SUB-TOTAL	**13**
	TOTAL	**$89\frac{1}{2}$**



1. CENTER LINES

SANS COMPLIANT	1
CENTRE LINES	
(1 - 7 = 0,5 ; 8 - 12 = 1)	$\frac{1}{2}$
TOTAL	

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EASTERN CAPE EDUCATION DEPARTMENT
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GRADE 12

ENGINEERING GRAPHICS AND DESIGN
PAPER 2
SEPTEMBER 2026
PREPATORY EXAMINATION
MARKING GUIDELINES

WEIGHTING OF QUESTIONS					
QUESTION	**LOW**	**MIDDLE**	**HIGH**	**TOTAL**	**% OF PAPER**
1	11.0	9.0	8.0	**28.0**	**14.0**
	39.3	32.1	28.6		
2	11.5	16.0	11.0	**38.5**	**19.3**
	29.9	41.6	28.6		
3	15.0	16.0	13.0	**44.0**	**22.0**
	34.1	36.4	29.5		
4	25.5	35.0	29.0	**89.5**	**44.8**
	28.5	39.1	32.4		
TOTAL	63.0	76.0	61.0	**200.0**	
	32.9	37.3	29.8		

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