



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

ENGINEERING GRAPHICS AND DESIGN P2

NOVEMBER 2022

MARKS: 100

TIME: 3 hours

This question paper consists of 6 pages.

Barcode label

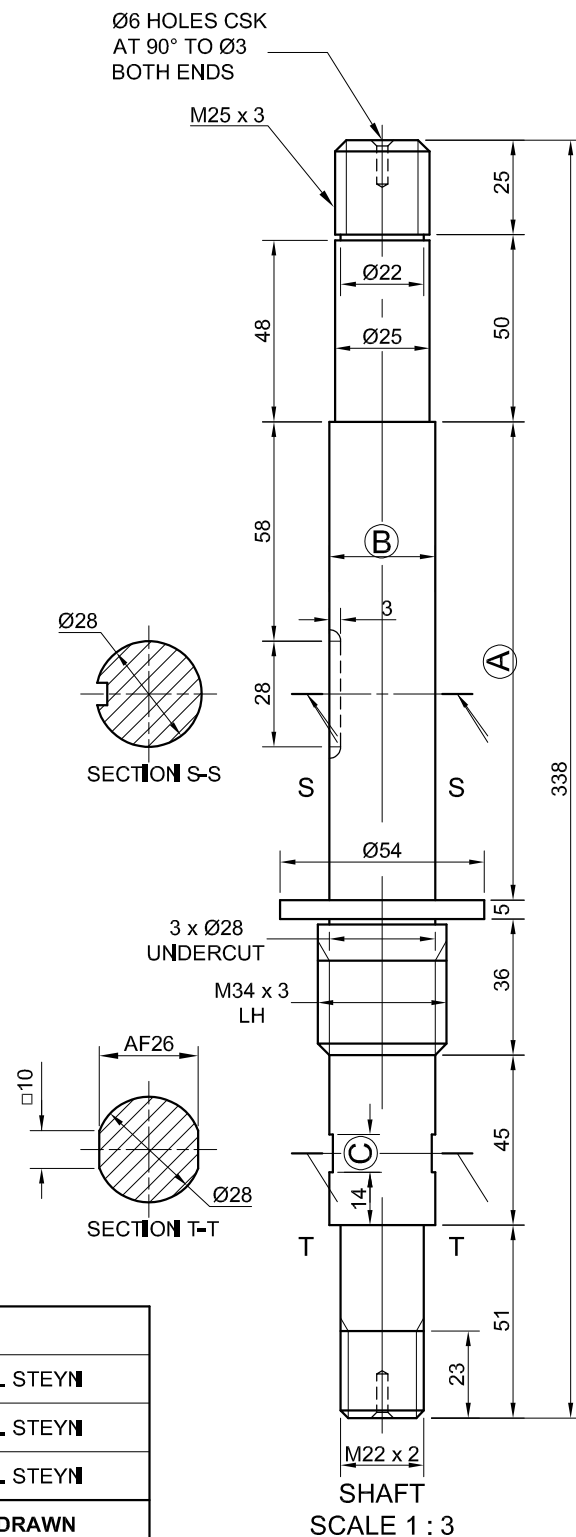
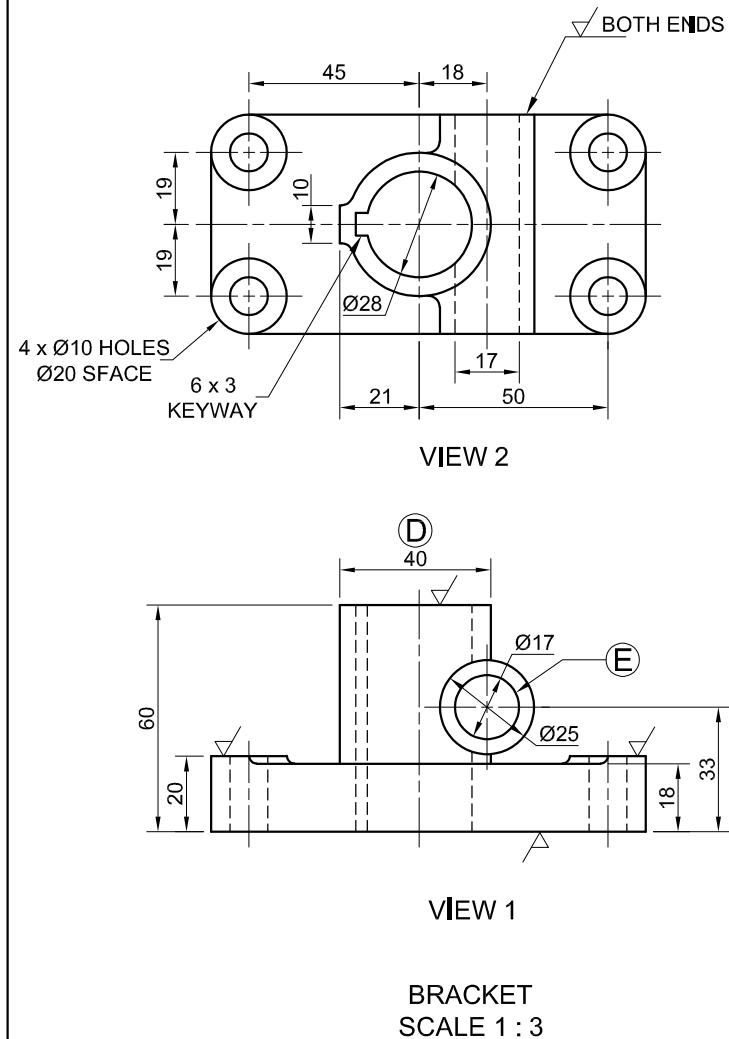
INSTRUCTIONS AND INFORMATION

