

NATIONAL SENIOR CERTIFICATE EXAMINATION
2014

ENGINEERING GRAPHICS AND DESIGN
PAPER 2

MARKS: 200
TIME: 3 HOURS

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of **7 pages** including the cover page and **4 questions**.
2. **All** the questions must be answered.
3. Unless specified otherwise, all questions are in **Third Angle Orthographic Projection**.
4. Unless specified otherwise, all questions are to be completed to a **scale of 1:1**.
5. **All** answer sheets must be **stapled** in **numerical** order, even questions that are not attempted/blank.
6. All **construction work** must be shown, even if a **stencil** was used.
7. Print your **examination number** neatly on each page.
8. Use only the **drawing sheets** provided.
9. Your drawings should be **well presented** and reflect **neatness** and **accuracy**. Marks will be **deducted** for untidy and inaccurate work.
10. Any dimensions or detail not given may be **assumed** in **good proportion**.
11. **Stencils** and **Calculators** may be used.

FOR OFFICIAL USE ONLY					
QUESTION	SECTION	MARK	MODERATED	MAXIMUM	CODE
1	MECHANICAL ANALYTICAL			20	
2a	CAM			20	
2b	MECHANISM			20	
3	ISOMETRIC PROJECTION			40	
4	MECHANICAL ASSEMBLY			100	
SYMBOL	TOTAL			200	
	TOTAL			100	

FINAL CONVERTED MARK	CHECKED BY
100	

EXAMINATION NUMBER

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QUESTION 1

MECHANICAL ANALYTICAL

Figure A

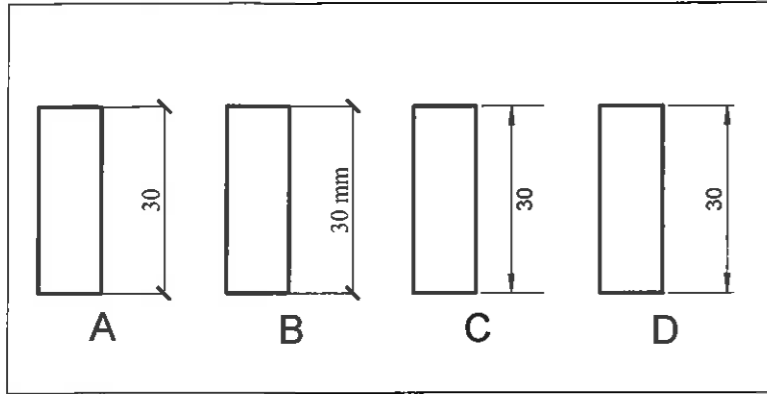


Figure B

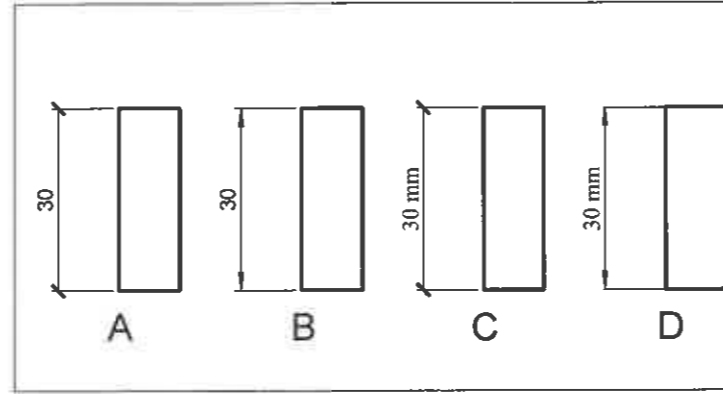


Figure C

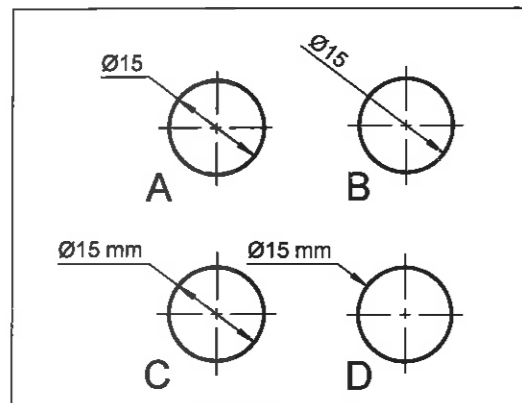
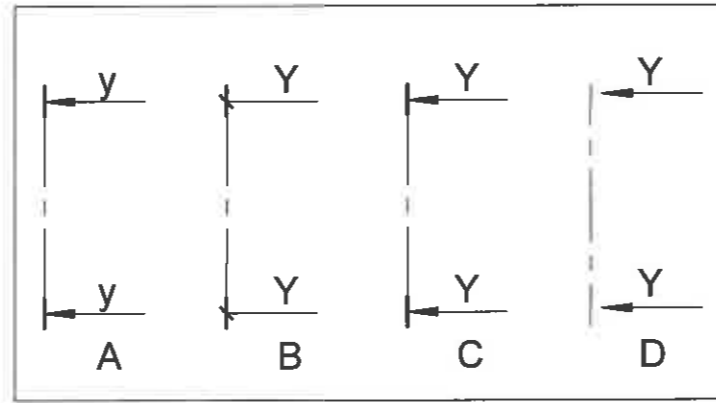


