basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

ENGINEERING GRAPHICS AND DESIGN P2

NOVEMBER 2024

MARKS: 100

TIME: 3 hours

This question paper consists of 6 pages.

Barcode label

INSTRUCTIONS AND INFORMATION

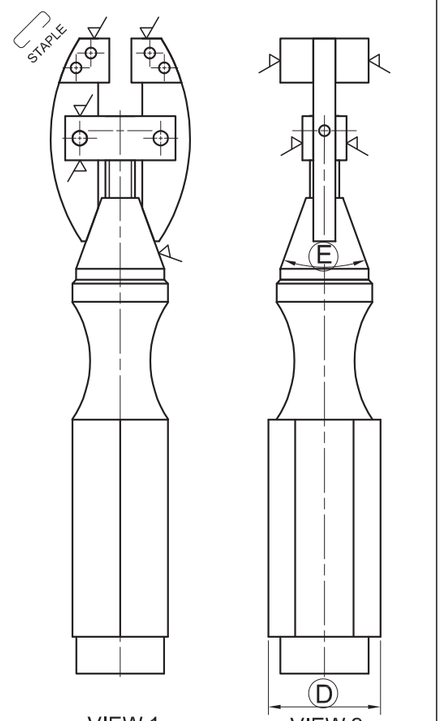
1. This question paper consists of FOUR questions.
2. Answer ALL the questions.
3. ALL drawings are in third-angle orthographic projection, unless otherwise stated.
4. ALL drawings must be prepared using pencil and instruments, unless otherwise stated.
5. ALL answers must be drawn accurately and neatly.
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			½	SIGN	MODERATED			½	SIGN	RE-MARKING			½	SIGN
1															
2															
3															
4															
TOTAL															
	2	0	0			2	0	0			2	0	0		

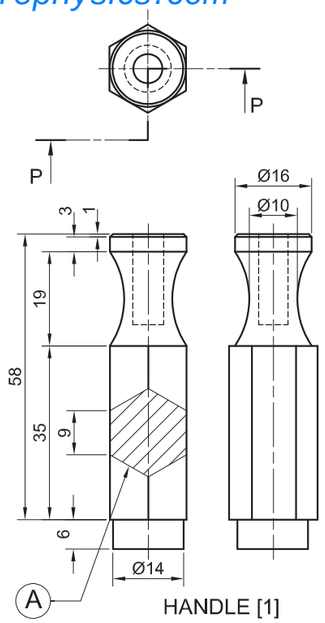
FINAL CONVERTED MARK	CHECKED BY
100	

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

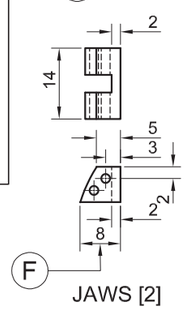
DO NOT FOLD THE QUESTION PAPER IN HALF.



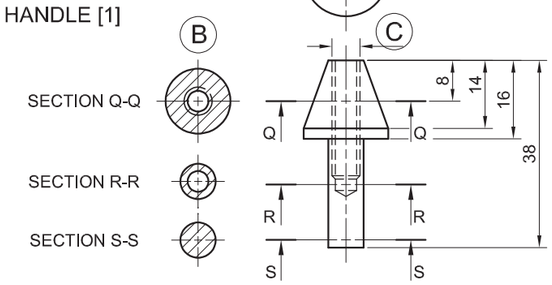
PIN VICE ASSEMBLY
SCALE 1 : 1



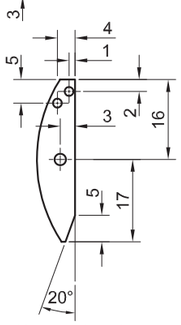
HANDLE [1]



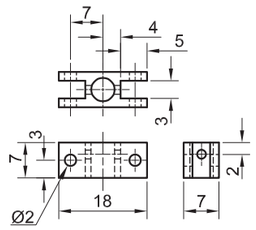
JAWS [2]



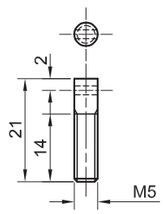
ADJUSTING CONE [3]



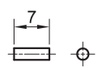
CLAMP ARM [4]



CLAMP BRACKET [5]

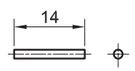


CLAMP SCREW [6]



PIN Ø2,5 [7]

PIN Ø2 [8]



PIN Ø2 [9]

PARTS LIST			
NO	PART	QUANTITY	MATERIAL
1	HANDLE	1	WOOD
2	JAWS	2	SILVER STEEL
3	ADJUSTING CONE	1	BRASS
4	CLAMP ARM	2	STEEL
5	CLAMP BRACKET	1	STEEL
6	CLAMP SCREW	1	STEEL
7	PIN (Ø2,5)	2	STEEL
8	PIN (Ø2)	1	STEEL
9	PIN (Ø2)	4	STEEL

