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Write your **student number** in the boxes above. **Letter**

VET Engineering Studies

Question and Answer Book

VCE Examination – Wednesday 20 November 2024

- Reading time is **15 minutes**: 9.00 am to 9.15 am
- Writing time is **1 hour 30 minutes**: 9.15 am to 10.45 am

Approved materials

- Protractor, set square and aids for curve sketching
- One scientific calculator

Materials supplied

- Question and Answer Book of 28 pages

Students are **not** permitted to bring mobile phones and/or any unauthorised electronic devices into the examination room.

Contents

	pages
25 questions (100 marks)	2–25

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VICTORIA State Government

Instructions

- Answer **all** questions in the spaces provided.
- Write your responses in English.
- All dimensions are in millimetres (mm) except where specified.
- Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1 (1 mark)

Other than wearing correct personal protective equipment (PPE), name **one** safety precaution required when operating a lathe.

Question 2 (3 marks)

The table below describes three items that need to be moved and a description of the required movement.

Manual handling is **not** considered a safe option.

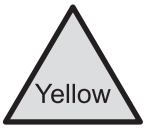
Complete the table below by stating the most suitable **mechanical aid / equipment** to safely move each of the items.

Item and description of movement	Mechanical aid / equipment
moving a 1 m^3 wooden crate containing steel components weighing 150 kg to a storage facility	
moving a box weighing 25 kg a distance of 10 m	
lifting a large vice onto a milling table	

Question 3 (6 marks)

Australian safety signs have been categorised into types, each type having a standard symbol and colour.

State the meaning of each type of safety sign shown in the table below, and give an example of why such a sign would be displayed. Information for the first symbol has been completed.

Symbol	Description	Meaning	Example
	**yellow** triangle with a diagram inside the triangle	*warning or danger*	*forklifts in area*
	**red** circle with red diagonal line over a diagram		
	**blue** circle with a diagram inside the circle		
	**green** square or rectangle with diagram inside the square		

Question 4 (2 marks)

A material rack has two short pieces of 25 mm diameter bar. One is aluminium and the other bright mild steel.

List two checks that can be done to identify each type of material.

1. _____

2. _____

Do not write in this area.

Question 5 (6 marks)

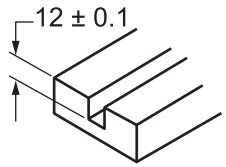
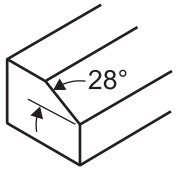
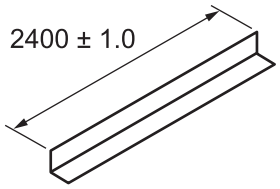
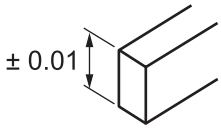
The table below shows four items that will be manufactured.

Complete the table by naming the most suitable material for each item and the reason for your answer. A sample item has been completed.

Item	Material	Reason
water tap	*brass*	*durable and won't rust*
kitchen sink		
frame of a rack to hold sheet metal		
portable step ladder		

Question 6 (4 marks)

Complete the table below by naming the most suitable measuring tool to measure each dimension.

Dimension	Measuring tool
	
	
	
	

Do not write in this area.

Question 7 (2 marks)

a. Identify the fastener shown in Figure 1. 1 mark

Figure 1

b. State **one** other type of fastener that is commonly used in conjunction with the fastener shown in Figure 1. 1 mark

Question 8 (5 marks)

Figure 2 shows an isometric drawing of a machined component.

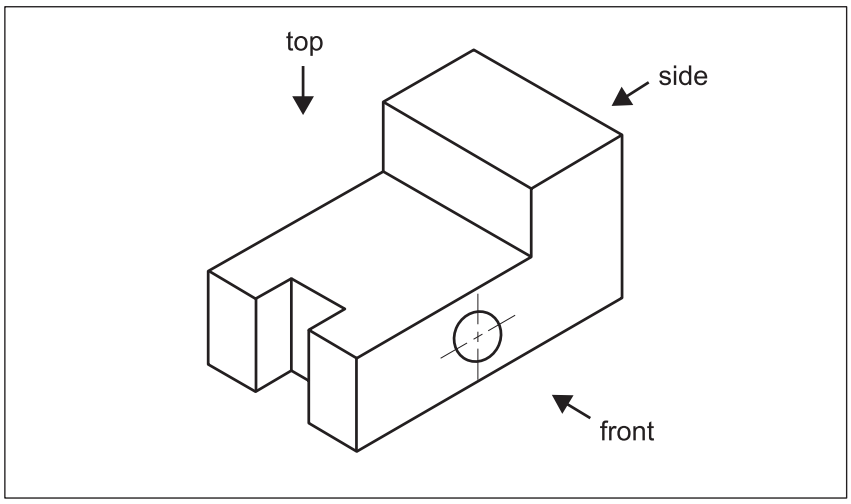


Figure 2

In the space provided below, draw the machined component shown in Figure 2 using third-angle projection. Your drawing should show:

- three views (top, side and front)
- all hidden detail
- all centre lines.

Question 9 (4 marks)

Figure 3 shows a selection of materials available in a metal storage area.