Figure D



Complete the following questions by writing the correct answer in the space provided.

- 1.1 Which dimension in Figure A is correct? _____ (1)
- 1.2 Which dimension in Figure B is correct? _____ (1)
- 1.3 Which dimension in Figure C is correct? _____ (1)
- 1.4 Which section line in Figure D is correct? _____ (1)
- 1.5 The feature 'E' on Figure E is a _____ (1)
- 1.6 The feature 'F' on Figure E is a _____ (1)
- 1.7 The feature 'G' on Figure E is a _____ (1)
- 1.8 Calculate the thickness 'H' of the bolt head (Figure F). _____ (1)
- 1.9 Calculate the thickness 'J' of the thread (Figure F). _____ (1)
- 1.10 Calculate the dimension 'K' of the spring (Figure G). _____ (1)
- 1.11 What type of sectioning is feature 'L' on Figure H? _____ (1)
- 1.12 What type of hole is 'M' on Figure I? _____ (1)
- 1.13 What type of hole is 'P' on Figure J? _____ (1)
- 1.14 Which washer in Figure M is a spring washer? _____ (1)
- 1.15 To strengthen the rib, a fillet weld is required at 'N' on Figure I. Draw and complete the given symbol at Figure K for this fillet weld that will be completed on the site. _____ (3)
- 1.16 Figure L shows an incomplete machine symbol. Insert the following data correctly on the symbol:
 - 1.16.1 Direction of lay is Radial. _____
 - 1.16.2 Roughness value of 0.6. _____
 - 1.16.3 Machining allowance of 0.9. _____ (3)

