VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

Victorian Certificate of Education 2008

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

									Letter
Figures									
Words									

VCE VET ENGINEERING STUDIES CERTIFICATE III

Written examination

Wednesday 19 November 2008

Reading time: 9.00 am to 9.15 am (15 minutes)
Writing time: 9.15 am to 10.45 am (1 hour 30 minutes)

QUESTION AND ANSWER BOOK

Structure of book

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	15	15	15
B	4	4	15
C	9	9	30
D	2	2	40
			Total 100

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, a protractor, a set square and aids for curve sketching.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.
- A scientific calculator is allowed in this examination.

Materials supplied
- Question and answer book of 28 pages with a formula sheet on page 28.
- Answer sheet for multiple-choice questions.

Instructions
- Write your **student number** in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- All written responses must be in English.

At the end of the examination
- Place the answer sheet for multiple-choice questions inside the front cover of this book.

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

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SECTION A – VBN 771 Apply electrotechnology principles in an engineering environment

Instructions for Section A

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.
Choose the response that is **correct** or that **best answers** the question.
A correct answer scores 1, an incorrect answer scores 0.
Marks will **not** be deducted for incorrect answers.
No marks will be given if more than one answer is completed for any question.

Question 1

A device that uses a chemical effect to produce electrical energy is the

A. electric motor.
B. light bulb.
C. battery.
D. transformer.

Question 2

The meter used to measure electrical pressure in a circuit is the

A. voltmeter.
B. ammeter.
C. ohmmeter.
D. wattmeter.

Question 3

The ampere is the unit for electrical

A. conductance.
B. current.
C. voltage.
D. resistance.

Question 4

A power resistor has R47 stamped on its body.
This indicates a resistance of

A. 0.47 Ω
B. 4.7 Ω
C. 47 Ω
D. 470 Ω

Question 5

A device which converts mechanical energy into electrical energy is the

A. solar cell.
B. battery.
C. motor.
D. generator.

Question 6

Power in a DC circuit can be calculated by using the formula

A. $P = V \times R$

B. $P = V \times I$

C. $P = V \times W$

D. $P = I \times R$

Question 7

To measure current with an ammeter, the ammeter must be placed

A. in series.

B. across the supply.

C. in parallel.

D. across the component drawing current.

Question 8

The most suitable application for a thermocouple is a

A. camera flash unit.

B. heating element in an electric jug.

C. voltage amplifier.

D. device for measuring high temperatures.

Question 9

If you are about to use an analog multimeter to measure resistance in a circuit, which of the following should you do first?

A. switch on the supply to the circuit to be tested

B. disconnect all supplies from the circuit to be tested

C. connect a probe to the low voltage end of the circuit

D. connect a probe to the high voltage end of the circuit

Question 10

A transformer is a device which

A. steps up or steps down AC voltages.

B. steps up or steps down DC voltages.

C. converts AC voltages to DC voltages.

D. converts DC voltages to AC voltages.

Question 11

Which one of the following groups are **all** good electrical conductors?

A. silver, glass and lead

B. copper, mica and gold

C. silver, copper and gold

D. copper, mica and plastic

Question 12

A 5.6 kΩ resistor has tolerance of ±5%.

Its acceptable resistance range is from

A. 5040 to 6160 Ω

B. 5320 to 5880 Ω

C. 4380 to 6720 Ω

D. 5000 to 6200 Ω

Question 13

A low current will **always** occur in a

A. series circuit.

B. parallel circuit.

C. high resistance circuit.

D. low resistance circuit.

Question 14

If the voltage applied to a circuit is halved, the circuit current will

A. remain constant.

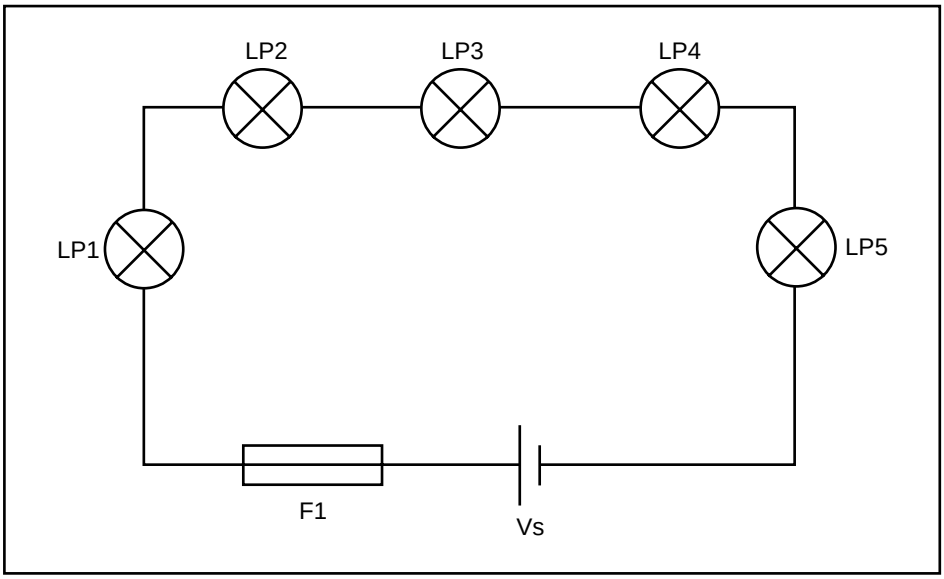
B. decrease to zero.