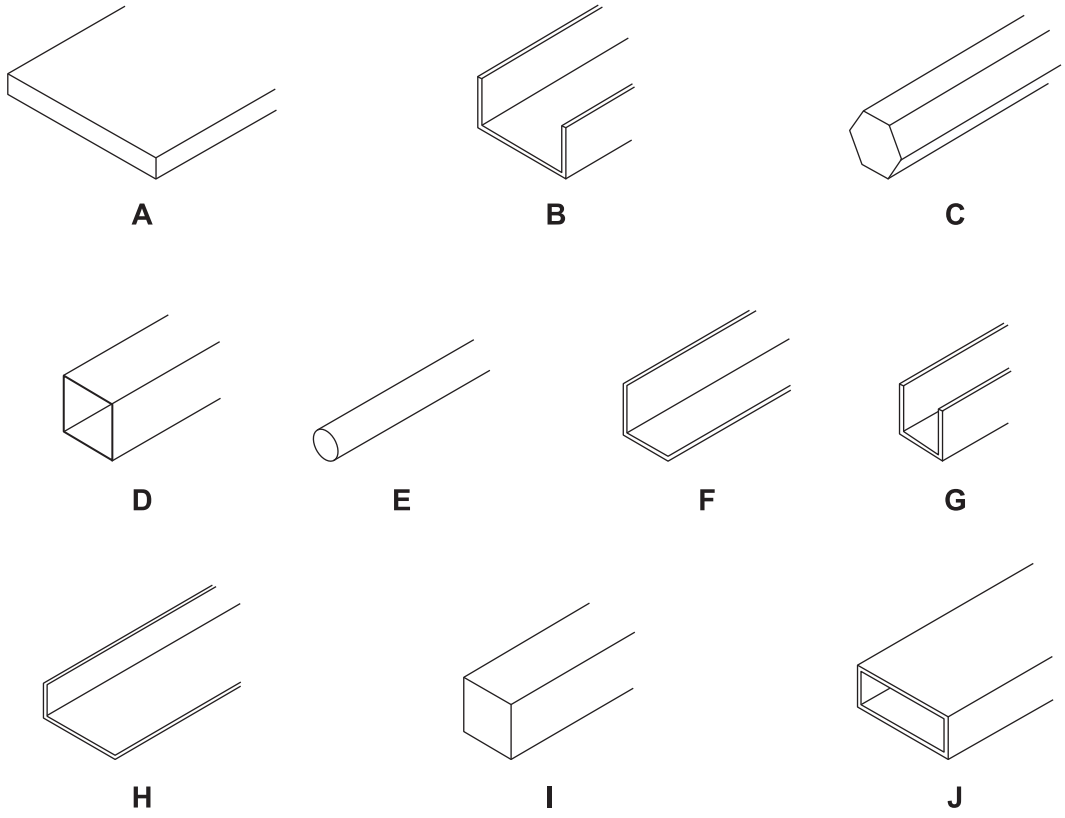


Figure 3

The table below shows a material list for a metal part that will be made.

Complete the table by selecting the letter that represents the correct material shape from Figure 3.

Material	Letter
25 × 25 angle iron	
20 × 50 rectangular hollow section (RHS)	
20 × 40 channel	
25 × 25 solid bar	

Question 10 (4 marks)

Figure 4 shows a range of hand tools.

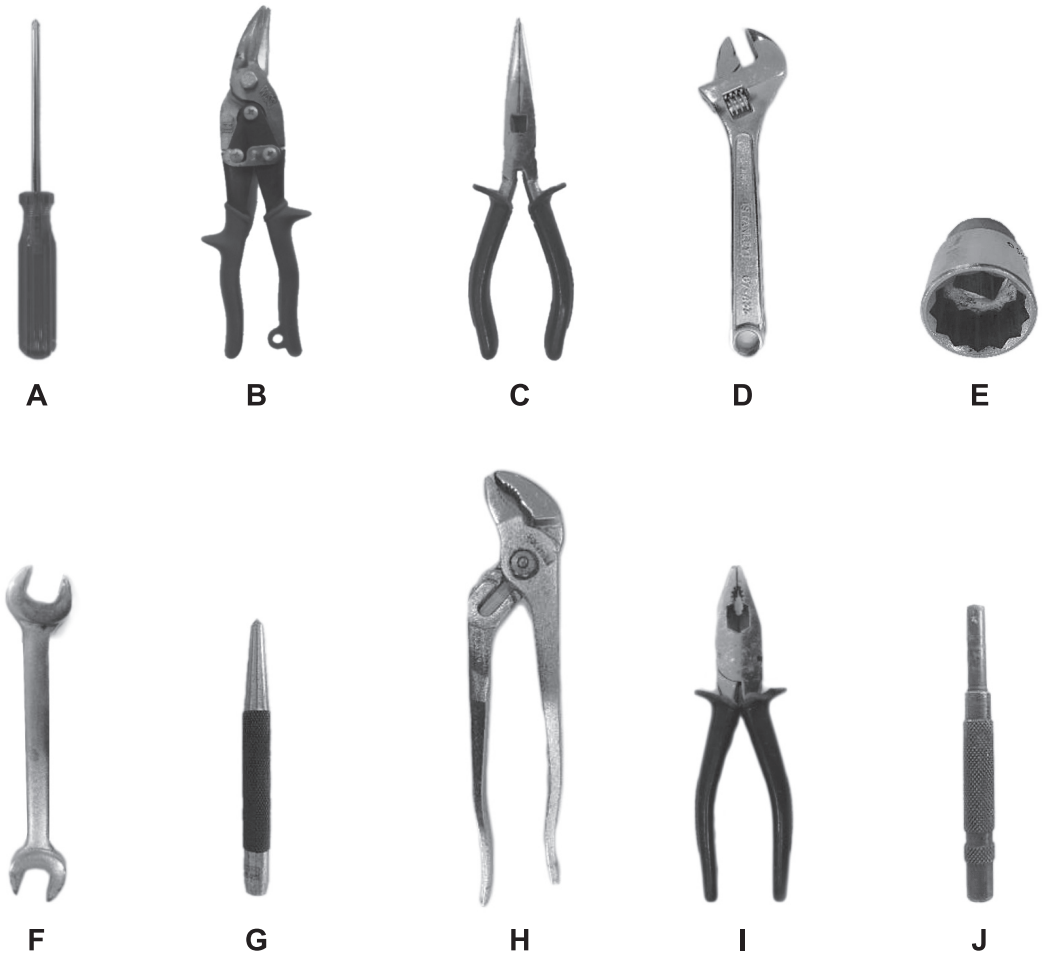


Figure 4

Complete the table below by selecting the most appropriate tool from Figure 4 for each task.
Insert the letter and name of the tool in the table.