Figure E

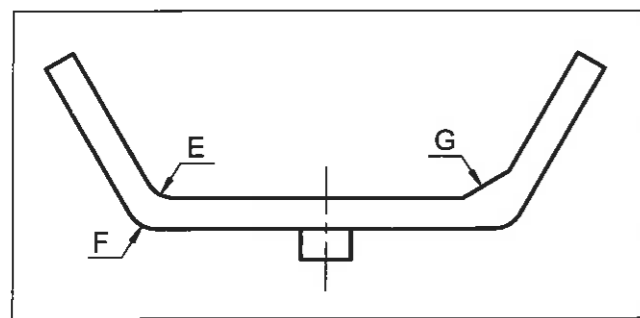


Figure F

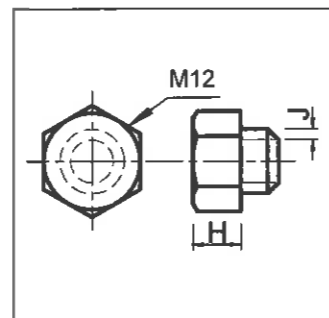


Figure G

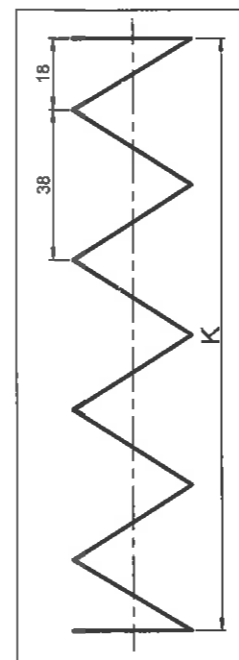


Figure H

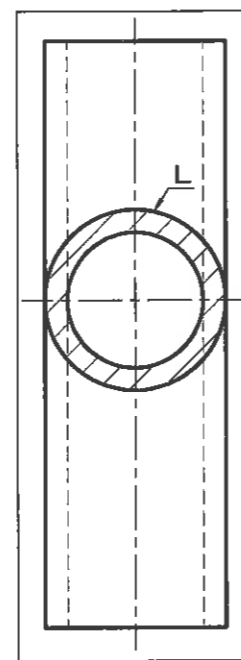


Figure I

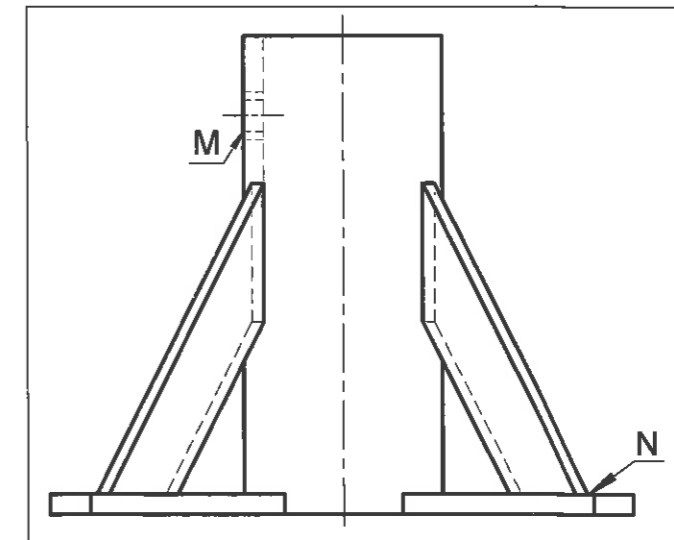


Figure M

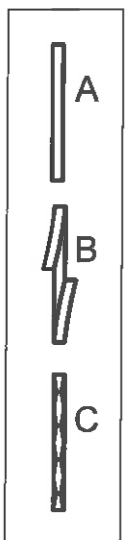


Figure J

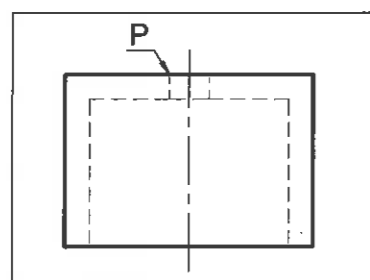


Figure K

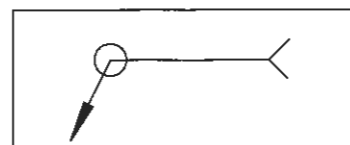
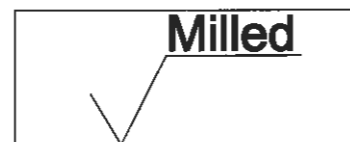