C. be double the original current.

D. be half the original current.

Question 15

The five lamps shown in the circuit below are connected in series.



If the third lamp (LP3) becomes open circuit, then

A. lamps LP1 and LP2 will go out and lamps LP4 and LP5 will remain on.

B. all lamps except LP3 will remain on.

C. all lamps will go out.

D. the fuse F1 protecting the circuit will blow.

END OF SECTION A

SECTION B – VBN 773 Produce engineering sketches and drawings

Instructions for Section B

Answer **all** questions in the spaces provided. All dimensions are in mm (millimetres).

Question 1

Figure 1 shows a drawing of a mandrel. A mandrel is a work-holding device.

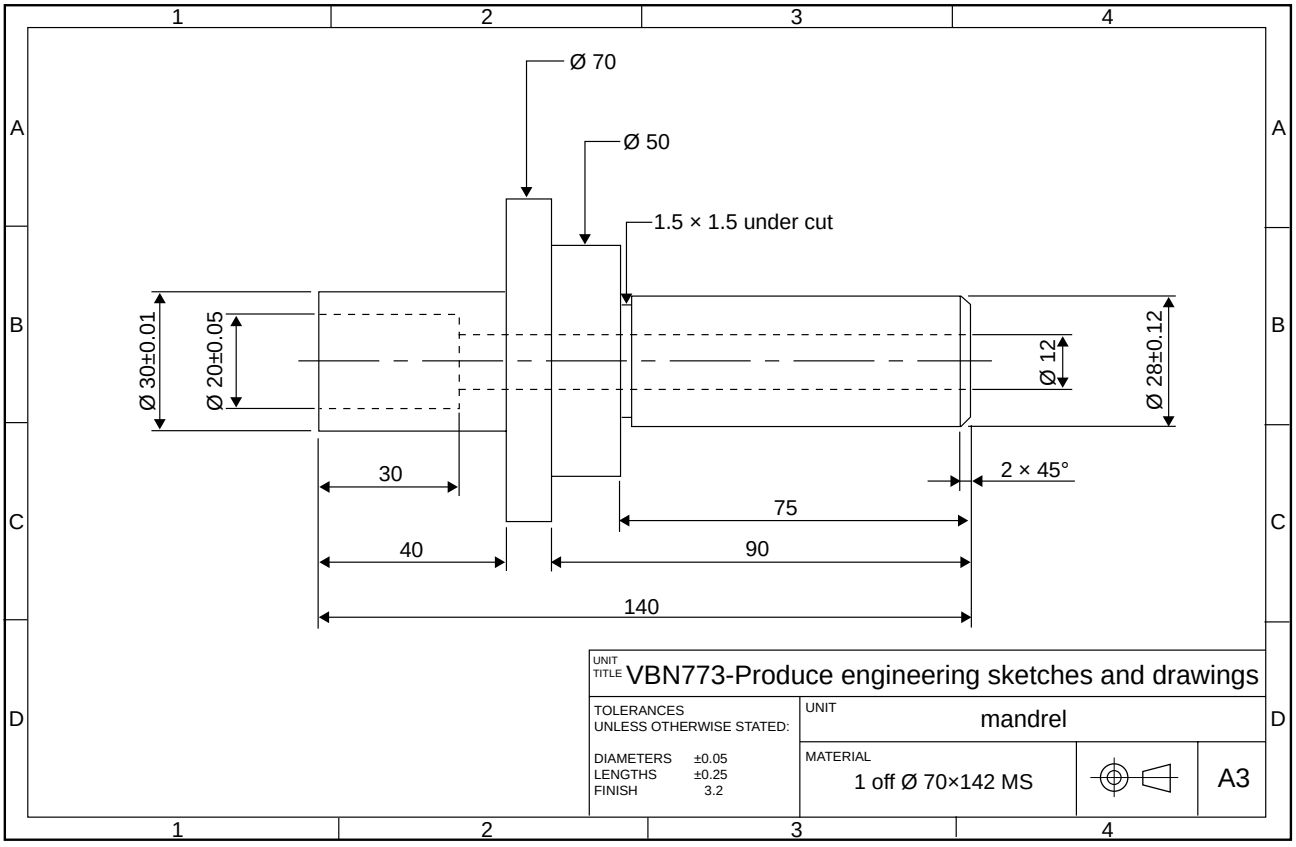


Figure 1

a. What is the cross-sectional shape of the mandrel?

_____

1 mark

b. What is the diameter of the counterbore?

_____

1 mark

c. What is the thickness of the Ø 70 flange?

_____

1 mark

d. What is the tolerance of the 140 length?

_____

1 mark

e. What are the maximum and minimum sizes that the Ø 28 can be machined to?

maximum _____ minimum _____

2 marks

f. What do you call the feature 2 × 45°?

_____

1 mark

Question 2

Figure 2 shows an isometric drawing of a bracket.