1. This question paper consists of FOUR questions.
2. Answer ALL the questions.
3. ALL drawings are in third-angle orthographic projection, unless otherwise stated.
4. ALL drawings must be prepared using pencil and instruments, unless otherwise stated.
5. ALL answers must be drawn accurately and neatly.
6. ALL the questions must be answered on the QUESTION PAPER, as instructed.
7. ALL the pages, irrespective of whether the question was attempted or not, must be re-stapled in numerical sequence in the TOP LEFT-HAND CORNER ONLY.
8. Time management is essential in order to complete all the questions.
9. Print your examination number in the block provided on every page.
10. Any details or dimensions not given must be assumed in good proportion.

FOR OFFICIAL USE ONLY															
QUESTION	MARKS OBTAINED			$\frac{1}{2}$	SIGN	MODERATED			$\frac{1}{2}$	SIGN	RE-MARKING			$\frac{1}{2}$	SIGN
1															
2															
3															
4															
TOTAL															
	2	0	0			2	0	0			2	0	0		

FINAL CONVERTED MARK	CHECKED BY
100	

COMPLETE THE FOLLOWING:
CENTRE NUMBER
CENTRE NUMBER
EXAMINATION NUMBER
EXAMINATION NUMBER



4			
3	CHANGE TOLERANCE TO $\pm 0,02$	09/12/2021	J. STEYN
2	ADD SECTIONS ON SHAFT	08/12/2021	J. STEYN
1	CHANGE INDICATED DIMENSIONS	06/12/2021	J. STEYN
REVISION	DESCRIPTION	DATE	DRAWN

FILE NAME: MS - 11 - 2022	MATERIAL: ● BRACKET : WROUGHT IRON ● SHAFT: MILD STEEL	ALL UNSPECIFIED RADII ARE 3 mm	TOLERANCE: ± 0,02 UNLESS OTHERWISE STATED	GRINDING 0,8 0,2√C
DRAWING No. 13				
COMMISSIONED BY: RACK IT MANUFACTURERS	DRAWING PROGRAMME: AUTOCAD 2022	ALL DIMENSIONS ARE IN MILLIMETRES,		
		QUANTITY: 3000	SCALE 1 : 3	
MILLER DESIGN AND DETAILING 1 ANFIELD PLACE LIVERPOOL X600 www.millerd&d.co.za 012 567 8910		DRAWN BY: J. BONGANI	DATE: 2021/12/04	
		CHECKED: S. SMITH	DATE: 2021/12/12	
		APPROVED BY: J. BHIKA	DATE: 2021/12/17	
TITLE: BRACKET AND SHAFT				

QUESTION 1: ANALYTICAL (MECHANICAL)

Given:

Two views of a bracket, and a view of a shaft, a **title block** and a **table** of questions. The drawings are not presented to the indicated **scale**.

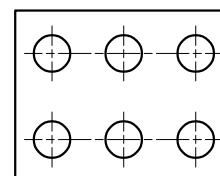
Instructions:

Complete the table below by neatly answering the questions, which refer to the accompanying drawings, the title block and mechanical content. [3]

QUESTIONS		ANSWERS		
1	Who checked the drawing?		1	
2	How many revisions have been made?		1	
3	From what material must the shaft be manufactured?		1	
4	How many holes are there in the bracket?		1	
5	What type of sections are S-S and T-T of the shaft?		1	
6	How many screw threads must be cut on the shaft?		1	
7	If VIEW 2 of the bracket is the front view, what would VIEW 1 be called?		1	
8	What does the abbreviation AF stand for?		1	
9	What is the abbreviation for countersunk?		1	
10	Determine the complete dimensions at: A: B: C:		3	
11	What is the height of the spot face on the bracket?		1	
12	What is the depth of the keyway on the shaft?		1	
13	If scale 1 : 1 was used, what would the dimension at D read?		1	
14	With reference to the orthographic system used, on which side of the truncated cone of the projection symbol would the two circles be drawn?		1	
15	Specify the size and depth for the left-hand thread.		1	
16	How many surfaces on the bracket must be machined?		1	
17	With reference to the tolerance, determine the minimum diameter of the hole at E.		2	
18	With reference to the machining symbol in the title block, what do the following component specifications refer to?	0,2	1	
		0,8	1	
		GRINDING	1	
		C	1	
19	In the space below (ANSWER 19), complete, in neat freehand, the SANS 10111 conventional representation for the given holes on a LINEAR PITCH.		3	
20	In the space below (ANSWER 20), complete, in neat freehand, the SANS 10111 conventional representation for an INTERRUPTED VIEW on a square bar.		3	
TOTAL			30	

QUESTION 19:

ANSWER 20:



DETAILED



CONVENTION

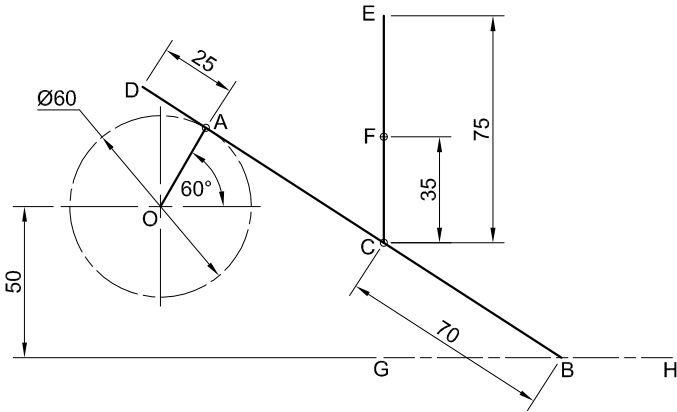


EXAMINATION NUMBER

EXAMINATION NUMBER

9	
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STAPLE



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			



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			

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]**

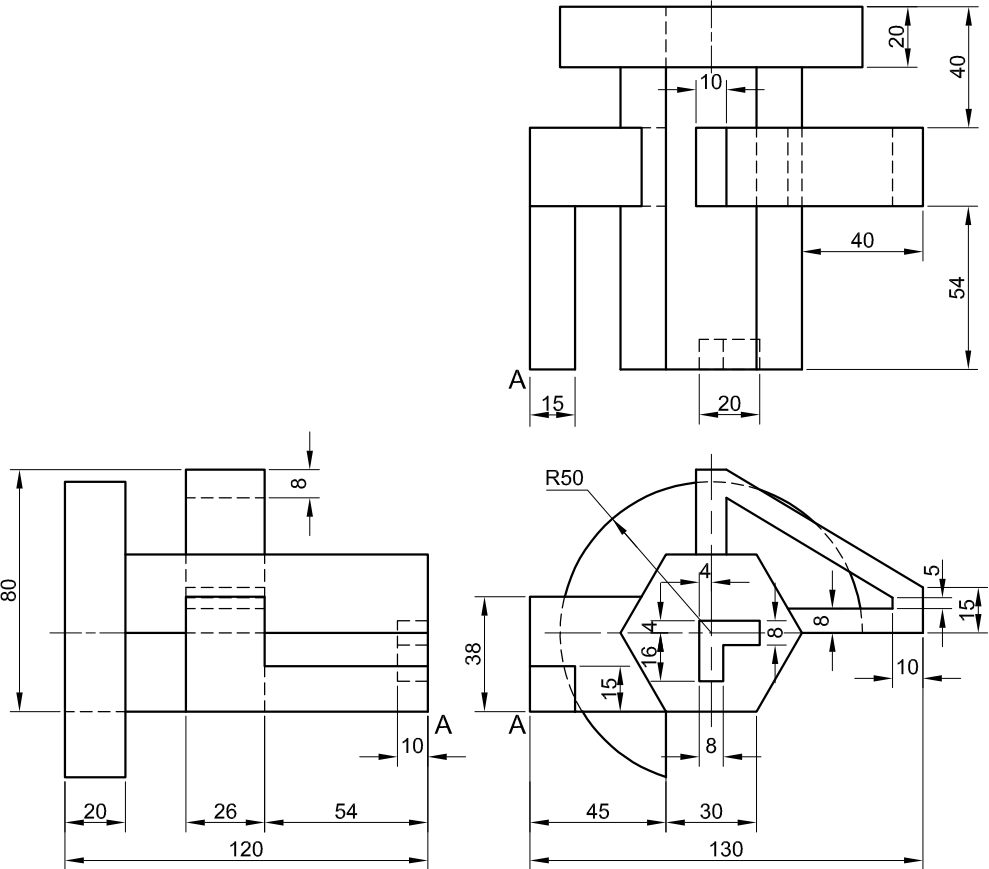
EXAMINATION NUMBER	
EXAMINATION NUMBER	3