Figure L



ANSWER SHEET 1

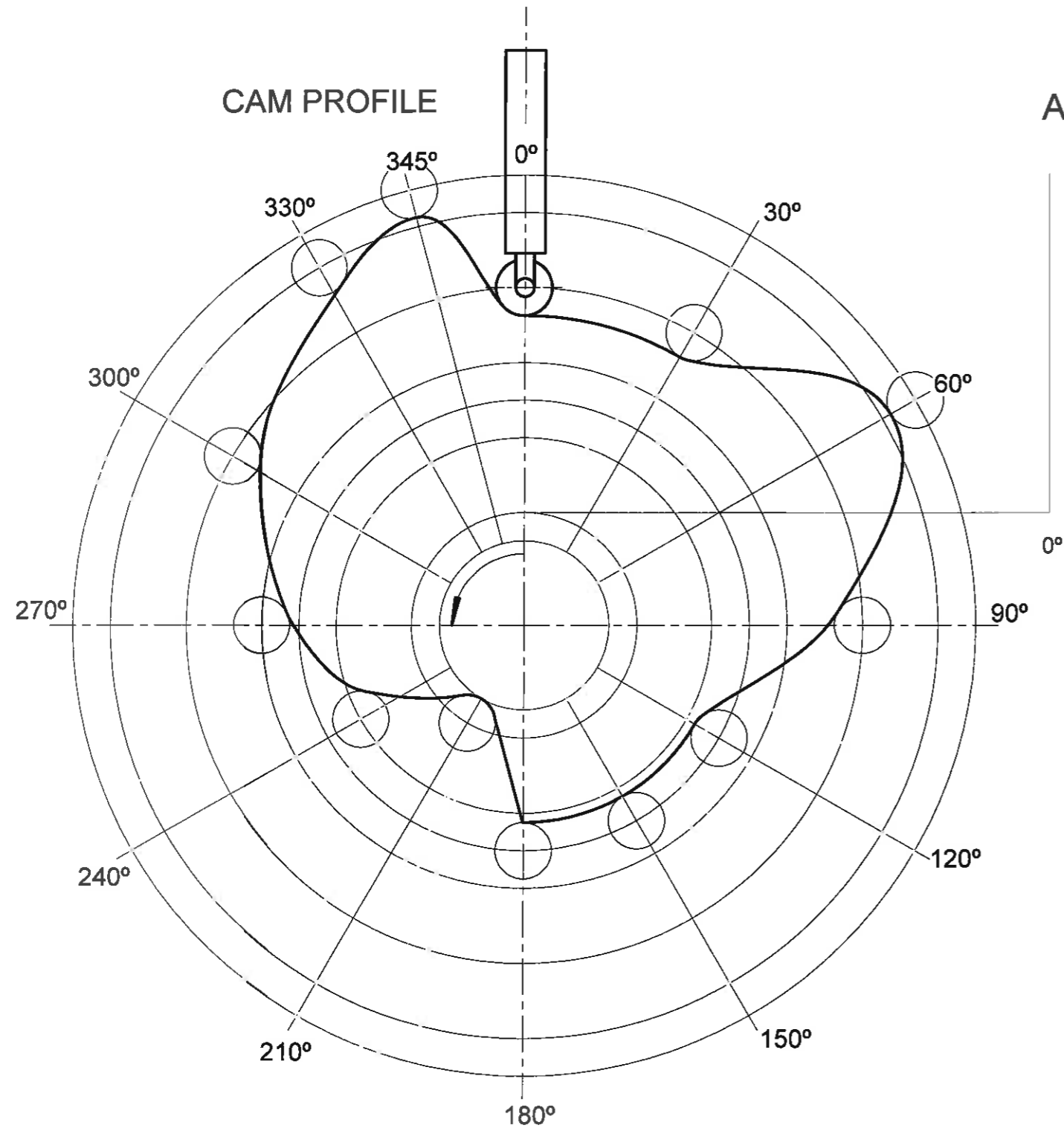
20 MARKS

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QUESTION 2a

LOCI
CAM



A. _____



C. _____

The **cam profile** and the starting point of a **roller-ended** follower that reciprocates with **uniform velocity** along the profile is given. **Complete** the **displacement graph** to the following specifications and then answer the questions below:

- > Use a **horizontal scale** of 7 mm = 30°.
- > Use a **vertical scale** of 1 mm = 1 mm.
- > The **camshaft** has a diameter of 21 mm.

Instructions:

- > **Draw** and **hatch** the shaft.
- > Project and complete the **displacement diagram** in the space provided.
- > **Print** the required labels at **A, B** and **C**.

Answer the following related questions:

- 2a.1 What is the **travel** after 210°? _____
- 2a.2 What is the **total travel**? _____
- 2a.3 What is the **maximum displacement**? _____
- 2a.4 What is the **distance** between the cam shaft **centre** and the cam **profile**? _____

B.

ASSESSMENT CRITERIA

- Complete graph 8
- Print labels 3
- Draw the shaft 2
- Hatch the shaft 1
- Scale/orientation 1
- Answers 4
- Lw/Acc/Pr. 1