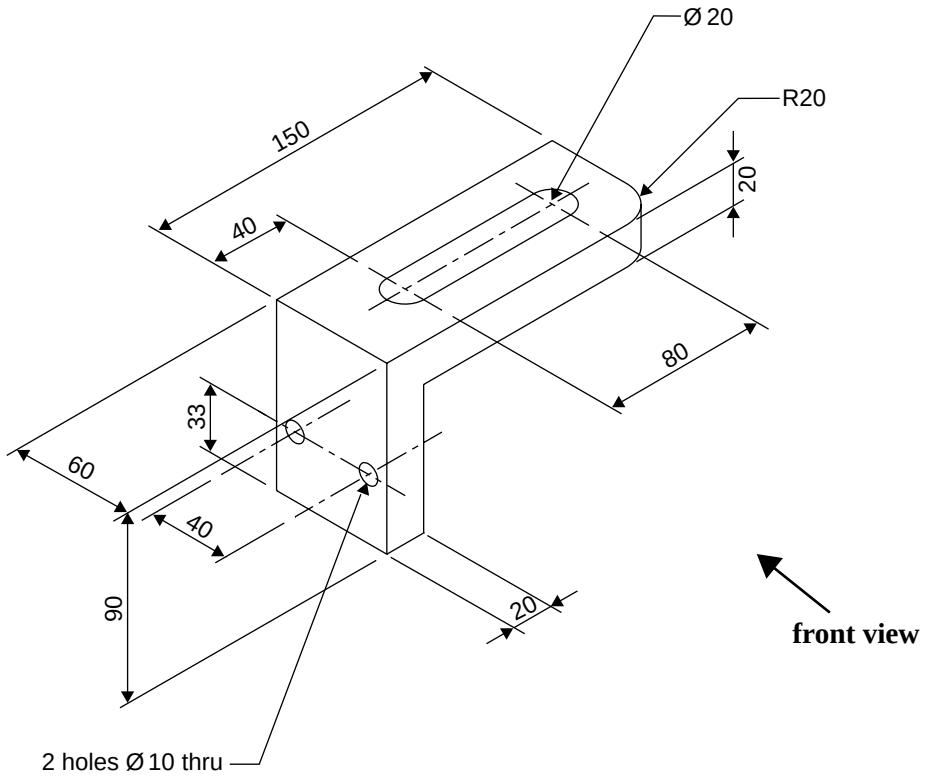
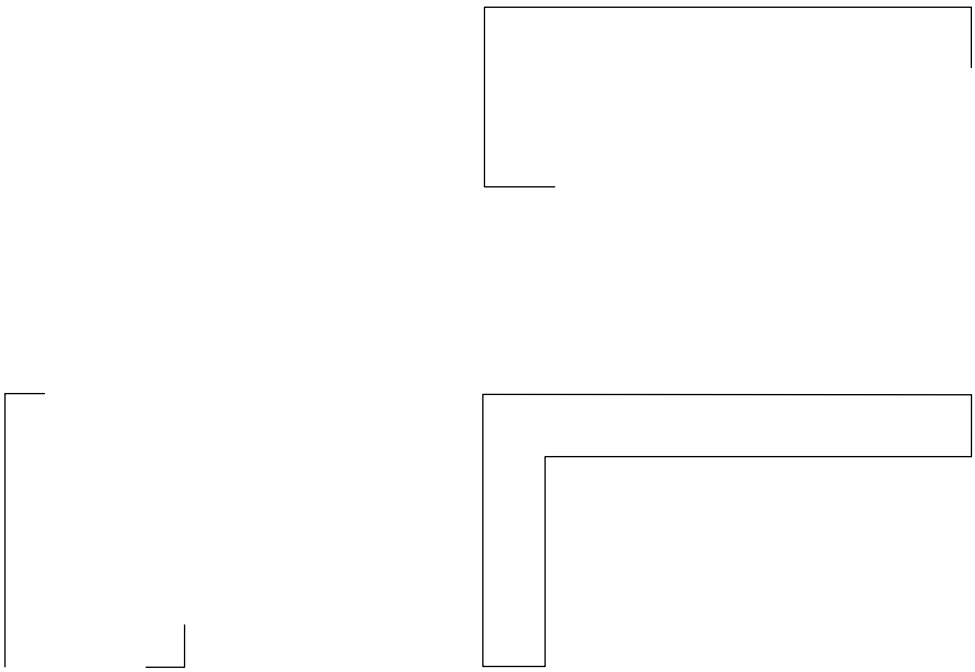


Figure 2

Below is the beginning of an orthogonal drawing of the bracket shown in Figure 2.
Complete the orthogonal drawing showing **top**, **front** and **side** views in third-angle projection.