Task	Letter	Name of tool
cutting sheet metal		
removing an 8 mm diameter pin from a hole		
gripping a 25 mm diameter pipe		
undoing a nut in a recessed location		

Question 11 (4 marks)

Figure 5 shows a tool cabinet that will be made from 20 mm square hollow section (SHS) and clad with sheet metal.

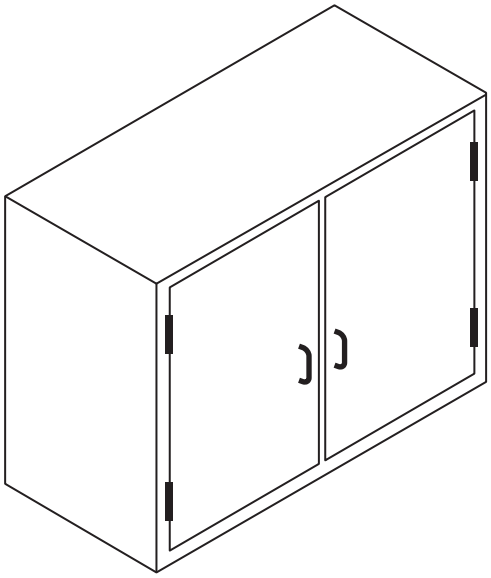


Figure 5

The main steps to manufacture the tool cabinet (not including the doors) are shown in the table below. The first and last steps are shown. The rest of the steps are not in the correct sequence.

a. Complete the table below by numbering the remaining steps in the correct sequence of manufacture. 3 marks

Step	Correct sequence
Cut SHS to length.	*1*
Check and square up frame.	
Measure size of cladding on frame.	
Cut sheet metal cladding to size.	
Finish weld SHS frame.	
Bend cladding.	
Tack weld SHS frame.	
Fit sheet metal cladding.	*8*

b. State a suitable fastener that can be used to attach the sheet metal cladding to the frame. 1 mark

_____

Do not write in this area.

Question 12 (3 marks)

Figure 6 shows a component that will be made on a lathe using Ø 22 mild steel bar.

The finished component will be cut from the steel bar while still in the lathe, using an appropriate lathe cut-off tool.

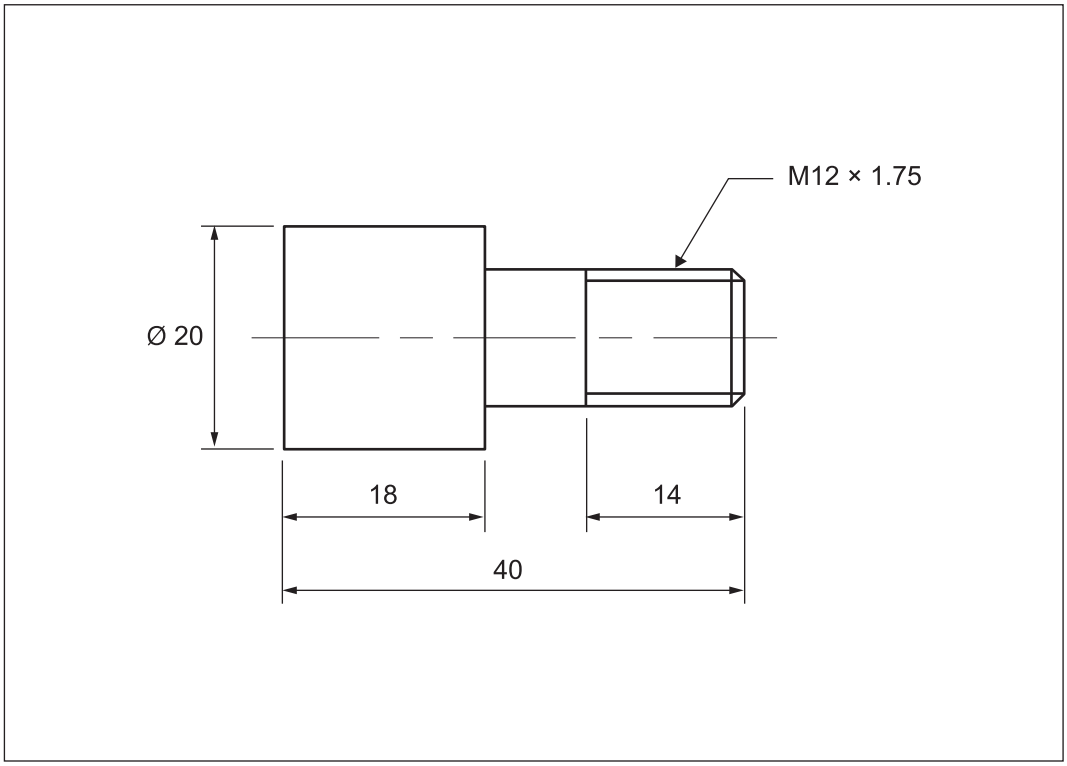


Figure 6

All the tools required to make the component shown in Figure 6 are kept in tool cupboards.

Complete the table below by listing all the tools required to make the component shown in Figure 6.

Task	Tool(s) required
turning diameters	
producing thread	
cutting completed component from the steel bar	

Question 13 (4 marks)

Figure 7 shows a steel plate.