GPH	8	
LAB	3	
SFT	2	
HAT	1	
SC/O	1	
ANS	4	
L/A/P	1	

20 MARKS

EXAMINATION NUMBER

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ANSWER SHEET 2a

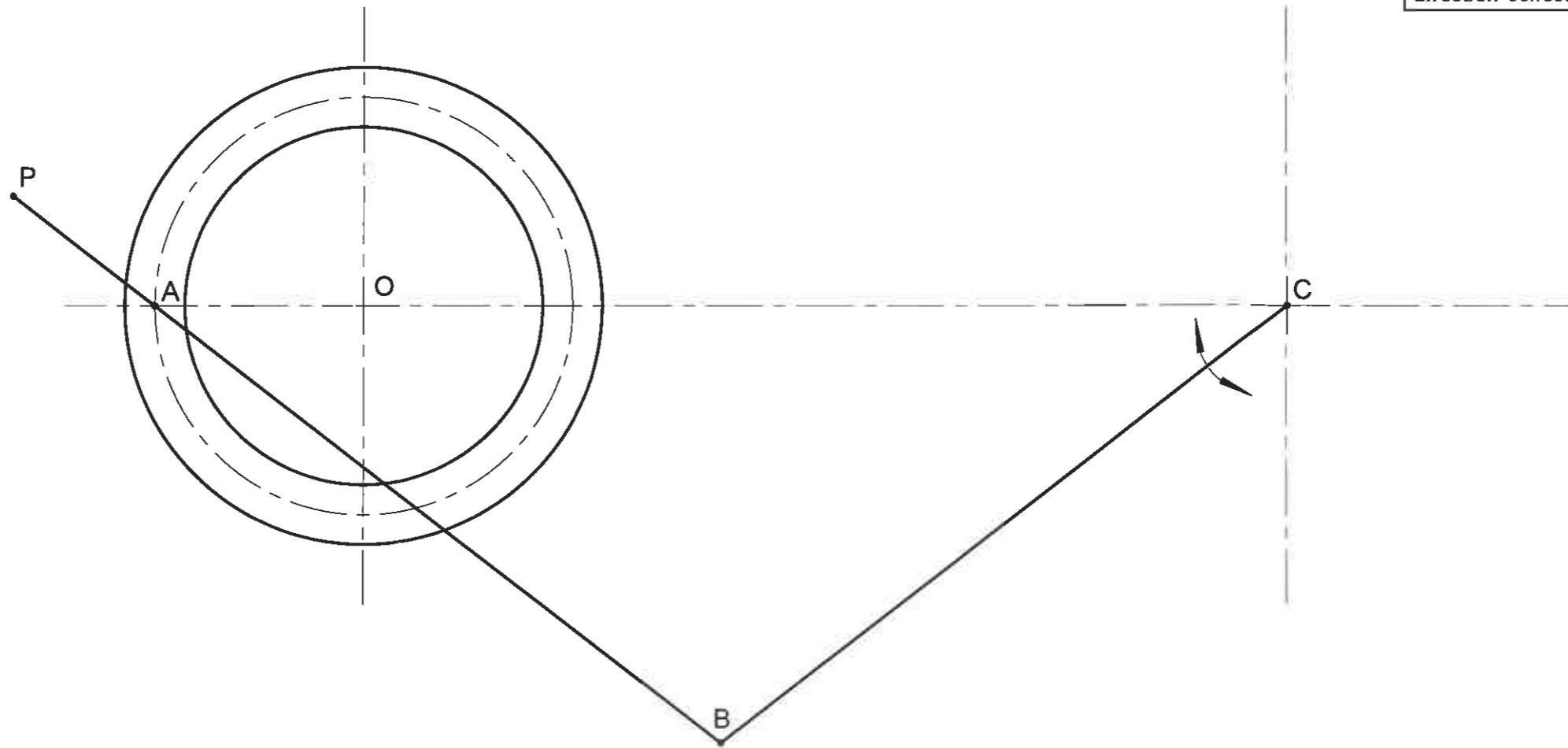
QUESTION 2b

LOCI
MECHANISM

The given figure shows a wheel, rotating around the centre O, with a **rod** PB attached to it at point A. The end of the rod (B) is attached to a **second rod** that is free to move around its anchor point C. BC rocks back and forth as the wheel rotates. Construct and draw the locus of **point P** if:

> The direction of rotation is **clockwise**.

Show all **constructions** and indicate the **direction** correctly.



SET	5	
PTS	11	
DIR	1	
LOC	3	

ASSESSMENT CRITERIA	
<input checked="" type="checkbox"/> Setup	5
<input checked="" type="checkbox"/> Plot Points	11
<input checked="" type="checkbox"/> Direction	1
<input checked="" type="checkbox"/> Locus	3