QUESTION 3: ISOMETRIC DRAWING

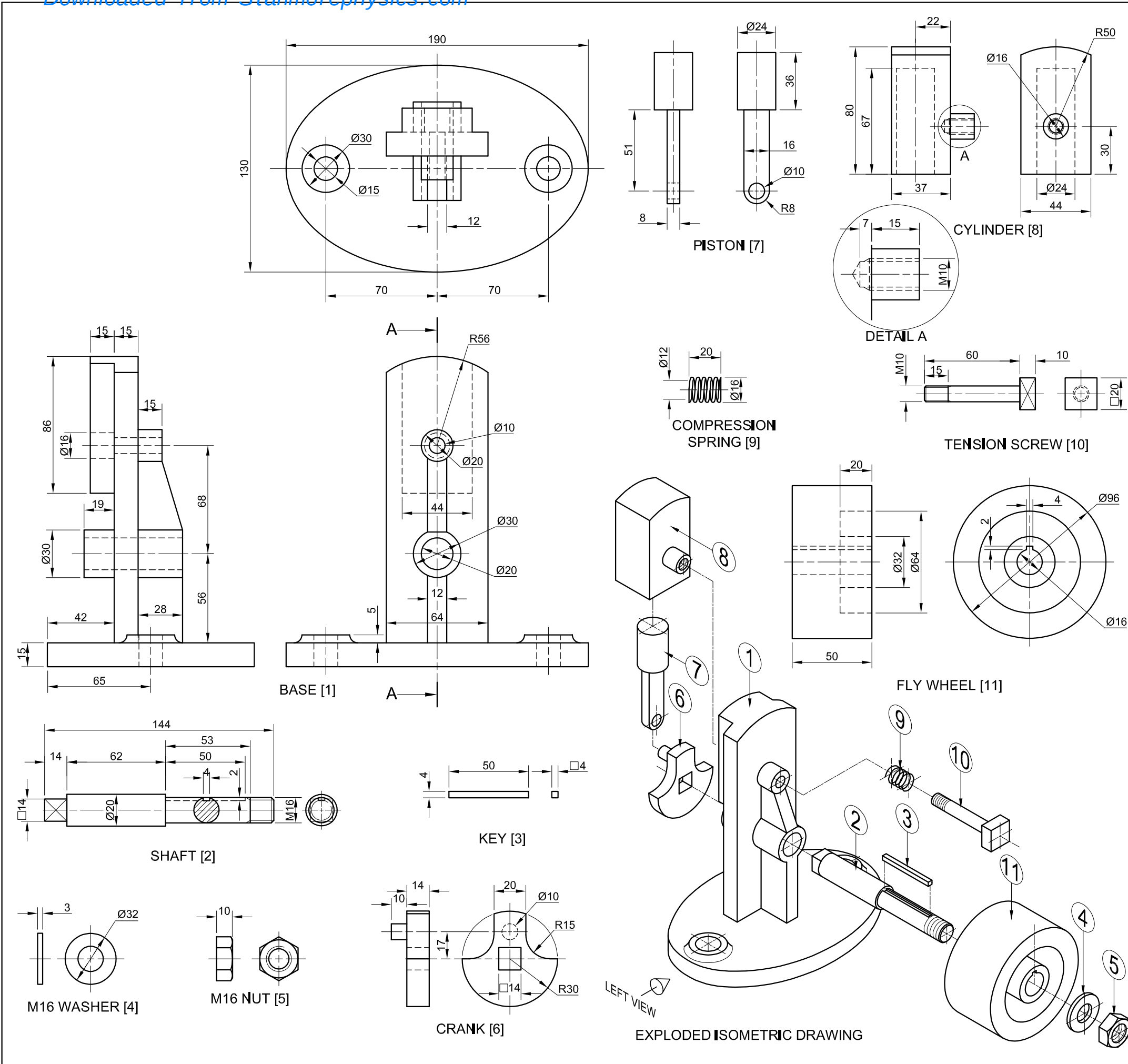
- Given:
- The front view, top view and left view of a tool
 - The position of point A on the drawing sheet

- Instructions:
- Using scale 1 : 1, convert the orthographic views of the tool into an isometric drawing.
- Make A the starting and lowest point of the drawing.
 - Show ALL construction.
 - NO hidden detail is required.
- [40]



↓
A

ASSESSMENT CRITERIA				
1	PLACING + AUX. VIEW	2		
2	BODY	20		
3	HANDLE	9 1/2		
4	CIRCLES + CONSTR. + CL	8 1/2		
PENALTIES (-)				
TOTAL		40		
EXAMINATION NUMBER				
EXAMINATION NUMBER				4



QUESTION 4: MECHANICAL ASSEMBLY

Given:

- The exploded isometric drawing of the parts of a wobble engine assembly, showing the position of each part relative to all the others
- Orthographic views of each of the parts of the wobble engine assembly

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 wobble engine assembly:
 - 4.1 ONLY the left half of the front view, by applying the convention of symmetry.
 - 4.2 A sectional left view on cutting plane A-A, as seen from the direction of the arrow on the exploded isometric drawing. The cutting plane is shown on the front view of the base (part 1).

NOTE:

- Planning is essential.
- The drawing must comply with the SANS 10111 guidelines.
- The piston (part 7) must be drawn in the highest position.
- Show THREE faces of the M16 nut (part 5) on the sectional view.
- The compression spring (part 9) must be drawn as a conventional representation, at the full extension of 20 mm.
- NO hidden detail is required.

[93]

PARTS LIST			
PARTS		QUANTITY	MATERIAL
1	BASE	1	CAST IRON
2	SHAFT	1	MILD STEEL
3	KEY	1	KEY STEEL
4	M16 WASHER	1	MILD STEEL
5	M16 NUT	1	MILD STEEL
6	CRANK	1	CAST IRON
7	PISTON	1	MILD STEEL
8	CYLINDER	1	CAST IRON
9	COMPRESSION SPRING	1	SPRING STEEL
10	TENSION SCREW	1	MILD STEEL
11	FLY WHEEL	1	CAST IRON

STEAM PUNK

ENGINEERING CC

7 WATT STREET
INDUSTRIA
www.steamp.co.za
012 345 6789

WOBBLE ENGINE ASSEMBLY

ALL DIMENSIONS ARE IN MILLIMETRES.