FILE NAME: CJ-10810	QUANTITY: 80 PIN VICES	ALL UNSPECIFIED RADII ARE 3 mm.	TOLERANCE: +0,25 -0,3
DRAWING No. 025	SCALE 4 : 5		
CLIENT NAME: CAROLUS JEWELLERS, VILJOEN STREET, CULLINAN	DRAWING PROGRAMME: AUTOCAD 2023	ALL DIMENSIONS ARE IN MILLIMETRES.	
XANDER DRAUGHTING CC 57 CHADLIN LANE, CULLINAN 6940	www.ksmerwedraw.co.za ☏ 023 685 1857	DRAWN BY: CHRIS P	DATE: 21-05-2024
		CHECKED BY: DIVAN	DATE: 25-05-2024
TITLE: PIN VICE		APPROVED BY: JOHN	DATE: 27-05-2024

INFORMATION AND PROCESSES	
PRODUCTION METHOD	GRINDING
ROUGHNESS VALUE	0,5
DIRECTION OF LAY	PERPENDICULAR
MACHINING ALLOWANCE	0,2

SURFACE

ANSWER 18

ANSWER 19

ANSWER 20

QUESTION 1: ANALYTICAL (MECHANICAL)

Given:
Two views of the assembled parts of a pin vice assembly, detailed views of the individual parts of the assembly drawn to a different scale, a parts list, a title block and a table of questions. The drawings are not presented to the indicated scales.

Instructions:
Complete the table below by neatly answering the questions, which refer to the accompanying drawings, title block and mechanical content. **[30]**

QUESTIONS		ANSWERS			
1	What unit of measurement has been used on the drawing?		1		
2	On what date was the drawing prepared?		1		
3	What is the title of the drawing?		1		
4	What is the telephone number of the draughting company?		1		
5	If VIEW 1 is the front view, what would VIEW 2 be called?		1		
6	What material is required for the handle?		1		
7	What scale is indicated for the individual parts?		1		
8	How many Ø2 pins are there in a single pin vice assembly?		1		
9	How many pin vices must be manufactured?		1		
10	Name the type of section shown at A.		1		
11	Name the type of section shown at B.		1		
12	What type of section would be produced by cutting plane P-P?		1		
13	How many surfaces of the pin vice assembly must be machined?		1		
14	Name the part on which the depth of the threaded hole for the clamp screw (part 6) would be measured.		1		
15	Determine the complete dimensions at: C: D:		2		
16	Determine the complete angle at E.		1		
17	With reference to the tolerance, determine the **maximum** and the **minimum** size for the dimension at F.	MAXIMUM:	1		
		MINIMUM:	1		
18	In the space provided above the views of the adjusting cone (ANSWER 18), use drawing instruments to determine the centre point of the arc. Show ALL construction.		4		
19	In the space below (ANSWER 19), draw, in neat freehand, a machining symbol, with labels for the information and processes provided in the table, for the given surface.		4		
20	In the space below (ANSWER 20), draw, in neat freehand, the *SANS 10111* conventional representation for a bearing.		3		
		TOTAL	**30**		

EXAMINATION NUMBER

EXAMINATION NUMBER 2

STAPLE

QUESTION 2: LOCI

NOTE: Answer QUESTIONS 2.1 and 2.2 NOV

2.1: MECHANISM

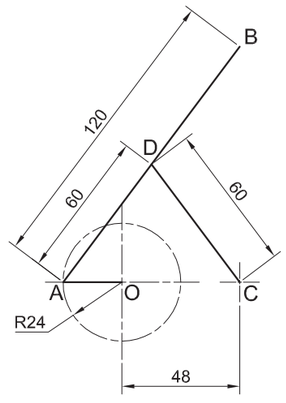
Given:
- A schematic drawing of a mechanism consisting of crank OA, connecting rod AB and rocker CD
- The position of centre point O on the drawing sheet

Specifications:
- The positions of centre point O and point C of rocker CD are fixed.
- Connecting rod AB is pin-jointed to crank OA at A.
- Rocker CD is pin-jointed to AB at D.

Motion:
As crank OA rotates for one complete rotation, rocker CD oscillates around point C.

Instructions:
- Using centre point O, draw, to scale 1 **:** 1, the given schematic drawing of the mechanism and label ALL the given points.
- Trace the locus generated by point B for ONE complete rotation of crank OA.
- Show ALL construction. [19½]

O



ASSESSMENT CRITERIA 2.1						
1	GIVEN	6 ½				
2	CONSTRUCTION	5				
3	LOCUS OF B	8				
PENALTIES (-)						
TOTAL		**19 ½**				

2.2: CAM

Given:
The bottom left-hand corner of the displacement graph, marked P, on the drawing sheet.

Motion:
A cam starts at the **maximum** displacement of 64 mm and imparts the following motion:
- There is a dwell period for the first 30°.
- It descends to its minimum displacement over the next 90° with uniform acceleration and retardation.
- It rises 36 mm over the next 45° with uniform motion.
- There is a dwell period for the next 30°.
- It then descends 22 mm over the next 30° with uniform motion.
- There is a dwell period for the next 45°.
- It returns to its original position over the last 90° with simple harmonic motion.