20 MARKS

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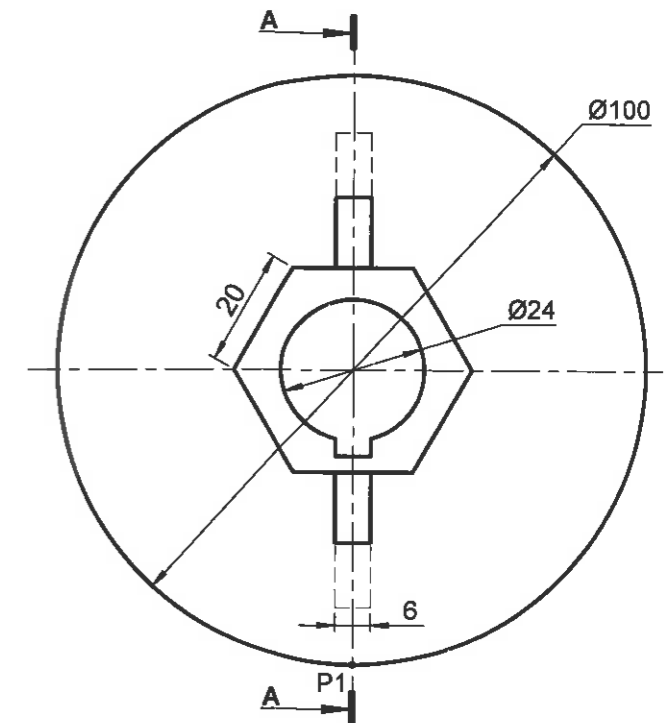
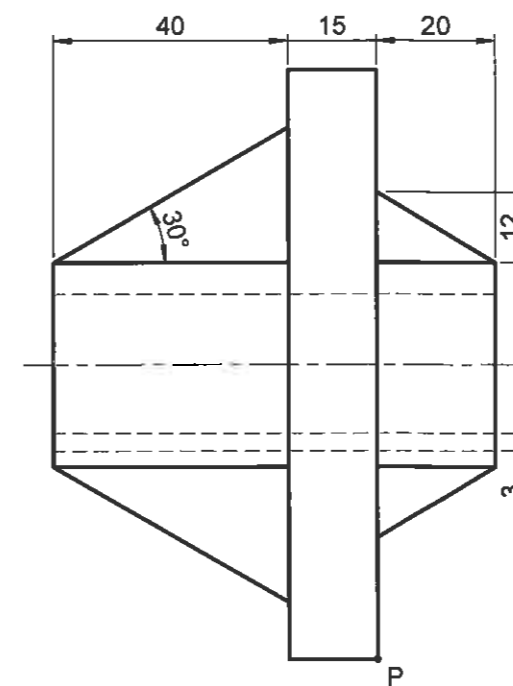
ANSWER SHEET 2b

QUESTION 3

ISOMETRIC
DRAWING

The figure below shows the front view and right view of a heavy duty **CASTING**.

- Complete a neat, sectioned *Isometric* drawing using the *cutting plane A-A*.
- Show all **constructions** and **centre lines**.
- Start your drawing on the given **crosshairs**.



+
P

ASSESSMENT CRITERIA	
<input checked="" type="checkbox"/>	Constructions 3
<input checked="" type="checkbox"/>	Iso Points 36/2 18
<input checked="" type="checkbox"/>	Iso circles 8
<input checked="" type="checkbox"/>	Centrelines 4
<input checked="" type="checkbox"/>	Hatching 4
<input checked="" type="checkbox"/>	Non-Hatching 4/2 2
<input checked="" type="checkbox"/>	LW/Positioning 1