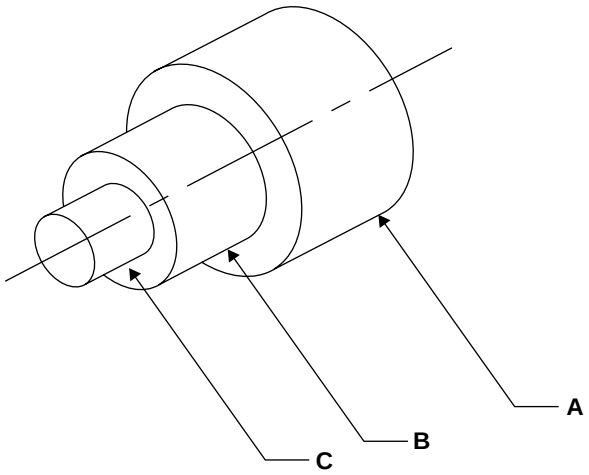
- The drawing is not to scale.
- Use conventional drawing systems.
- Show all hidden detail.
- Do **not** dimension.



4 marks

Question 3

Figure 3 shows an isometric drawing of a spindle. The sizes for each feature are shown in the table.

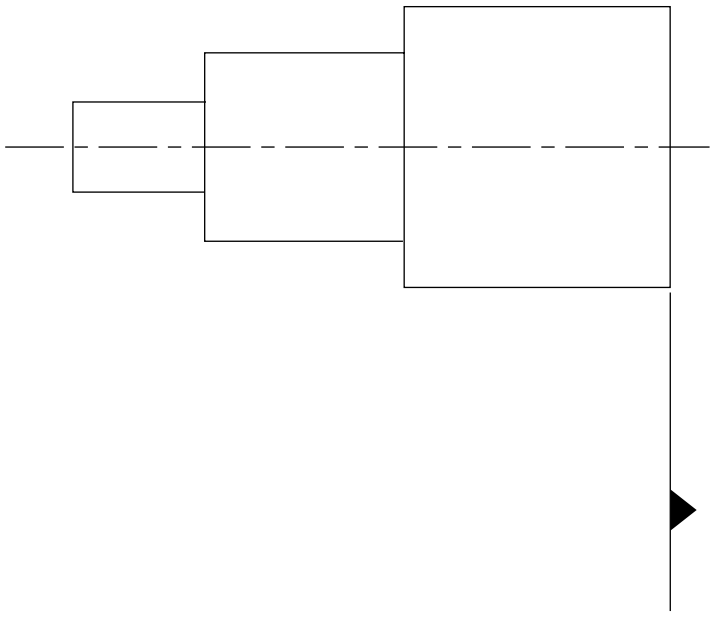


	Length (mm)	Ø (mm)
A	40	30
B	30	20
C	20	10

Figure 3

Correctly dimension the orthogonal drawing of the spindle shown below using the information from Figure 3.

- Show all dimensions.
- Where applicable, dimension from the datum surface.
- Use conventional dimensioning systems.



3 marks

Question 4

Figure 4 shows a shaft.

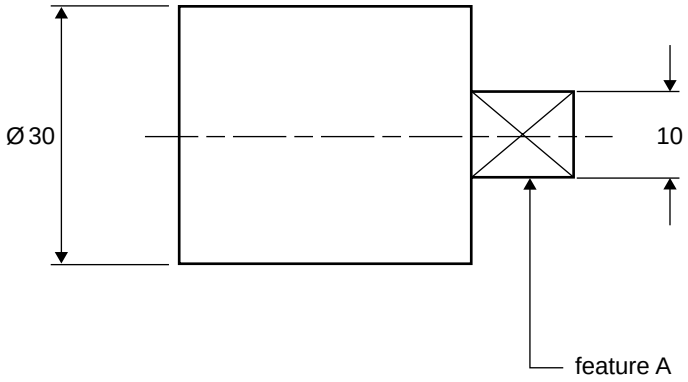


Figure 4

What do the crossed lines at feature A indicate?

_____

1 mark

Total 15 marks

END OF SECTION B
TURN OVER

SECTION C – VBN 787 Apply mathematical principles to engineering designs

Instructions for Section C

Answer **all** questions in the spaces provided.
Where a question is worth more than one mark, you **must** show all working.
All answers must include appropriate units.

Question 1

The waste material from a machining process is called swarf.

A bronze casting with a mass of 72 kg loses 7 kg in swarf during machining.

a. What percentage of the total casting has become swarf? (Answer to one decimal place.)

1 mark

Bronze has a scrap value of $2.40 per kg.

b. If 18 castings are machined, calculate the total value of the swarf.

1 mark

Question 2

Figure 1 shows a pipe frame for an outboard motor trolley.

Calculate the total distance around the pipe frame.

Dimensions are in mm (millimetres).

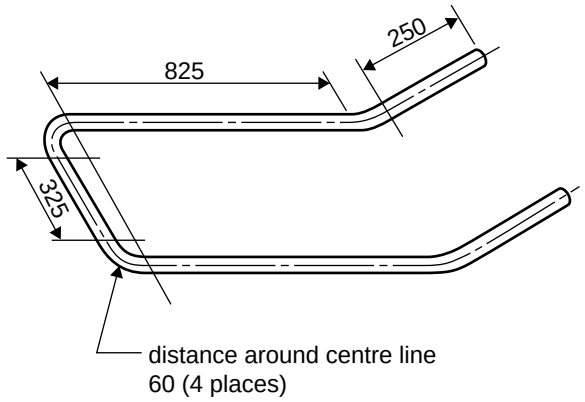


Figure 1

3 marks

Question 3

The interior walls of a warehouse are to be painted. The two side walls are 8 m high × 70 m long. The front and back walls are 8 m high × 30 m wide. (Assume there are no windows or doors.)

a. Calculate the total surface area of the interior walls.