Instructions:
- Using corner P as the 0° position, draw, to a rotational scale of 120 mm = 360° and a displacement scale of 1 **:** 1, the displacement graph for the given motion.
- Label the displacement graph and include the rotational scale.
- Show ALL construction. [18½]

P 0°

ASSESSMENT CRITERIA 2.2						
1	GRAPH CONSTRUCTION	6				
2	POINTS + CURVE	11 ½				
3	LABELS	1				
PENALTIES (-)						
SUBTOTAL 2.2		**18 ½**				
SUBTOTAL 2.1		**19 ½**				
TOTAL		**38**				

EXAMINATION NUMBER	
EXAMINATION NUMBER	3

STAPLE

QUESTION 3: ISOMETRIC DRAWING

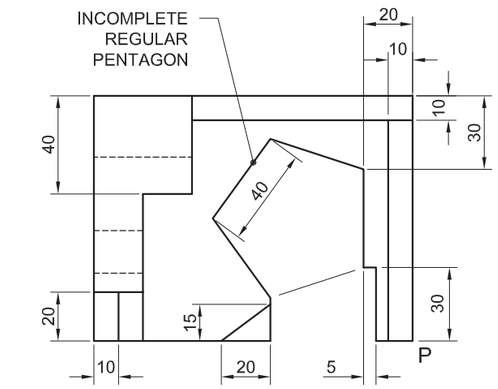
Given:

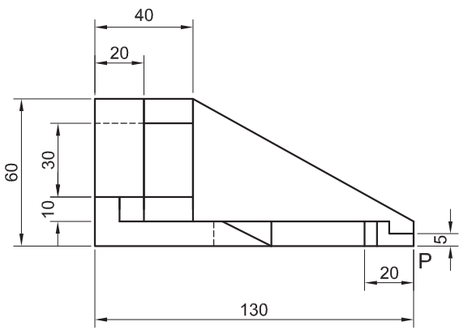
- The front view, top view and right view of a casting
- The position of point P on the drawing sheet

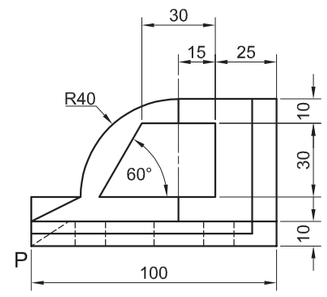
Instructions:

Using scale 1 : 1, convert the orthographic views of the casting into an isometric drawing.

- Use P as the starting and lowest point of the drawing.
- Show ALL construction.
- NO hidden detail is required. **[40]**





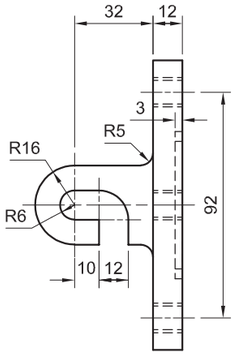


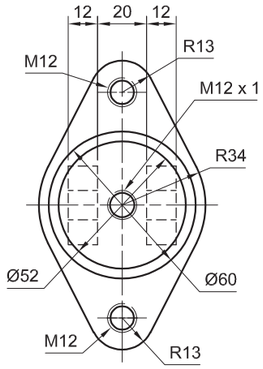
P

ASSESSMENT CRITERIA					
1	PLACING + AUX. VIEW	2 ½			
2	BASE + PENTAGON	20			
3	UPPER PORTION	14 ½			
4	CIRCLES + CONSTR. + CL	3			
PENALTIES (-)					
	TOTAL	**40**			

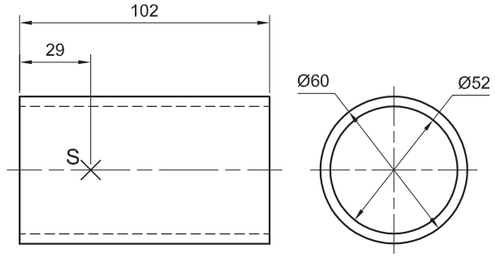
EXAMINATION NUMBER

EXAMINATION NUMBER 4

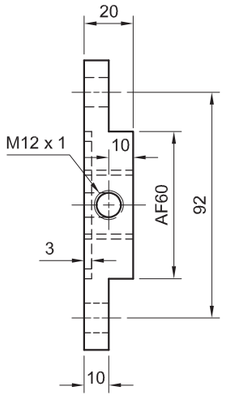


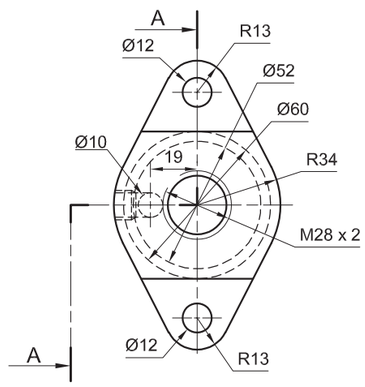


LEFT-END PLATE [1]

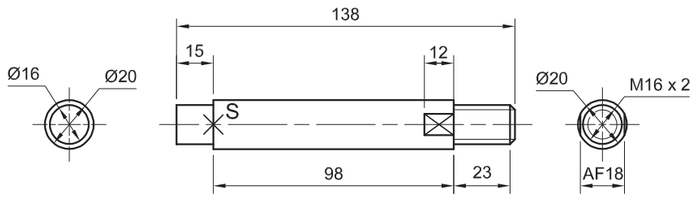


CYLINDER HOUSING [2]