5



FOR OFFICIAL USE ONLY	
INCORRECT ORTHOGRAPHIC PROJECTION	
INCORRECT OVERALL SCALE	
INCORRECT HATCHING	
PARTS NOT ASSEMBLED	
TOTAL PENALTIES (-)	

ASSESSMENT CRITERIA					
FRONT VIEW					
		POSSIBLE	OBTAINED	SIGN	MODERATED
1	BASE	5 ¹ / ₂			
2	TENSION SCREW	1 ¹ / ₂			
3	FLY WHEEL	1			
4	NUT + WASHER	4 ¹ / ₂			
5	INDICATION OF SYMMETRY	2			
SUBTOTAL		14 ¹ / ₂			
SECTIONAL LEFT VIEW					
1	BASE	13 ¹ / ₂			
2	CYLINDER	10			
3	PISTON	5 ¹ / ₂			
4	TENSION SCREW	8			
5	SPRING	1 ¹ / ₂			
6	CRANK	5 ¹ / ₂			
7	SHAFT + KEY + WASHER + NUT	15 ¹ / ₂			
8	FLY WHEEL	7			
SUBTOTAL		66 ¹ / ₂			
GENERAL					
1	CENTRE LINES	2			
2	ASSEMBLY	10			
SUBTOTAL		12			
TOTAL		93			
PENALTIES (-)					
GRAND TOTAL					
EXAMINATION NUMBER					
EXAMINATION NUMBER					6



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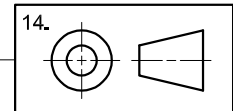
MARKING GUIDELINES

MARKS: 100

These marking guidelines consist of 7 pages.

ANSWERS

1	S.SMITH	1
2	3	1
3	MILD STEEL	1
4	6	1
5	SUCCESSIVE / REMOVED	1
6	3	1
7	BOTTOM VIEW	1
8	ACROSS FLATS	1
9	CSK	1
10	A: 126 B: Ø28 C: 10	3
11	2	1
12	3	1
13	40	1
14	LEFT	1
15	M34 x 3	1
16	8	1
17	16.98	2
18	MACHINING ALLOWANCE / TOLERANCE	1
	ROUGHNESS VALUE	1
	METHOD / TREATMENT / COATING / PROCESS	1
	DIRECTION OF LAY / CIRCULAR / PATTERN	1
19	See below	3
20		3
TOTAL		30

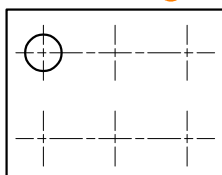


ANSWER 19

FREEHAND

①

ONE CIRCLE ONLY ①

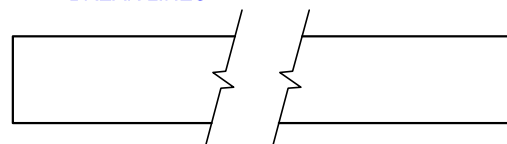


HORIZONTAL CLs without CIRCLES 2 x 0.5
 VERTICAL CLs without CIRCLES 2 x 0.5

ANSWER 20

FREEHAND

②

LENGTHENING OF
BREAK LINES ②

PARALLEL BREAK LINES 2 x 0.5
 ZIG ZAG 2 x 0.5

NOTE: BREAKLINES CAN BE ALIGNED
 or VERTICAL

PAPER 2 QUESTION 1
 GRADE 12
 NOVEMBER 2022
 MARKING GUIDELINE

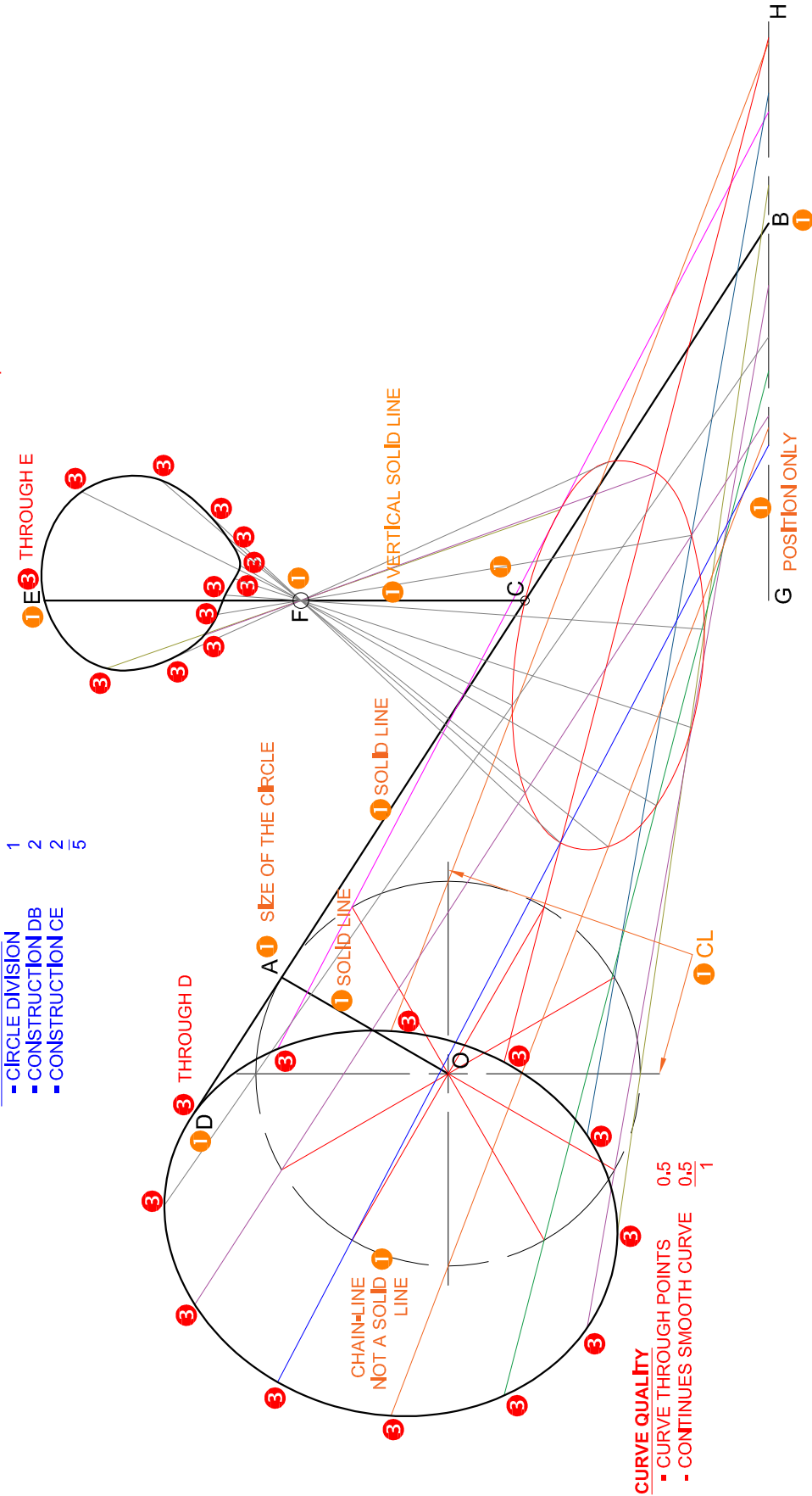
ASSESSMENT CRITERIA 2.1	
1	GIVEN + LABELS + CL 6
2	CONSTRUCTION 5
3	LOC OF D + E 14
SUBTOTAL 2.1 25	