2 marks

10 litres of paint covers 40 m^2.

b. Calculate the number of 10 litre paint tins required to give the walls **two** coats of paint.

2 marks

Question 4

Calculate the distance X shown in Figure 2.

Dimensions are in mm (millimetres).

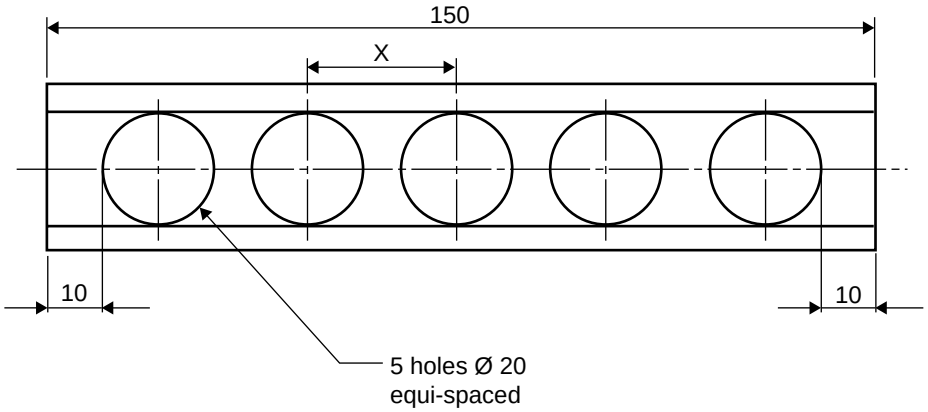


Figure 2

2 marks

Question 5

Calculate the X–Y coordinates of hole A and hole B from the zero point in Figure 3 below. (Answers to two decimal places.)

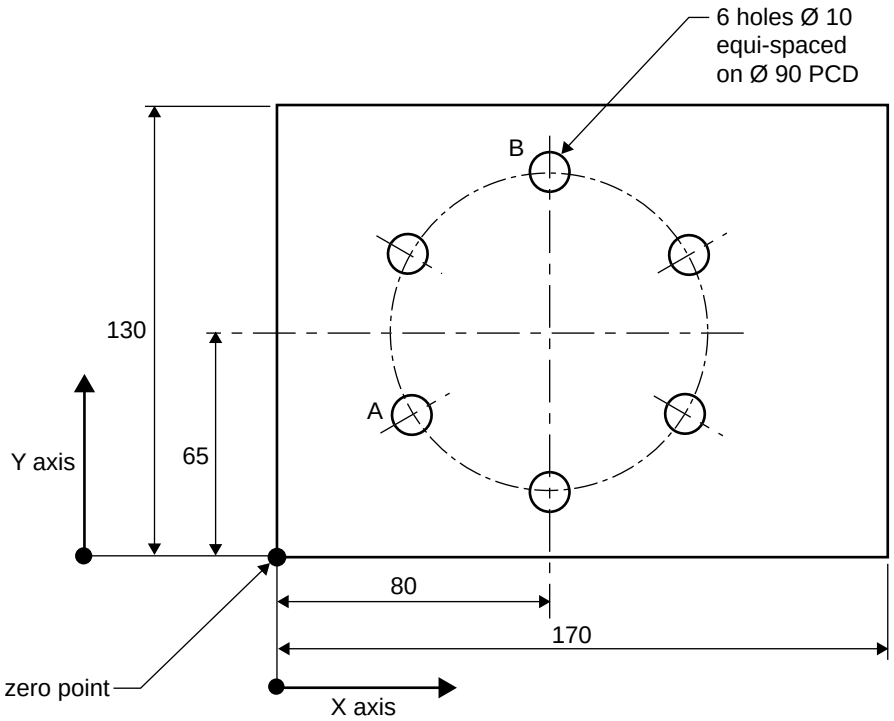


Figure 3

Hole	X	Y
A		
B		

6 marks

Question 6

An Olympic pool is 50 m long × 15 m wide.

The pool depth tapers uniformly from 1 m to 1.5 m.

a. Calculate the average depth of the pool.

1 mark

1000 litres of water occupies a volume of 1 m^3.

b. Calculate how many litres of water are needed to fill the pool.

2 marks

Question 7

A timber pallet, Figure 4, measures 1200 mm × 1200 mm and weighs 52 kg.

Boxes measuring 400 mm × 200 mm are to be placed onto the pallet.

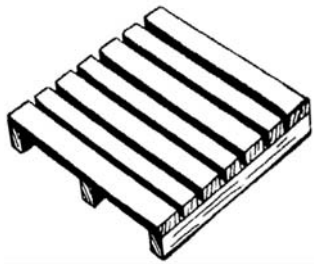


Figure 4

a. Calculate the number of boxes that would fit on one layer.

1 mark

The height of the boxes is 240 mm and the pallet will be loaded to a height which makes the load a cube.

b. Calculate the total number of boxes placed on the pallet.

