



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

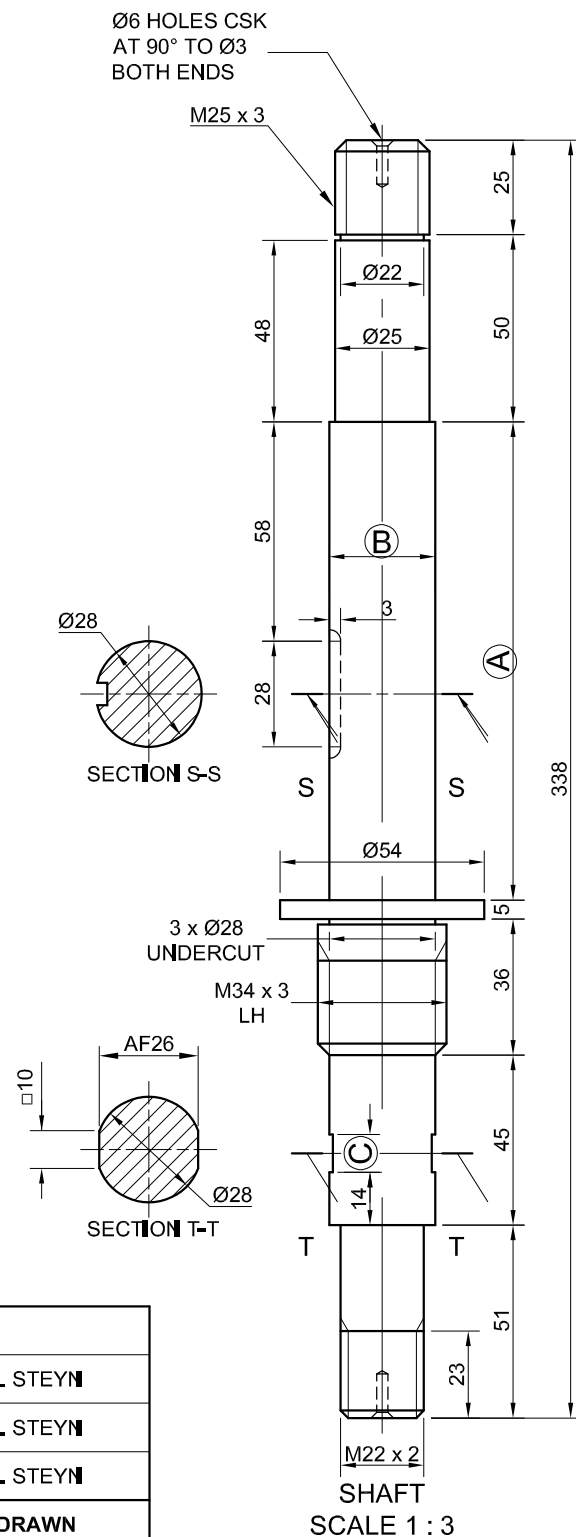
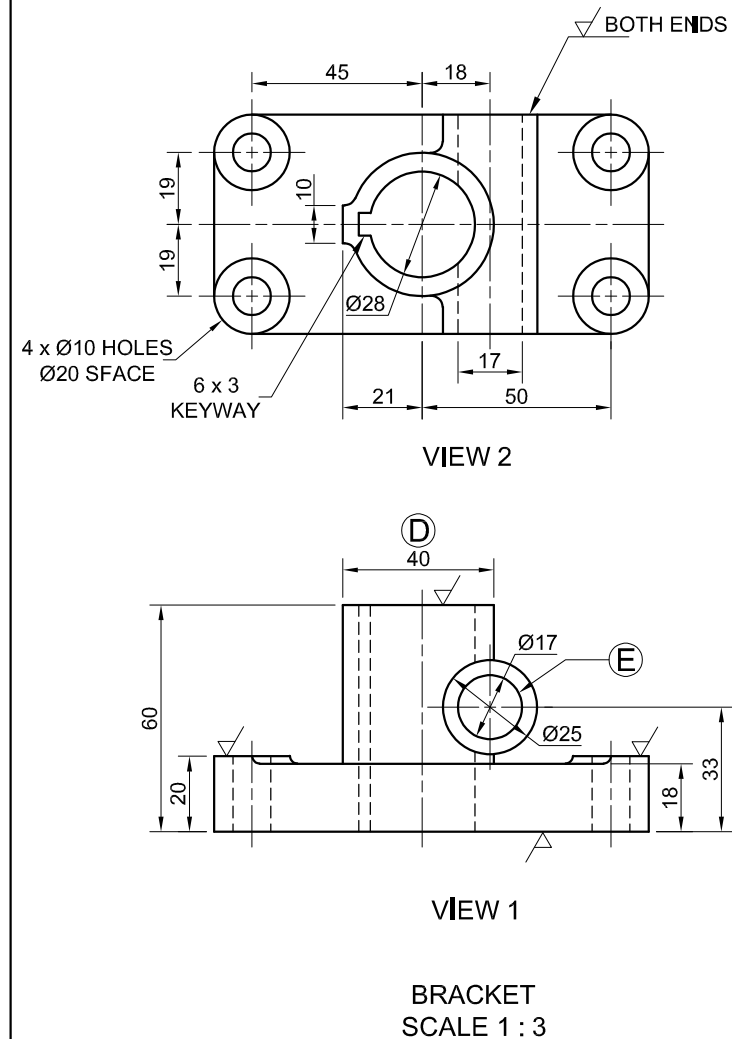
COMPLETE THE FOLLOWING:

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.