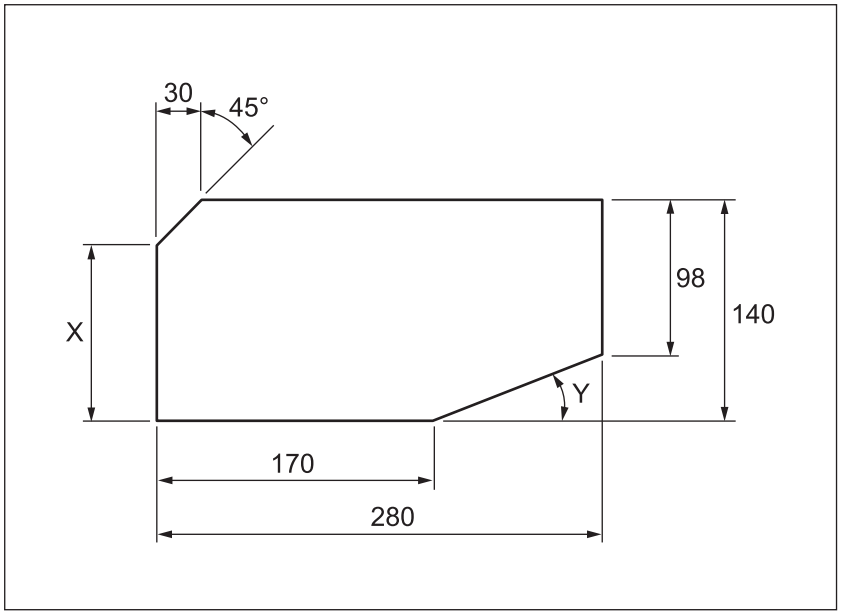


Figure 7

a. Calculate dimension 'X' of the steel plate shown in Figure 7. 1 mark

b. Calculate angle 'Y' of the steel plate shown in Figure 7. Give your answer correct to one decimal place. Show your working. 3 marks

Question 14 (5 marks)

Figure 8 shows a component that will be made using a vertical milling machine and a pedestal drill.

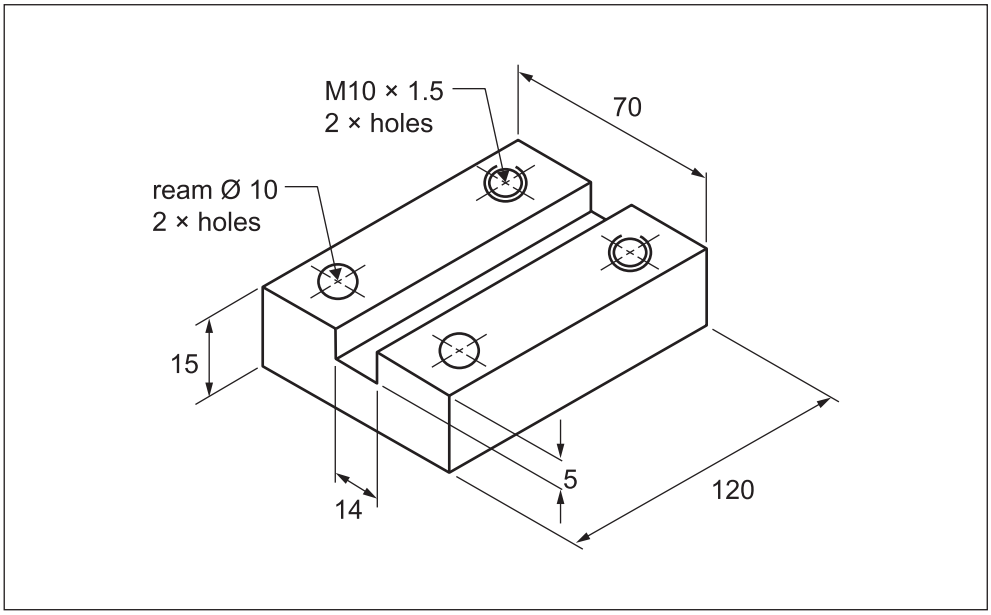


Figure 8

Figure 9 shows a tapping chart.

ISO metric coarse threads Note: All dimensions in mm							
Outside diameter	**Core**	**Pitch**	**Depth**	**Flat**	**Effective diameter**	**Tapping drill**	**Clearance drill**
1.6	1.1706	0.35	0.2147	0.04375	1.373	1.25	1.65
1.8	1.3706	0.35	0.2147	0.04375	1.573	1.45	1.85
2.0	1.5092	0.40	0.2454	0.05000	1.740	1.60	2.05
2.2	1.6480	0.45	0.2760	0.05625	1.908	1.75	2.25
2.5	1.9480	0.45	0.2760	0.05625	2.208	2.05	2.60
3.0	2.3866	0.50	0.3067	0.06250	2.675	2.50	3.10
3.5	2.7638	0.60	0.3681	0.07500	3.110	2.90	3.60
4.0	3.1412	0.70	0.4294	0.08750	3.545	3.30	4.10
4.5	3.5798	0.75	0.4601	0.09375	4.013	3.80	4.60
5.0	4.0184	0.80	0.4908	0.10000	4.480	4.20	5.10
6.0	4.7732	1.00	0.6134	0.12500	5.350	5.00	6.10
7.0	5.7732	1.00	0.6134	0.12500	6.350	6.00	7.20
8.0	6.4664	1.25	0.7668	0.15625	7.188	6.80	8.20
10.0	8.1596	1.50	0.9202	0.18750	9.026	8.50	10.20
12.0	9.8530	1.75	1.0735	0.21875	10.863	10.20	12.20
14.0	11.5462	2.00	1.2269	0.25000	12.701	12.00	14.25
16.0	13.5462	2.00	1.2269	0.25000	14.701	14.00	16.25
18.0	14.9328	2.50	1.5336	0.31250	16.376	15.50	18.25
20.0	16.9328	2.50	1.5336	0.31250	18.376	17.50	20.25