CON	3	
ISOM	18	
CIRC	8	
CLS	4	
HAT	4	
No-H	2	
L/Pos	1	

40 MARKS

EXAMINATION NUMBER

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ANSWER SHEET 3

QUESTION 4
MECHANICAL ASSEMBLY

FIGURE 1

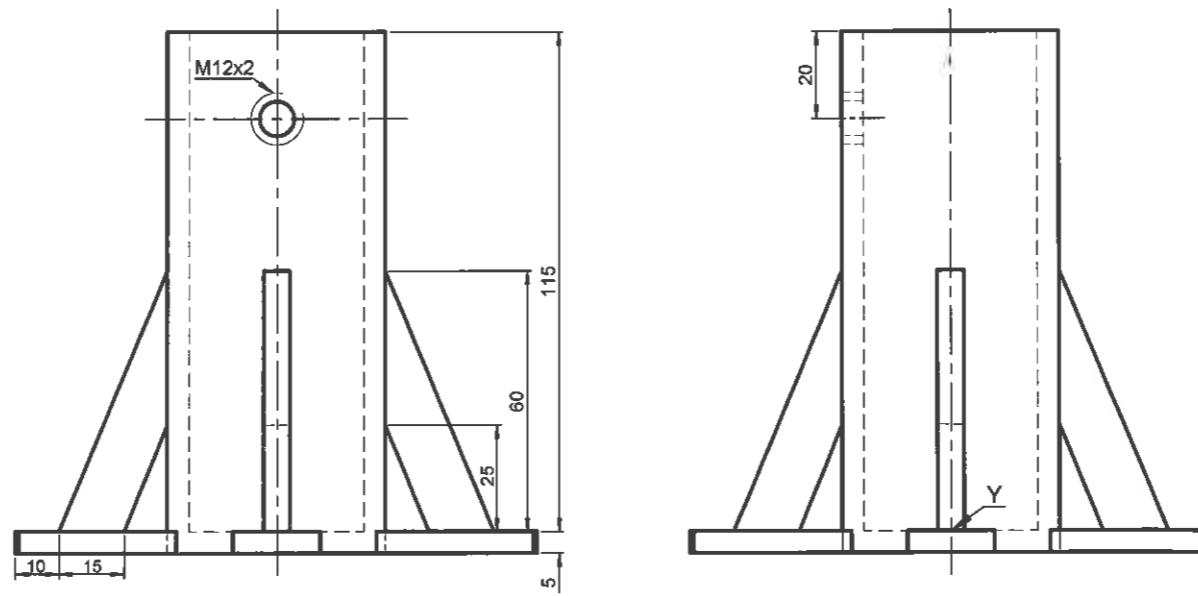
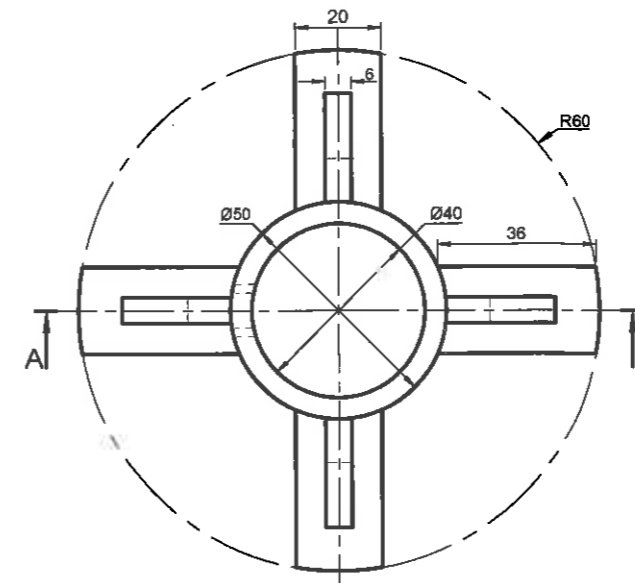
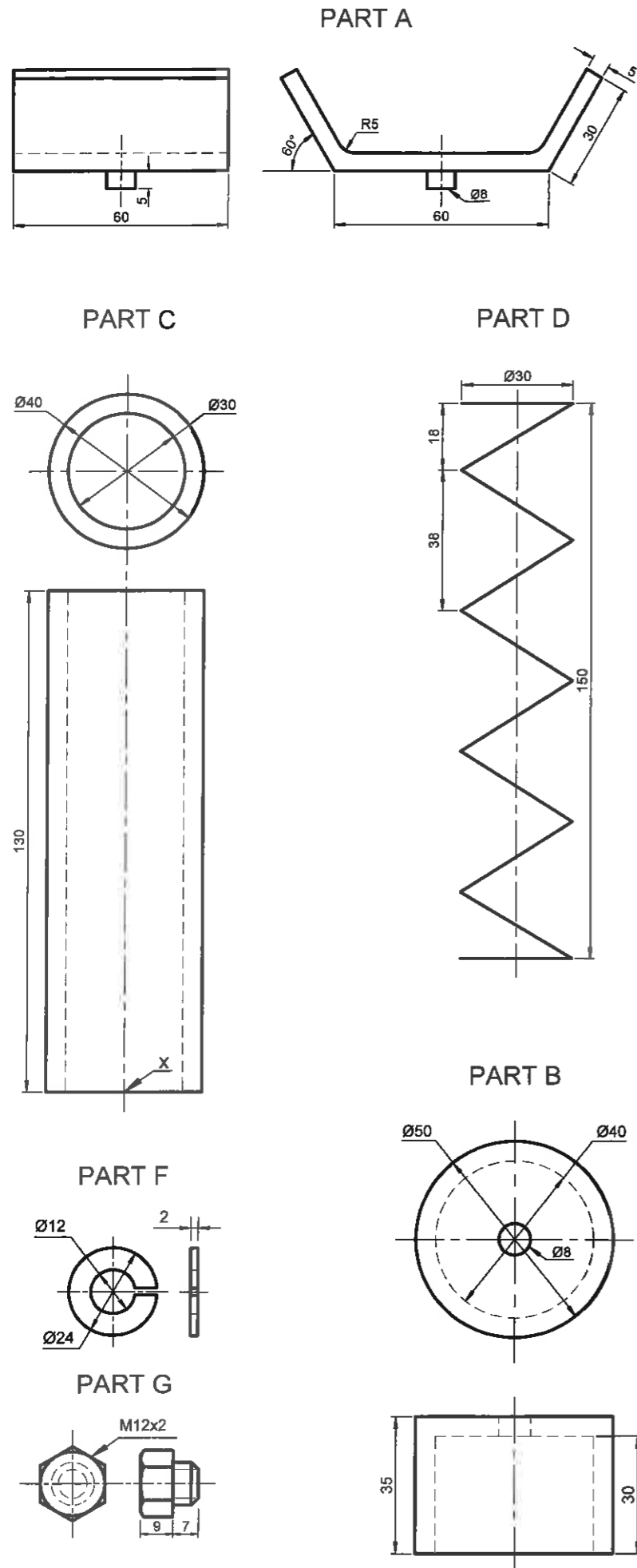


Figure 2 shows a series of pictures of a JACK STAND, as well as an exploded view of how the components of a similar, simplified system are assembled.