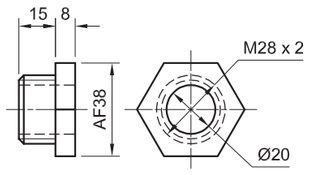




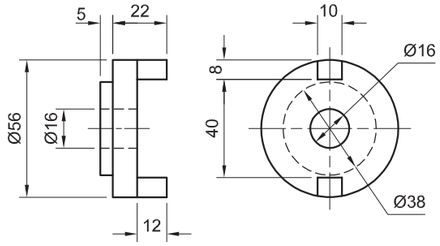
RIGHT-END PLATE [3]



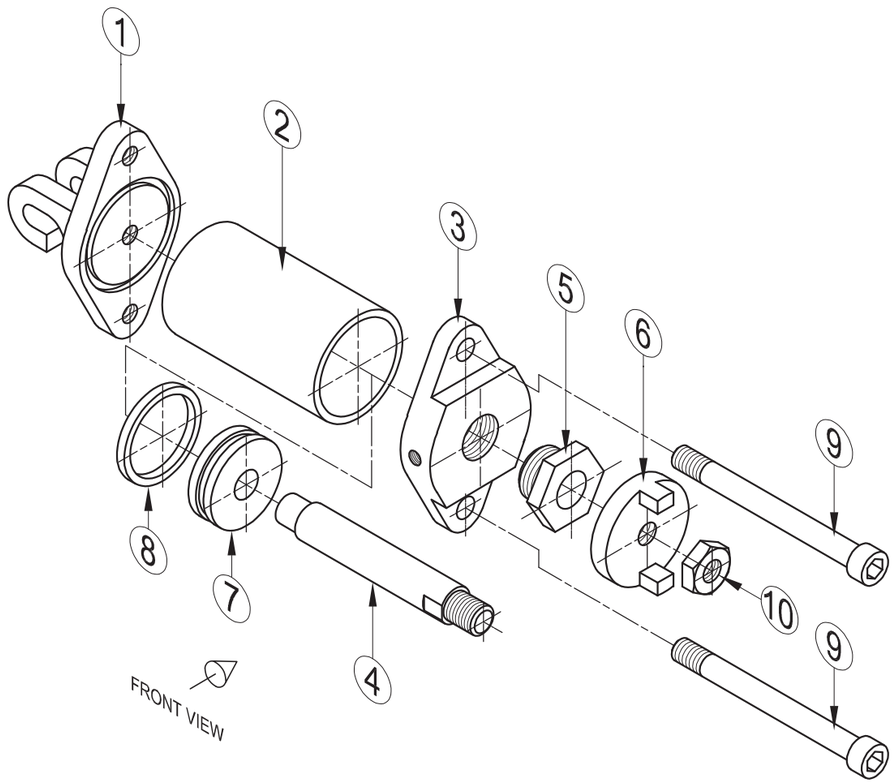
CONNECTING ROD [4]



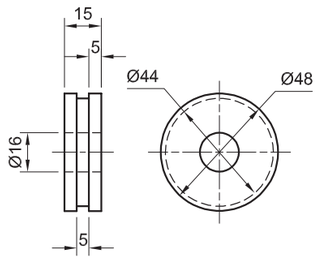
ROD GUIDE [5]



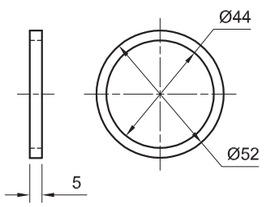
COUPLING [6]



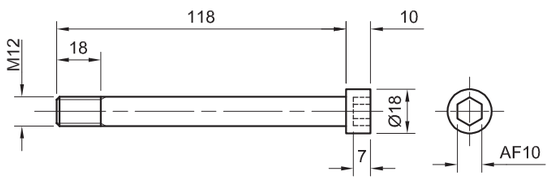
EXPLODED ISOMETRIC DRAWING



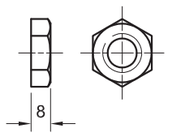
PISTON [7]



PISTON SEAL [8]



BOLT [9]



M16 NUT [10]

QUESTION 4: MECHANICAL ASSEMBLY

Given:

- The exploded isometric drawing of the parts of a hydraulic cylinder assembly, showing the position of each part relative to all the others
- Orthographic views of each of the parts of the hydraulic cylinder 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 hydraulic cylinder assembly:
  - 4.1 **The right view**
  - 4.2 **A half-sectional front view** on cutting plane A-A. Show the top half of the assembly in section, as seen from the direction of the arrow on the exploded isometric drawing. The cutting plane is shown on the right view of the right end plate (part 3).