Figure 9

a. Use the tapping chart shown in Figure 9 to determine the tapping drill size required for the threaded holes of the component shown in Figure 8. 1 mark

b. **i.** The slot in the component shown in Figure 8 will be milled in one pass using an end mill.
What diameter end mill is required for this slot? 1 mark

ii. Calculate the revolutions per minute (RPM) needed for the end mill to cut the slot for the component shown in Figure 8, using a cutting speed of 30 m/min and the following formula for RPM. 1 mark

$$\text{RPM} = \frac{320v}{d}$$, where v = cutting speed and d = diameter

c. Setting the correct RPM of tools is essential when cutting material.
State **one** common negative outcome from using a much higher RPM than required. 1 mark

d. There are two reamed holes in the component in Figure 8.
Explain the purpose of reaming compared to drilling. 1 mark

Question 15 (2 marks)

Bearings are designed to handle two key types of loads, as indicated by the arrows in Figure 10.

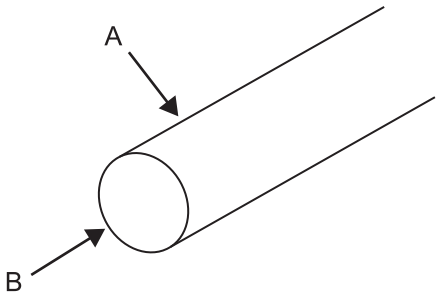


Figure 10

State the two key types of loads indicated by arrows in Figure 10.

A _____

B _____

Question 16 (4 marks)

Figure 11 shows a plate that is dimensioned in imperial measurements.

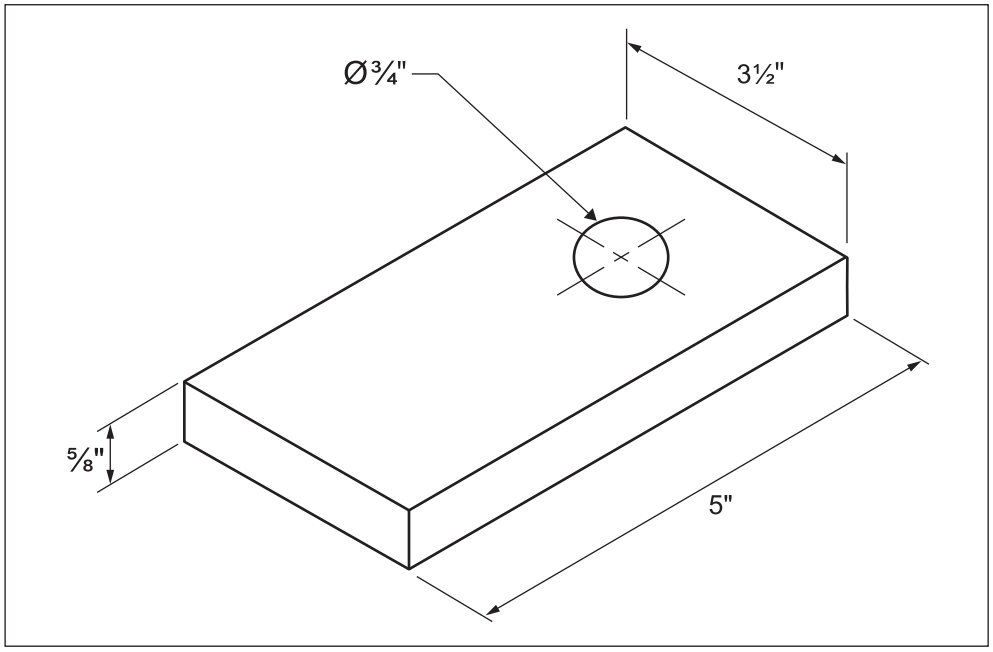


Figure 11

Complete the table below by converting the imperial measurements (inches) to metric (mm). Give your answers correct to two decimal places.

1 inch (1") = 25.4 mm

Imperial size	Metric size
5"	
3½"	
Ø ¾"	
⅝"	

Question 17 (7 marks)

Figure 12 shows a drawing of a shaft.