Figure 1 shows the different components (not to scale) that need to be assembled.

Complete the following to a **SCALE** of 1:1:

4.1 A **Left View** of the assembled components.

4.2 A **Sectioned Front View** of the assembled components to the cutting plane A-A.

4.2.1 **Point X** on the pipe (Part C) must be assembled **20 mm** above **Point Y** on the base (Part E).

4.2.2 The **bolt** must show 3 faces.

4.3 Show **Hidden Detail** on the **Left View** of only the **Support** (Part A) and the **Bolt** (Part G).

4.4 Show the **Cutting Plane** and the **Centre Lines**.

4.5 Insert 3 important, functional **Dimensions**.

4.6 Draw the **Projection Symbol**.

(In the space provided)

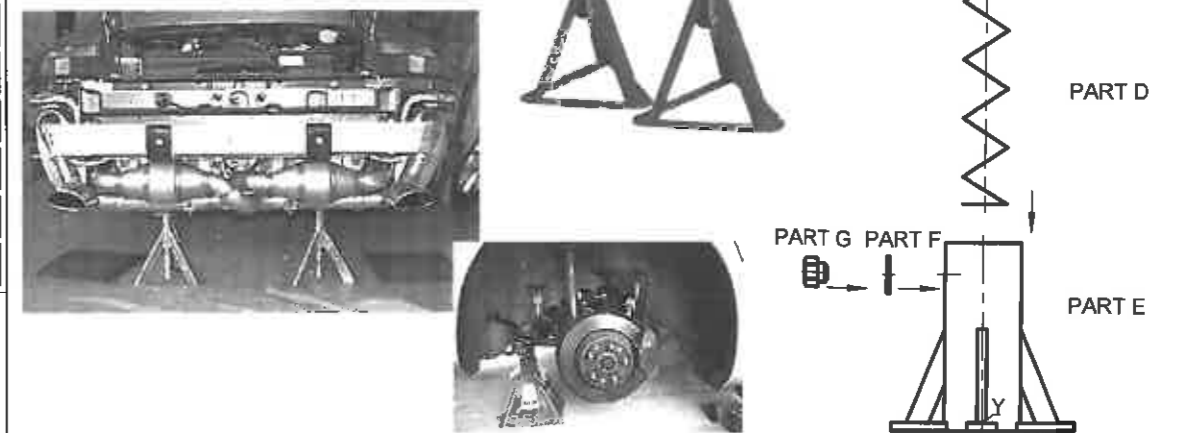
4.7 Add a suitable **Title** and indicate the **Scale** used.

(In the space provided)

4.8 Label the **Sectioned View**.

COMPONENT LIST			
NO.	PART	QUANTITY	MATERIAL
A	SUPPORT	1	MILD STEEL
B	COVER	1	MILD STEEL
C	PIPE	1	MILD STEEL
D	SPRING	1	STEEL
E	BASE	1	MILD STEEL
F	WASHER	1	STEEL
G	M12 BOLT	1	MILD STEEL

FIGURE 2



EXAMINATION NUMBER

100 MARKS

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QUESTION 4

MECHANICAL ASSEMBLY

ASSESSMENT CRITERIA

FRONT VIEW

A	SUPPORT	9	
B	COVER	6	
C	PIPE	3	
D	SPRING	4	
E	BASE	9	
F	WASHER	2	
G	M12 BOLT	5	
TOTAL	38		

LEFT VIEW

A	SUPPORT	4	
B	COVER	4	
C	PIPE	2	
E	BASE	16	
F	WASHER	2	
G	M12 BOLT	3	
	HIDDEN DETAIL	3	
TOTAL	34		

ADDITIONAL

CORRECT ASS.	5	
HATCHING	7	
NON-HATCHING	3	
CENTRE LINES	3	
DIMENSIONS	3	
SECTION LINE	2	
SYMBOL	2	
TITLE/SCALE	2	
LABEL	1	
LW / ACC / PRE	-2	
TOTAL	28	
TOTAL	100	

TITLE		SCALE		SYMBOL	
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EXAMINATION NUMBER

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ANSWER SHEET 4

100 MARKS