CURVE QUALITY

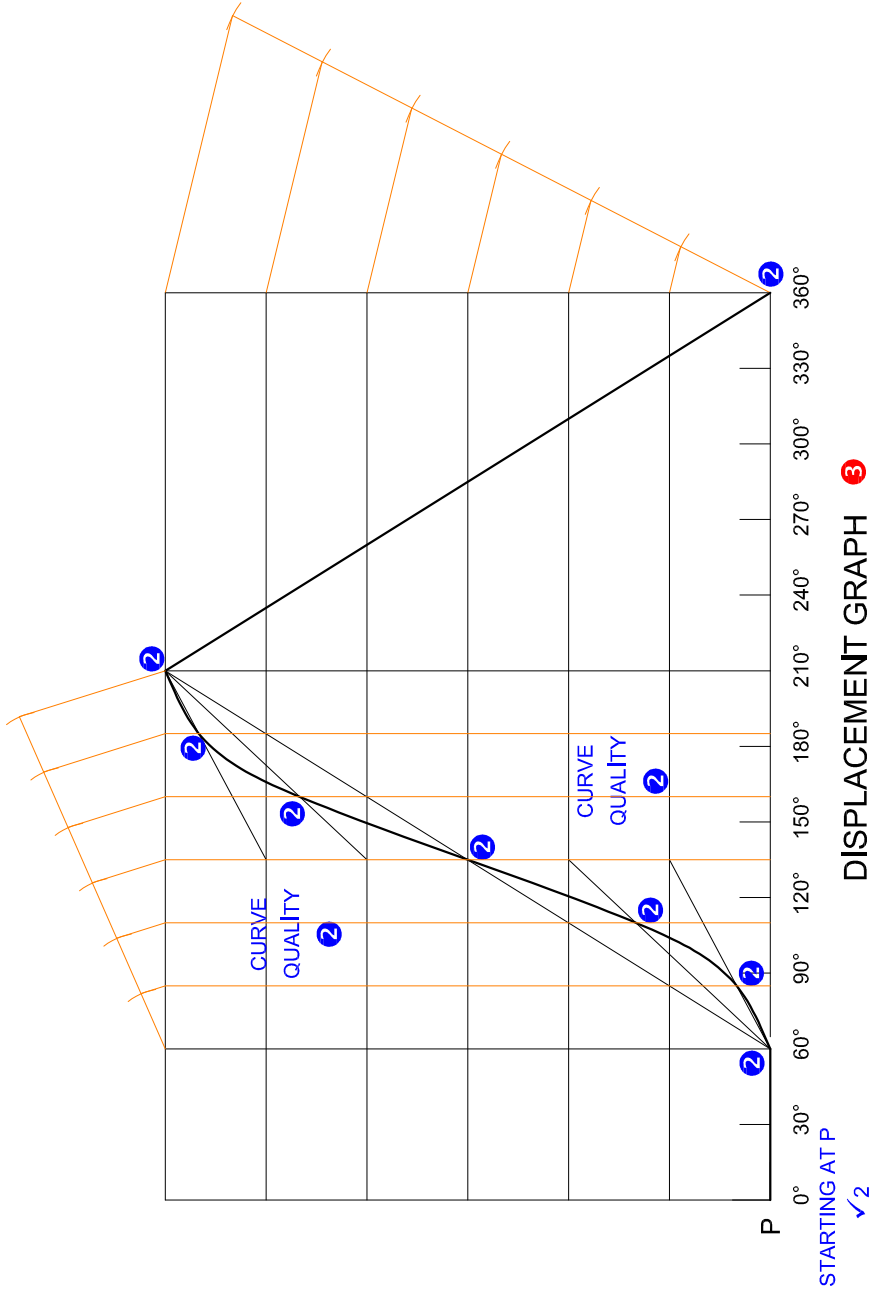
- CURVE THROUGH POINTS 0.5
- CONTINUES SMOOTH CURVE 0.5