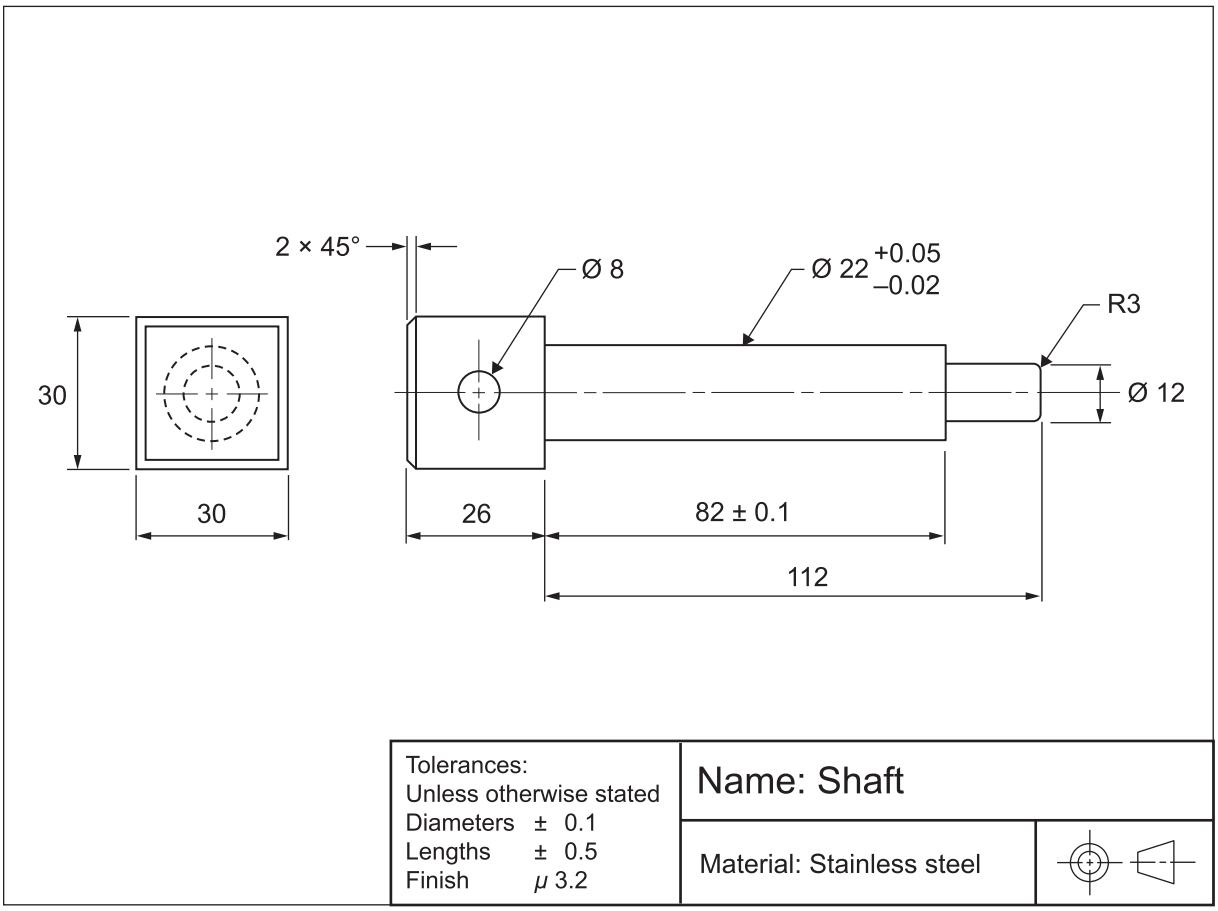


Figure 12

a. State the feature indicated by 2 × 45° in the drawing. 1 mark

b. State the feature indicated by R3 in the drawing. 1 mark

c. Draw an arrow on Figure 12 to show the datum line. 1 mark

d. Explain the purpose of using datum lines when dimensioning. 1 mark

e. The left end of the shaft will be held in a lathe for machining.
Identify the most suitable type of chuck for holding the left end. 1 mark

f. Calculate the maximum and minimum allowable dimensions shown in the table below. 2 marks

Dimension	Maximum	Minimum
112 length		
Ø 22		

Question 18 (3 marks)

a. State **one** key reason why bolting parts together is sometimes preferred over welding. 1 mark

_____

_____

b. State **one** advantage and **one** disadvantage of using adhesives to join metal parts together. 2 marks

Advantage _____

Disadvantage _____

Question 19 (3 marks)

Figure 13 shows a set of hand taps.

Figure 13

a. **i.** Which hand tap would be used last to tap a 15 mm deep blind hole in 20 mm thick material? 1 mark

Tap _____

ii. State the reason for selecting this tap. 1 mark

Reason _____

_____

b. Identify the tool used to hold and turn taps. 1 mark

_____

Question 20 (4 marks)

Complete the table below by stating a common use for each tool.

Tool	Common use
parallel strips	
centre drill	
drill drift	
vernier height gauge	

Question 21 (3 marks)

a. What is CAD used for in engineering? 1 mark

_____

b. State **one** advantage and **one** disadvantage of using CAD compared to manual drawing. 2 marks

Advantage _____

Disadvantage _____

Question 22 (2 marks)

Figure 14 shows a tool commonly used in engineering.

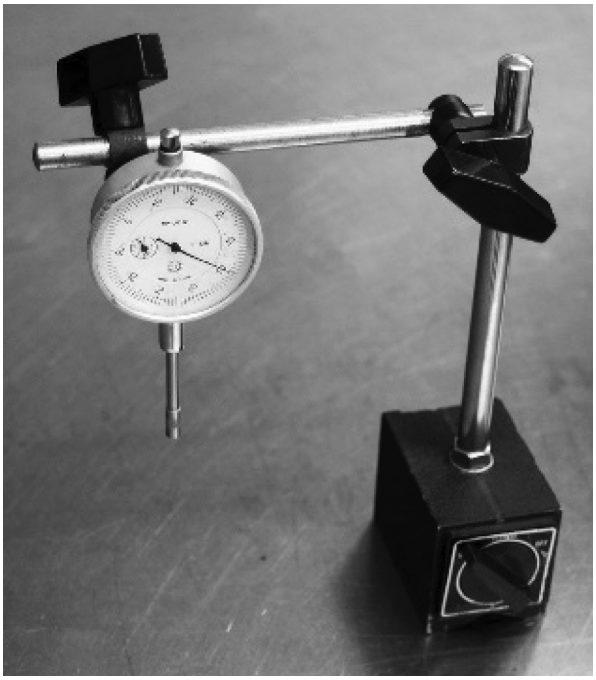


Figure 14

a. Identify the tool shown in Figure 14. 1 mark

_____

b. State a common use for the tool shown in Figure 14. 1 mark

_____

_____

Question 23 (5 marks)

Figure 15 shows a storage tank. The tank is 1200 mm in diameter and is 2000 mm high.

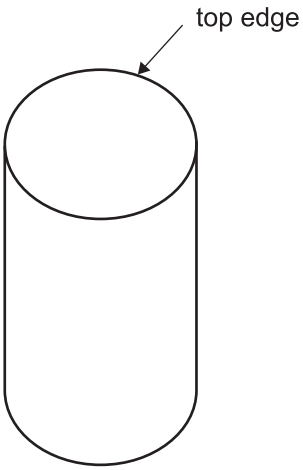


Figure 15

a. A rubber seal will be placed around the top edge of the tank.