NOTE:

- Planning is essential.
- ALL drawings must comply with the *SANS 10111* guidelines.
- The convention of symmetry may NOT be applied.
- Align point S on the connecting rod (part 4) with point S on the cylinder housing (part 2).
- Show THREE faces of the M16 nut (part 10) on the half-sectional front view.
- NO hidden detail is required. **[92]**

PARTS LIST

	PART	QUANTITY	MATERIAL
1	LEFT-END PLATE	1	STAINLESS STEEL
2	CYLINDER HOUSING	1	MILD STEEL
3	RIGHT-END PLATE	1	CAST IRON
4	CONNECTING ROD	1	STAINLESS STEEL
5	ROD GUIDE	1	BRASS
6	COUPLING	1	CAST IRON
7	PISTON	1	ALUMINIUM ALLOY
8	PISTON SEAL	1	RUBBER
9	BOLT	2	MILD STEEL
10	M16 NUT	1	MILD STEEL

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HYDRAULIC CYLINDER

ALL DIMENSIONS ARE IN MILLIMETRES.

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

ASSESSMENT CRITERIA					
RIGHT VIEW					
		POSSIBLE	OBTAINED	SIGN	MODERATED
1	RIGHT-END PLATE	5			
2	BOLTS	4			
3	COUPLING	3 $\frac{1}{2}$			
4	M16 NUT	4			
SUBTOTAL		**16 $\frac{1}{2}$**			
HALF-SECTIONAL FRONT VIEW					
1	LEFT-END PLATE	10 $\frac{1}{2}$			
2	CYLINDER HOUSING	5			
3	RIGHT-END PLATE	9			
4	CONNECTING ROD + PISTON + SEAL	11			
5	ROD GUIDE	3			
6	COUPLING	6			
7	BOLTS	14			
8	M16 NUT	4			
SUBTOTAL		**62 $\frac{1}{2}$**			
GENERAL					
1	CENTRE LINES	3			
2	ASSEMBLY	10			
SUBTOTAL		**13**			
TOTAL		**92**			
PENALTIES (-)					
GRAND TOTAL					
EXAMINATION NUMBER					
EXAMINATION NUMBER					6

basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

ENGINEERING GRAPHICS AND DESIGN P2

NOVEMBER 2024

MARKING GUIDELINES

MARKS: 100

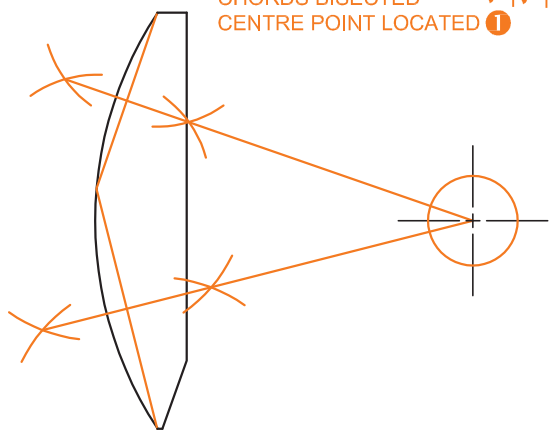
These marking guidelines consist of 7 pages.

ANSWERS

1	MILLIMETRES / mm	1
2	21-05-2024	1
3	PIN VICE	1
4	023 685 1857	1
5	RIGHT VIEW	1
6	WOOD	1
7	4 : 5	1
8	5	1
9	80	1
10	REVOLVED SECTION	1
11	SUCCESSIVE SECTIONS	1
12	HALF SECTION	1
13	11	1
14	ADJUSTING CONE	1
15	C: M5 D: 18	2
16	E: 40°	1
17	MAXIMUM: 8,25	1
	MINIMUM: 7,7	1
18	*See below*	4
19		4
20		3
	TOTAL	**30**