2. CONSTRUCTION

- CIRCLE DIVISION 1
- CONSTRUCTION DB 2
- CONSTRUCTION CE 2



PAPER 2 QUESTION 2
GRADE 12
NOVEMBER 2022
MARKING GUIDELINE



DISPLACEMENT GRAPH 3
SCALE 10 mm = 30° 3

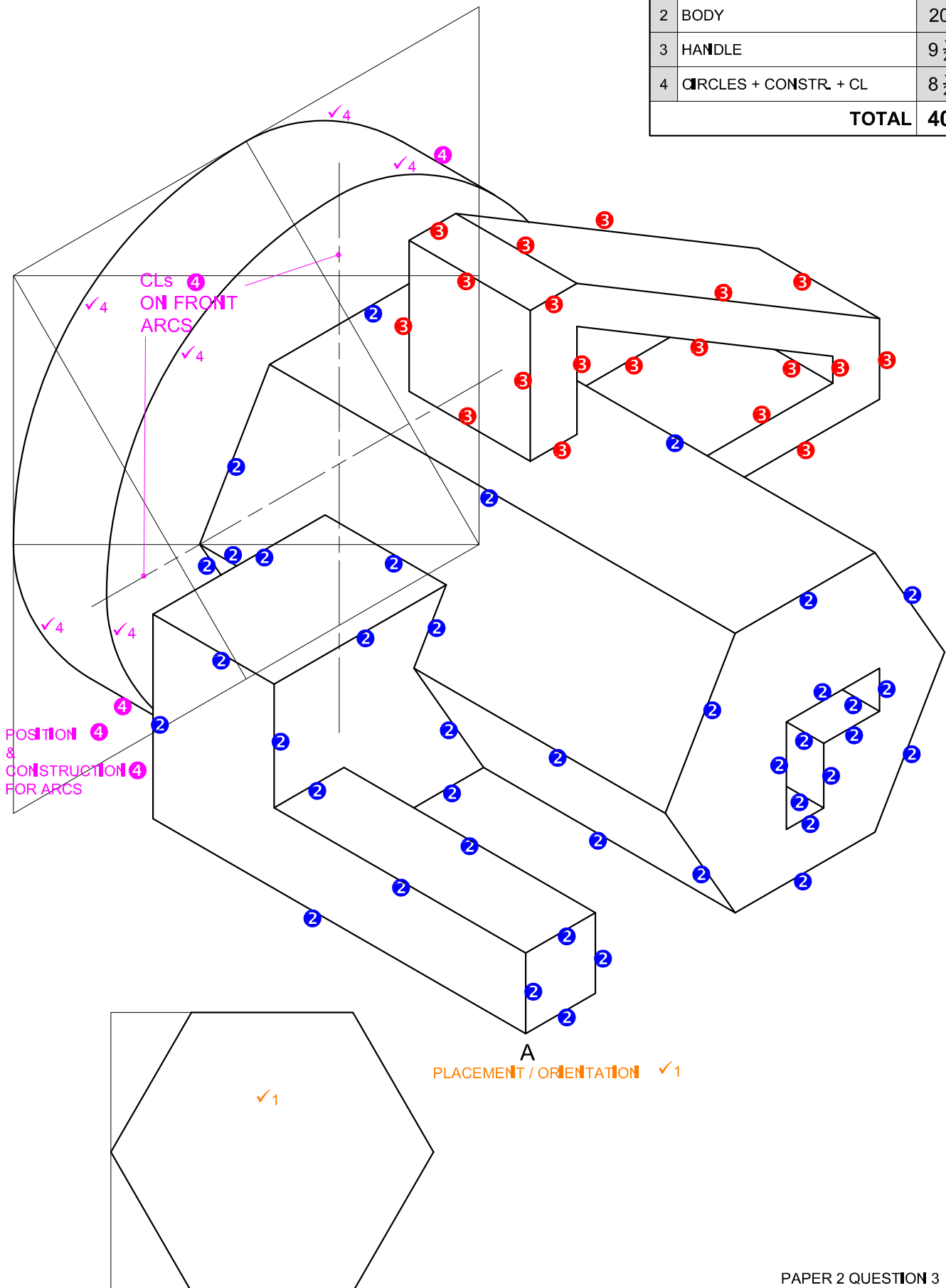
NOTE ON CURVE QUALITY
MUST BE THROUGH DETERMINED
POINTS, & CURVE MUST BE
CONTINUOUS AND SMOOTH