1 mark

The weight of each box is 7.2 kg.

c. Calculate the total weight of the **pallet** and **boxes**.

2 marks

Question 8

Figure 5 shows a sketch of a garage which will have a corrugated iron roof with a fall of 3 degrees.

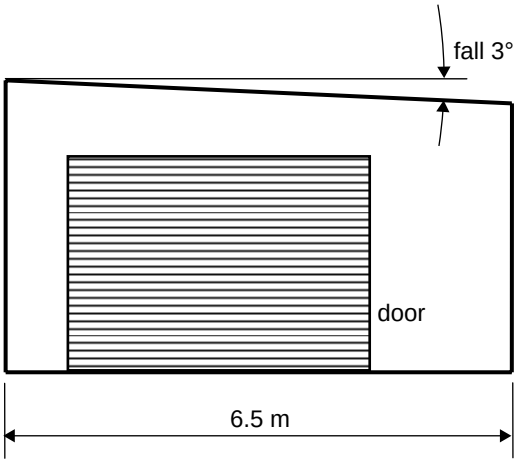


Figure 5

a. Calculate the difference between the height of the high wall and the height of the low wall.

2 marks

The garage will be built using clay bricks which are 76 mm high. The mortar thickness between the bricks will be 10 mm.

b. Calculate the difference in the number of brick courses between the high and the low walls.

1 mark

Question 9

Figure 6 shows a bracket made from 20 mm × 20 mm × 1.6 mm tube.

Calculate the angle θ to the nearest degree.

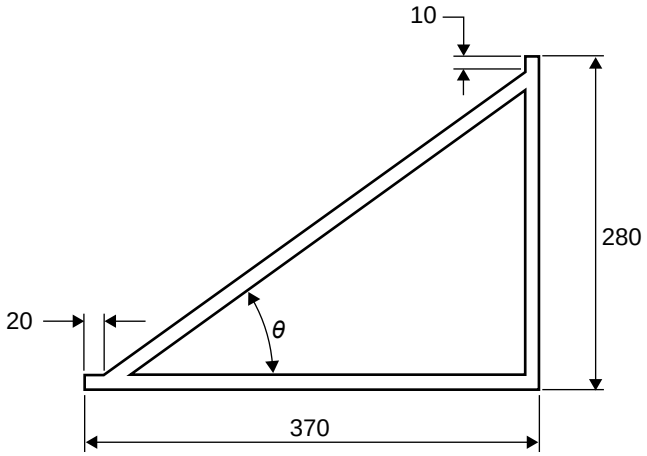


Figure 6

3 marks

Total 30 marks

END OF SECTION C

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SECTION D – VBN 788 Design and prototype components and/or small structures using engineering design principles

Instructions for Section D

Answer **all** questions in the spaces provided. All dimensions are in mm (millimetres).

Question 1

Figure 1 is a picture of a tool trolley that will be manufactured to the following specifications.

- The base will be made from 1.6 mm thick sheet metal.
- The outside dimensions of the base are 600 × 400 × 50.
- The front axle will include a steering mechanism.
- The rear axle will be fixed.

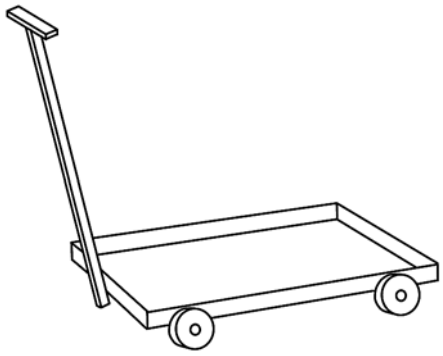

Figure 1

Figure 2 shows the type of wheel that will be used for the tool trolley.

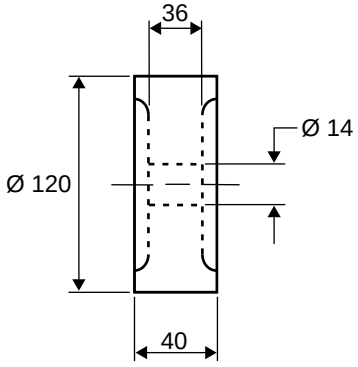

Figure 2

You are required to design a **rear** axle for the tool trolley shown in Figure 1.

- The material available for the axle is 16 mm square mild steel bar.
- You have available a full range of standard fasteners.

a. Sketch an assembly drawing of the rear axle and label all components.
Your sketch must include a description of

- how the wheels shown in Figure 2 are kept on the axle
- how the axle is attached to the base of the tool trolley.

5 marks

b. Sketch a detailed drawing of the axle showing all dimensions.

5 marks

c. Describe how the rear axle that you designed will be manufactured, using the operational plan below. Use N/A (Not Applicable) if you think a certain box is not required for an operation.

Op. No.	Operation description	Type of machine	Work-holding method	Equipment/cutters

4 marks

The tool trolley base will be marked out from the piece of sheet metal shown in Figure 3.

d. Sketch how the base will be marked out before cutting and folding. The marking out should minimise material waste. (Show dimensions.)