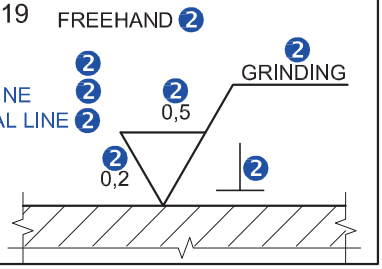
ANSWER 18

INSTRUMENTS 1
TWO CHORDS DRAWN 1 1
CHORDS BISECTED ✓1 ✓1
CENTRE POINT LOCATED 1



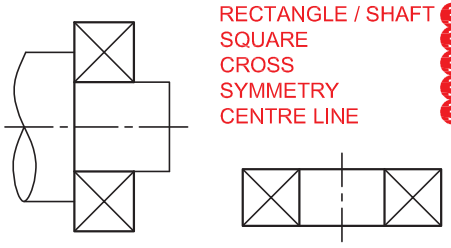
ANSWER 19

FREEHAND 2
SYMBOL
TRIANGLE 2
INCLINED LINE 2
HORIZONTAL LINE 2
GRINDING 2
0,5 2
0,2 2
2

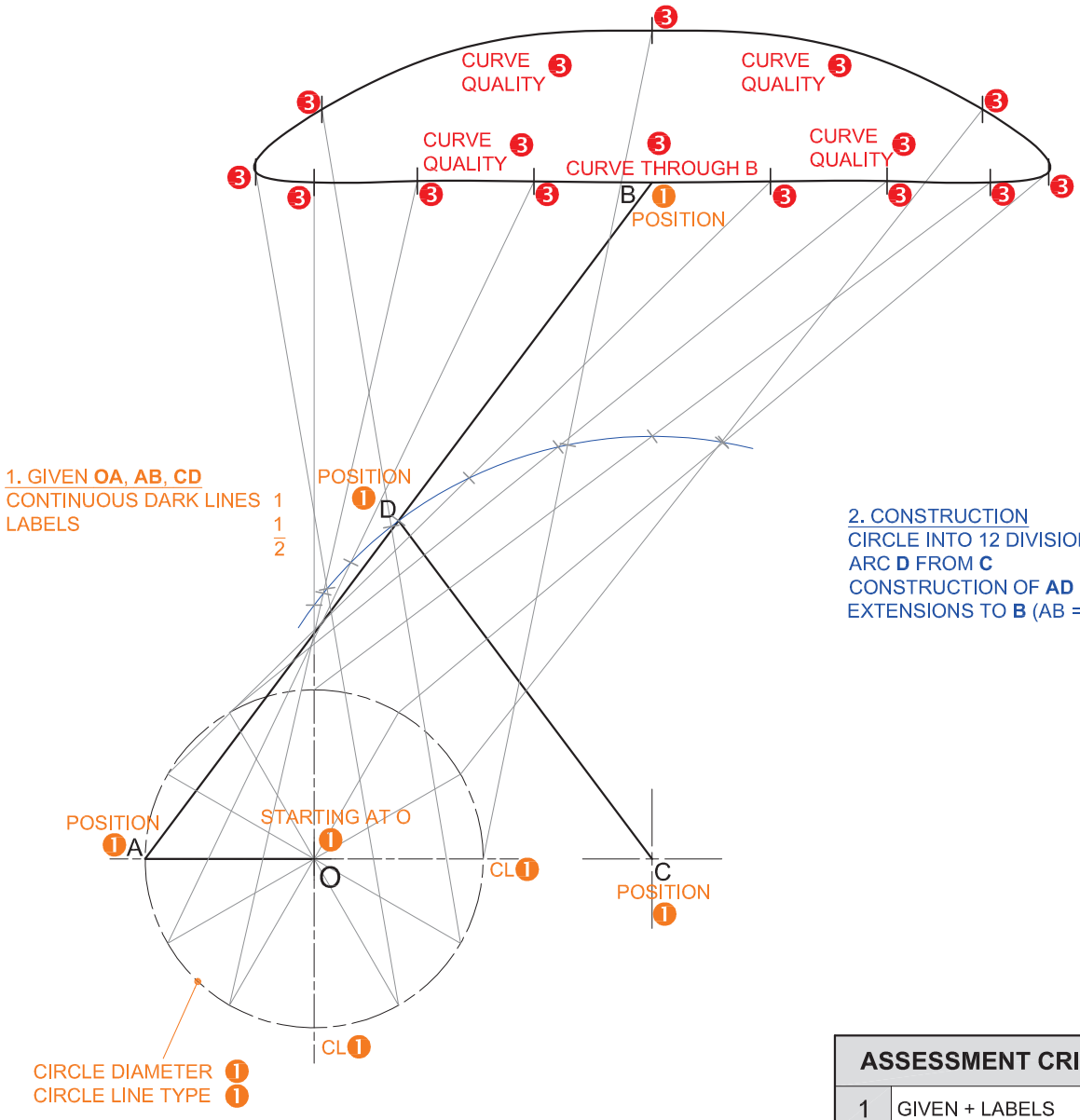


ANSWER 20

FREEHAND 3
RECTANGLE / SHAFT 3
SQUARE 3
CROSS 3
SYMMETRY 3
CENTRE LINE 3