Calculate the length of rubber seal required. Round your answer to the closest mm. Show your working. 1 mark

b. Calculate the volume of the tank shown in cubic metres (m^3). Give your answer correct to two decimal places. Show your working. 2 marks

c. One week after the tank had been completely filled, the level dropped to 650 mm.

Calculate the percentage (%) of product that had been used correct to one decimal place. Show your working. 2 marks

Question 24 (3 marks)

Figure 16 shows an isometric view of a block with a section line.

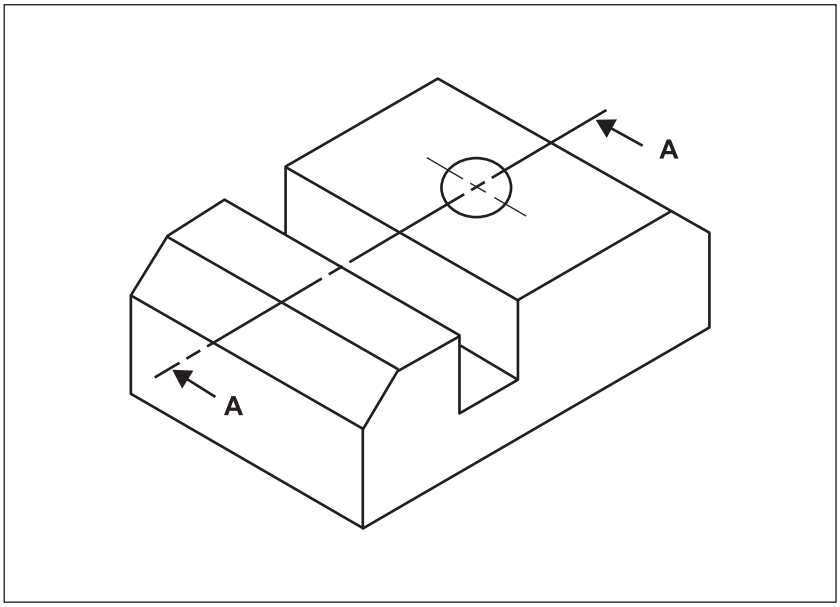
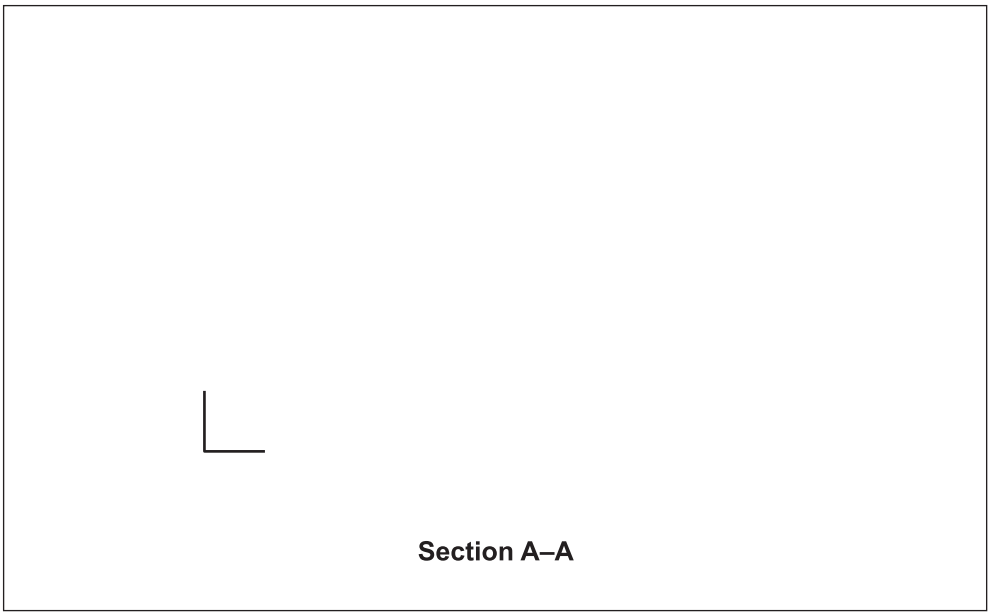


Figure 16

In the space below, draw the section A–A view of the block shown in Figure 16.



Section A–A

Question 25 (11 marks)

Figure 17 shows a gate that will be made from 25 mm square hollow section (SHS).