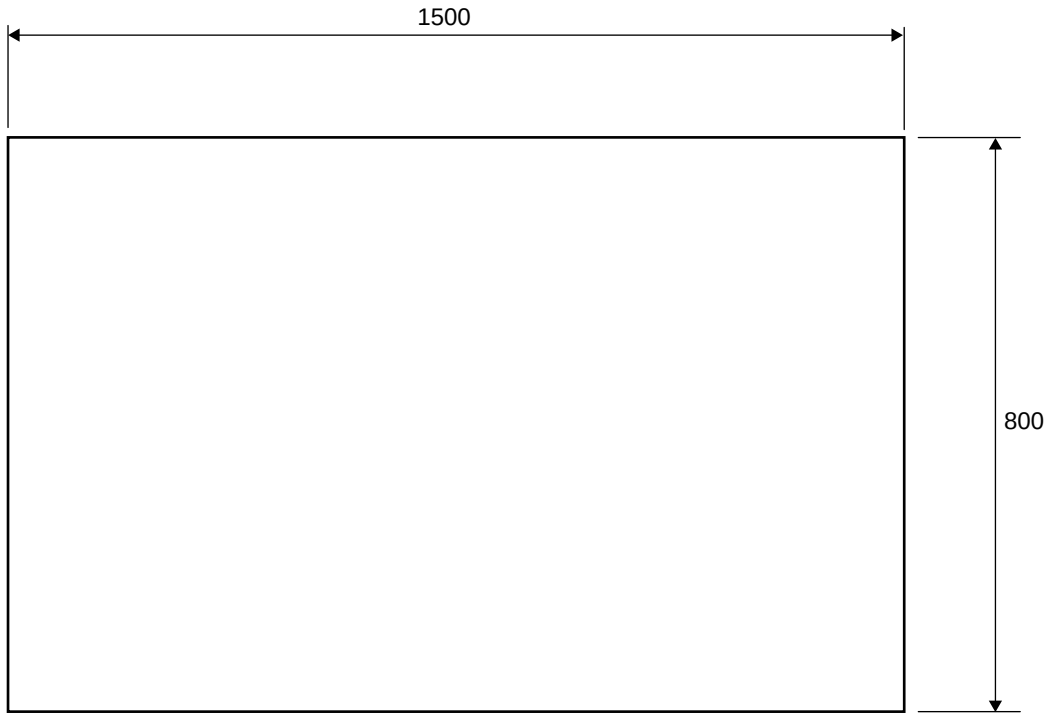

Figure 3

2 marks

After folding, the corners of the base need to be joined for strength.

e. Describe how this can be done.
(Use a sketch if necessary.)

1 mark

Question 2

A solar panel is to be mounted on a stand consisting of a pole and base plate as shown in Figure 4. The solar panel will have a tilting frame mechanism which will need to be fabricated.

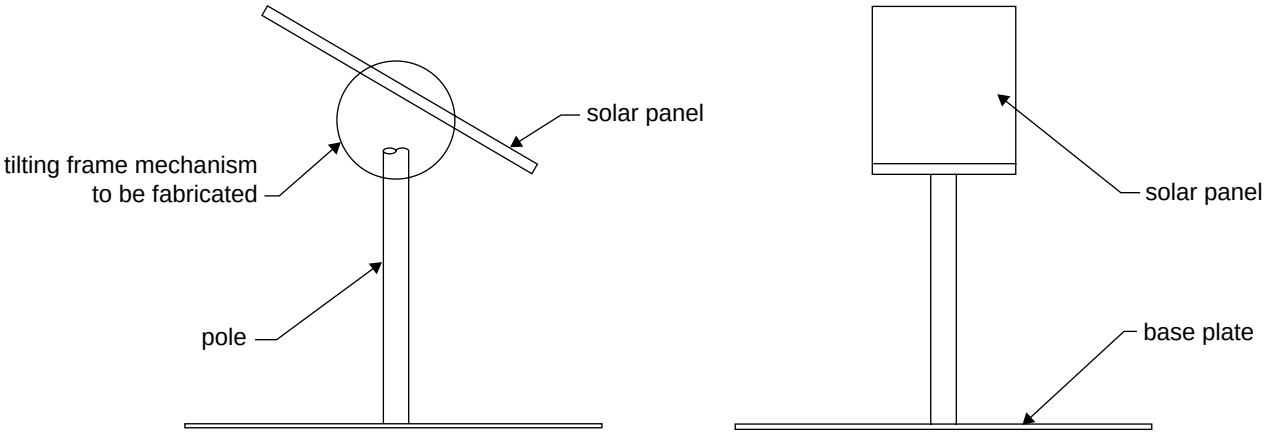

Figure 4

Details of the solar panel and the solar panel frame are shown in Figure 5.