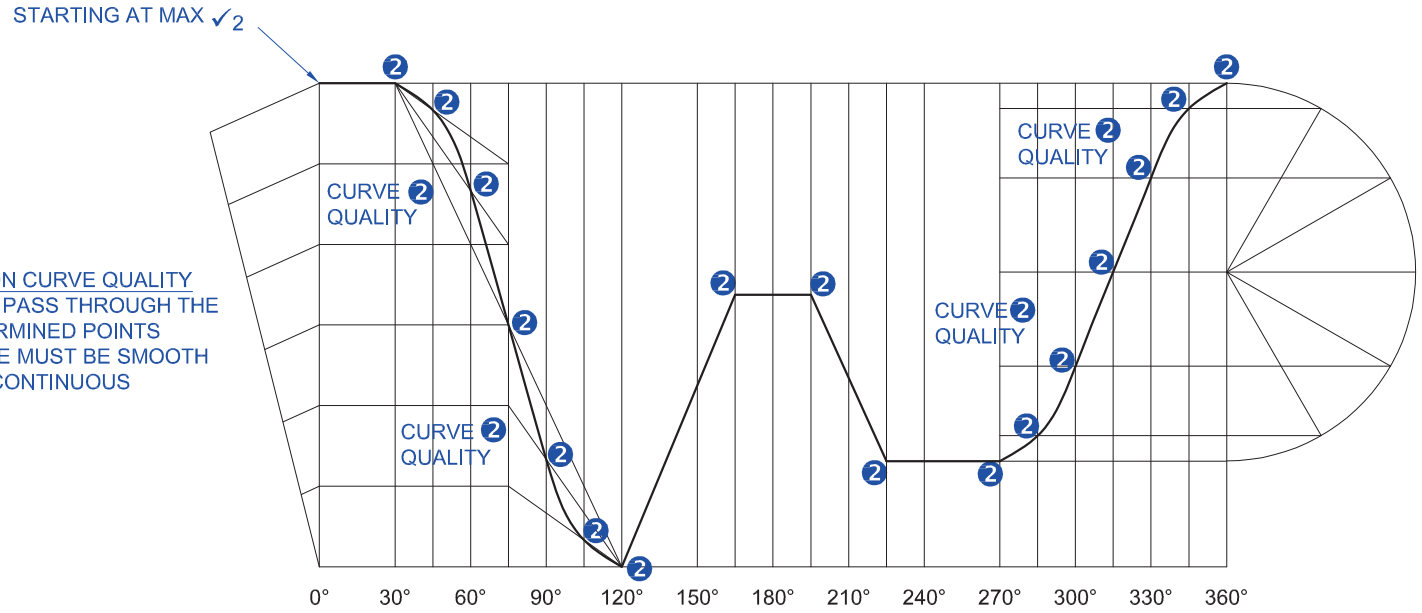


PAPER 2 QUESTION 1
GRADE 12
NOVEMBER 2024
MARKING GUIDELINES



ASSESSMENT CRITERIA 2.1		
1	GIVEN + LABELS	6 1/2
2	CONSTRUCTION	5
3	LOCUS OF B	8
SUBTOTAL 2.1		**19 1/2**

PAPER 2 QUESTION 2.1
GRADE 12
NOVEMBER 2024
MARKING GUIDELINES



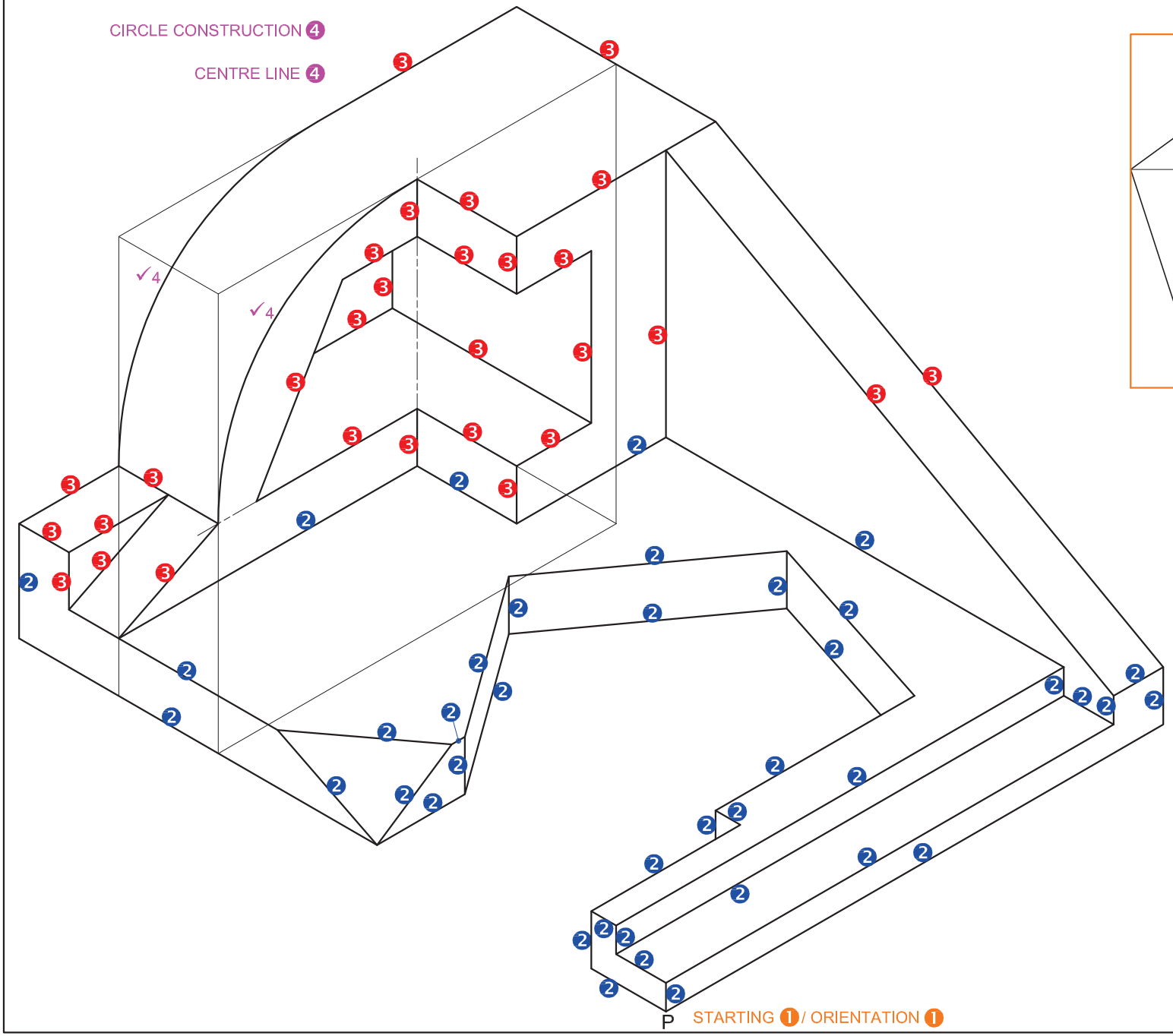
NOTES ON CURVE QUALITY
- MUST PASS THROUGH THE DETERMINED POINTS
- CURVE MUST BE SMOOTH AND CONTINUOUS