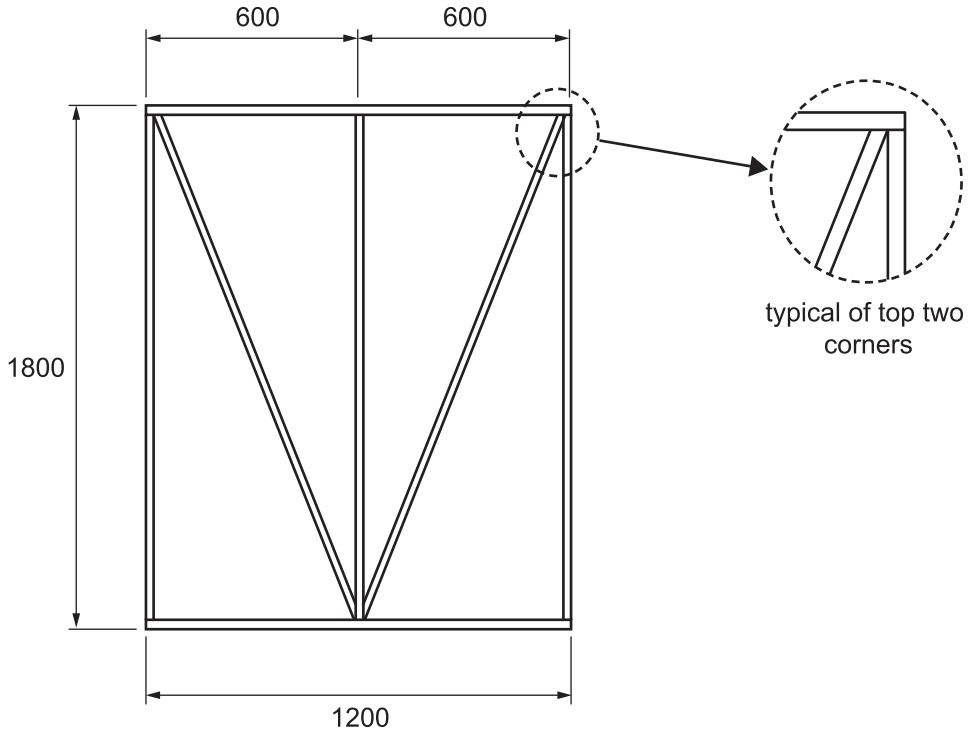


Figure 17

a. Calculate the total length in metres of 25 mm SHS required to make the gate.
Give your answer correct to two decimal places. 3 marks

Question 25 continues on the next page.

b. The gate will be covered with sheet metal on both the front and back.

Calculate the total surface area in square metres (m^2) of sheet metal required.
Give your answer correct to two decimal places. 2 marks

c. Before final welding, the gate frame must be checked for squareness.

List two ways the frame could be checked for squareness. 2 marks

1. _____

2. _____

d. The padbolt shown in Figure 18 will be used to lock the gate. The padbolt is approximately 120 mm × 40 mm, and has Ø 6.5 mm holes for attachment.

The padbolt will be attached to the left-hand side, halfway up the gate.

Securing the padbolt directly to the sheet metal was not found to be strong enough.

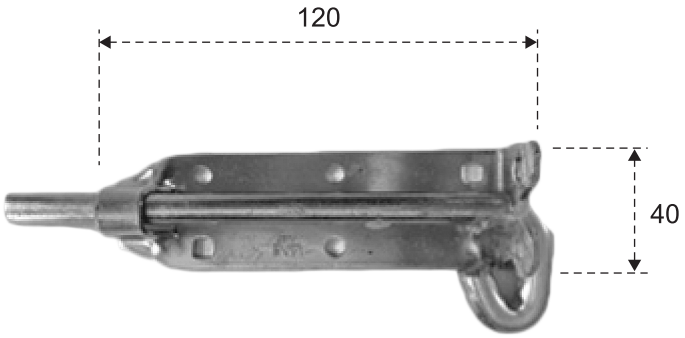


Figure 18

Figure 19 shows an enlarged view of the left-hand side of the gate shown in Figure 17.

Use the view in Figure 19 to design a change that will allow the padbolt to be secured to the gate.

Your design needs to detail the following:

- type and thickness of any materials used
- description of key design details
- how the padbolt is attached. 4 marks

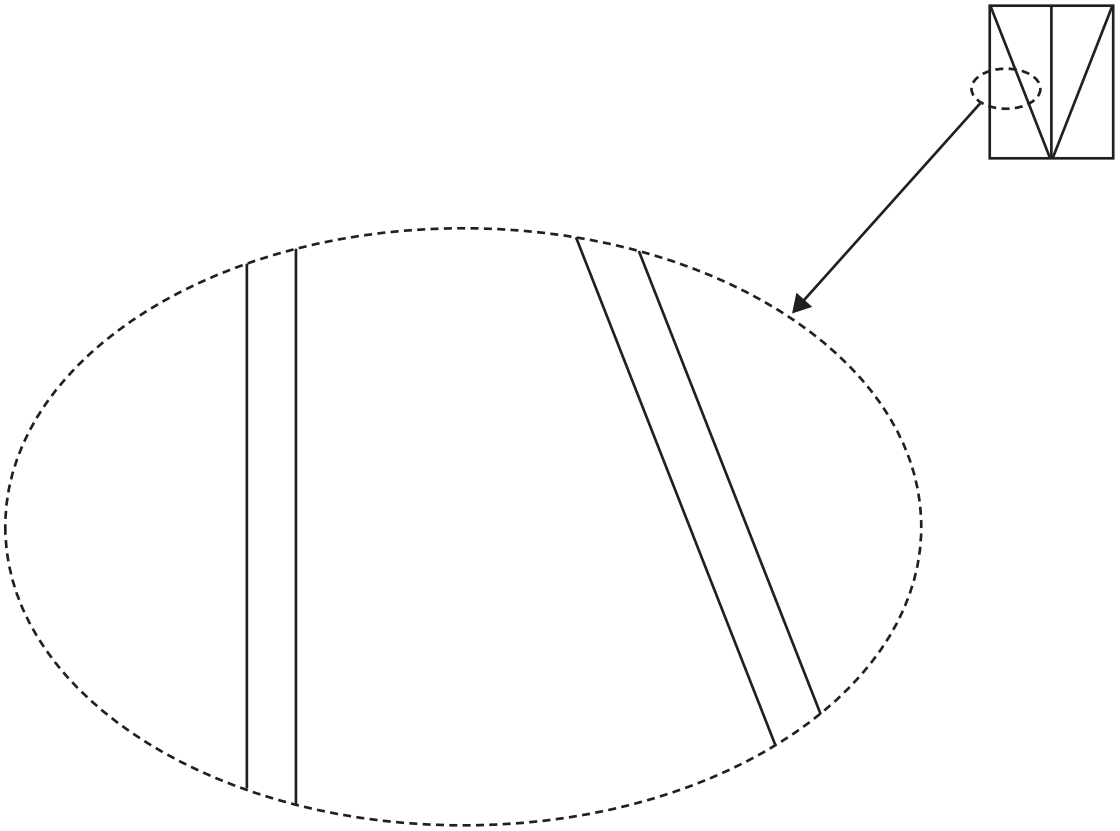


Figure 19

End of examination questions

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