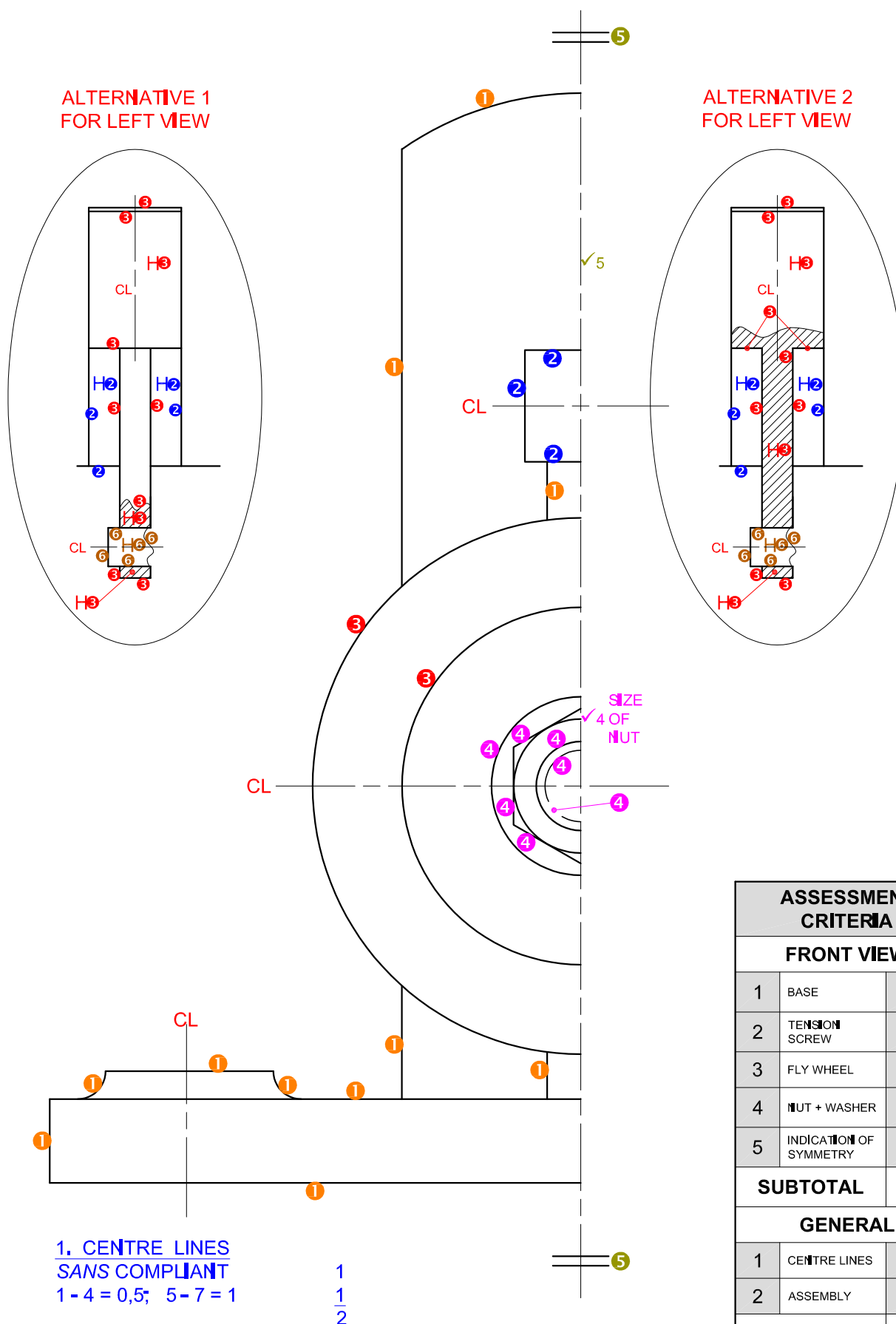
- 1. CONSTRUCTION
 - LENGTH 120 + LINE DIVISIONS (1/2 + 1/2)
 - 150° HORIZONTAL LINE DIVISION for UAR
 - VERTICAL DIVISIONS for UAR (hor / vert. division number must be equal)
 - FIRST HALF CONSTRUCTION for UAR
 - SECOND HALF CONSTRUCTION for UAR
- 1 1 1 1 1 1 5

ASSESSMENT CRITERIA 2.2		
1	GRAPH CONSTRUCTION	5
2	POINTS + CURVE	6
3	LABELS	1
SUBTOTAL 2.2		12

PAPER 2 QUESTION 2
GRADE 12
NOVEMBER 2022
MARKING GUIDELINE

ASSESSMENT CRITERIA		
1	PLACING + AUX. VIEW	2
2	BODY	20
3	HANDLE	9 $\frac{1}{2}$
4	CIRCLES + CONSTR. + CL	8 $\frac{1}{2}$
TOTAL		40





ASSESSMENT CRITERIA		
FRONT VIEW		
1	BASE	5 $\frac{1}{2}$
2	TENSION SCREW	1 $\frac{1}{2}$
3	FLY WHEEL	1
4	NUT + WASHER	4 $\frac{1}{2}$
5	INDICATION OF SYMMETRY	2
SUBTOTAL		14 $\frac{1}{2}$
GENERAL		
1	CENTRE LINES	2
2	ASSEMBLY	10
SUBTOTAL		12

PAPER 2 QUESTION 4
GRADE 12
NOVEMBER 2022
MARKING GUIDELINE