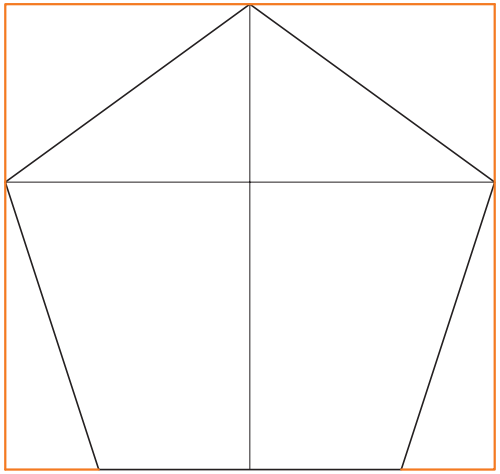
DISPLACEMENT GRAPH 3
SCALE 120 mm = 360° 3

1. CONSTRUCTION	
- LENGTH (120)	1
- 12 EQUAL LINE DIVISIONS	1
	2
UNIFORM ACCELERATION. + RETARDATION	
- 15° DIVISIONS	0.5
- HEIGHT DIVISION	0.5
- FIRST HALF CONSTRUCTION	0.5
- SECOND HALF CONSTRUCTION	0.5
	2
SIMPLE HARMONIC MOTION	
- SEMI CIRCLE IN THE CORRECT POSITION	0.5
- CIRCLE DIVISION	0.5
- ADDITIONAL 15° DIVISIONS	0.5
- PROJECTION	0.5
	2
TOTAL	6.0

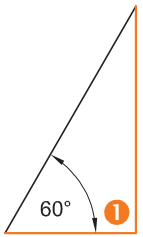
ASSESSMENT CRITERIA 2.2		
1	CONSTRUCTION	6
2	POINTS + CURVE	11 1/2
3	LABELS	1
SUBTOTAL 2.2		**18 1/2**

PAPER 2 QUESTION 2.2
GRADE 12
NOVEMBER 2024
MARKING GUIDELINES





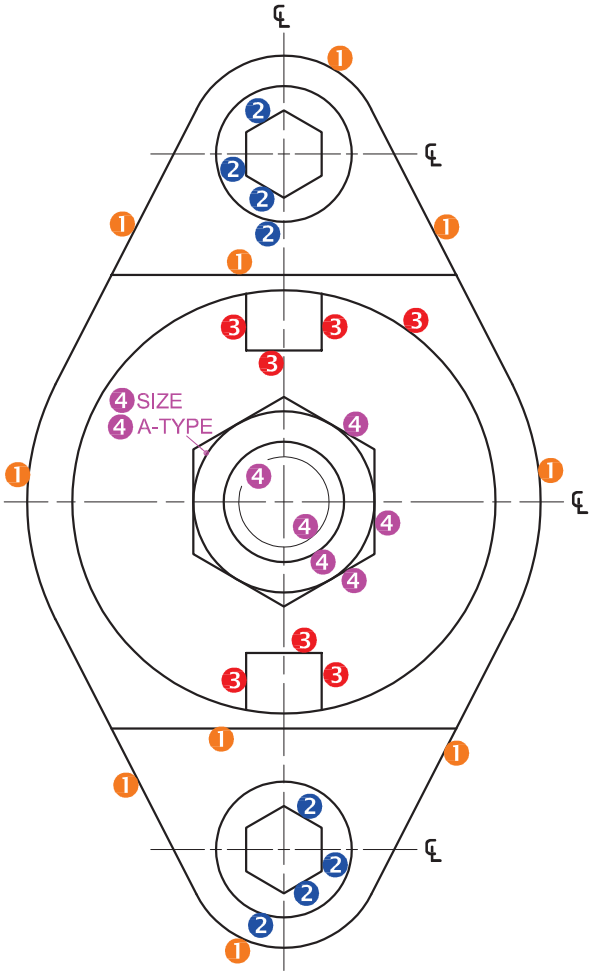
PENTAGON CONSTRUCTION ✓1



ASSESSMENT CRITERIA		
1	PLACING + AUX. VIEW	$2\frac{1}{2}$
2	BASE + PENTAGON	20
3	UPPER PORTION	$14\frac{1}{2}$
4	CIRCLES + CONSTR. + CL	3
	TOTAL	**40**

PAPER 2 QUESTION 3
GRADE 12
NOVEMBER 2024
MARKING GUIDELINE

Please turn over



ASSESSMENT CRITERIA		
RIGHT VIEW		
1	RIGHT-END PLATE	5
2	BOLTS	4
3	COUPLING	$3\frac{1}{2}$
4	M16 NUT	4
SUBTOTAL		$16\frac{1}{2}$

PAPER 2 QUESTION 4
GRADE 12
NOVEMBER 202-
MARKING GUIDELINE