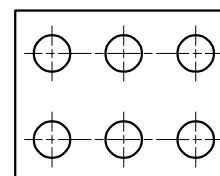
Instructions:

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:

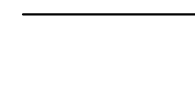
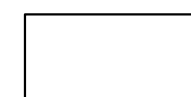
ANSWER 20:



DETAILED



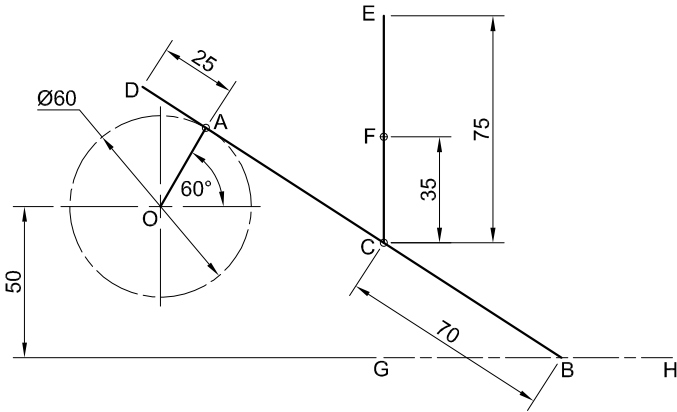
CONVENTION



EXAMINATION NUMBER

EXAMINATION NUMBER

2



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

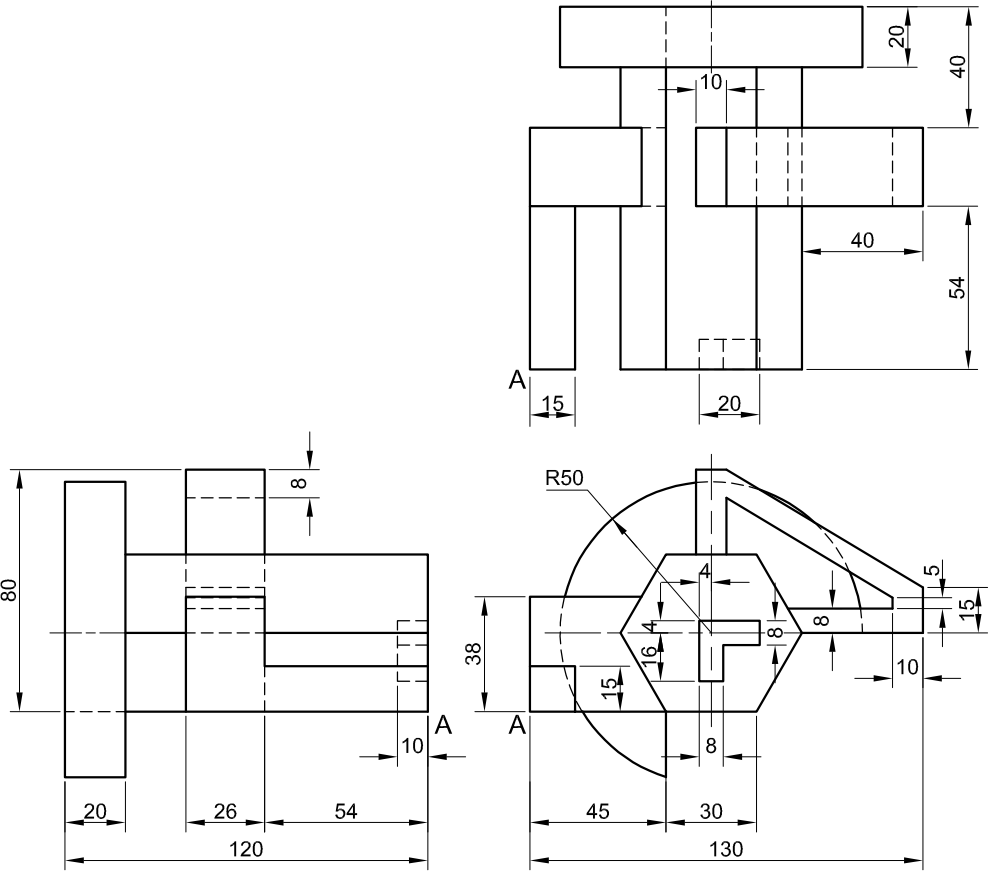


QUESTION 3: ISOMETRIC DRAWING

- 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]**

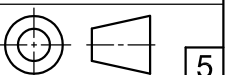
PARTS LIST			
PARTS		QUANTITY	MATERIAL
1	BASE	1	CAST IRON
2	SHAFT	1	MILD STEEL
3	KEY	1	KEY STEEL
4	M16 WASHER	1	MILD STEEL
5	M16 NUT	1	MILD STEEL
6	CRANK	1	CAST IRON
7	PISTON	1	MILD STEEL
8	CYLINDER	1	CAST IRON
9	COMPRESSION SPRING	1	SPRING STEEL
10	TENSION SCREW	1	MILD STEEL
11	FLY WHEEL	1	CAST IRON

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WOBBLE ENGINE ASSEMBLY

ALL DIMENSIONS ARE IN MILLIMETRES.





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