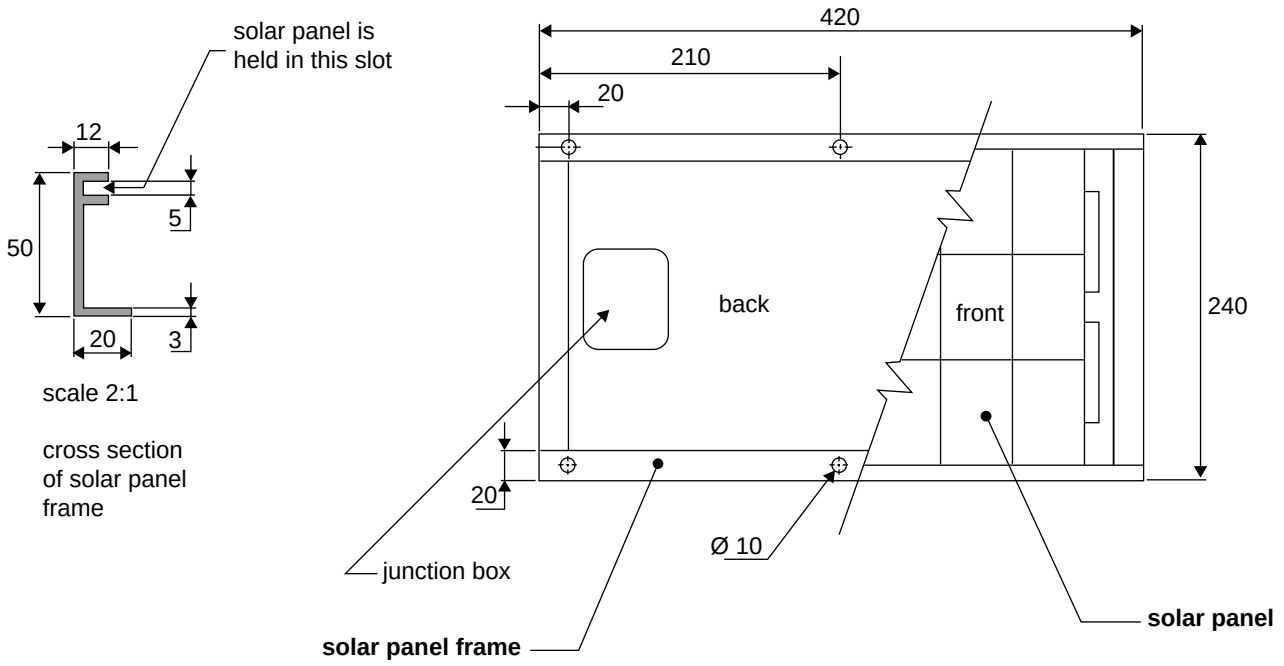

Figure 5

a. You are required to design a tilting mechanism for the solar panel frame. The solar panel must be able to tilt through 90° between vertical and horizontal. The locking mechanism for tilting must be operated by hand, without the use of tools.

Draw your design in the space below.

- Show how the tilting mechanism is attached to the solar panel frame.
- Show how the tilting mechanism is attached to the pole.
- Label your sketch and show basic dimensions.

Note: The pole is Ø 60 tube O.D., with Ø 52 I.D.

12 marks

The base plate of the stand has been designed with a stub that the pole slides onto when assembled, as shown in Figure 6.

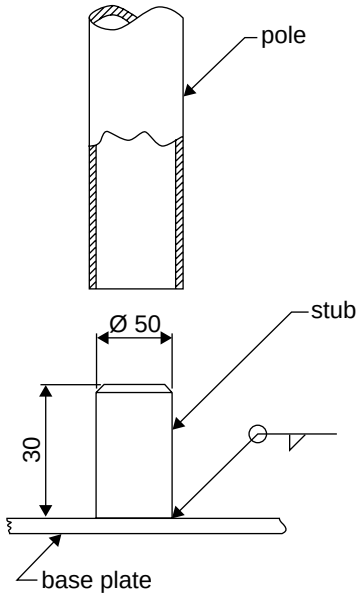

Figure 6

The length of the stub was originally 30 mm as shown in Figure 6. This was found to be unsuitable, so it was redesigned to be 200 mm long.

b. Why do you think the original 30 mm length of the stub was unsuitable?

2 marks

With the present design the pole gets stuck on the weld when the pole is placed over the stub. The pole is then difficult to remove.

c. How could you overcome this problem? (Use a sketch to illustrate your solution.)

3 marks

The pole must be prevented from freely rotating around the stub.

d. Give **two** reasons why this is important.

2 marks

e. Describe a simple way of preventing the pole from freely rotating around the stub.

1 mark

The base is currently made of steel and will be exposed to the weather.

f. What could be done to the steel to protect it from corrosion?

_____

_____

_____

2 marks

g. What other material could the base be made from to provide long-term corrosion resistance?

_____

1 mark

Total 40 marks

END OF SECTION D
TURN OVER

Data/formula sheet

Circumference of a circle = πD

Area of a circle = πr^2

Area of a triangle = $\frac{1}{2}$ × base × height

Volume of a sphere = $\frac{4\pi r^3}{3}$

Area of a rectangle = L × W

Volume of a square prism = L × W × H

Area of a circular ring = $\frac{\pi (D^2 - d^2)}{4}$

Volume of a cylinder = $\pi r^2 \times L$

Sin = $\frac{\text{opposite}}{\text{hypotenuse}}$

Cos = $\frac{\text{adjacent}}{\text{hypotenuse}}$

Tan = $\frac{\text{opposite}}{\text{adjacent}}$

END OF QUESTION AND ANSWER BOOK

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The Place To Be