



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

## **NATIONAL SENIOR CERTIFICATE**

**GRADE 12**

**CIVIL TECHNOLOGY**

**NOVEMBER 2014**

**MARKS: 200**

**TIME: 3 hours**

**This question paper consists of 18 pages, 5 answer sheets and a formula sheet.**

**REQUIREMENTS:**

1. Drawing instruments
2. A non-programmable pocket calculator
3. ANSWER BOOK

**INSTRUCTIONS AND INFORMATION**

1. This question paper consists of SIX questions.
2. Answer ALL the questions.
3. Answer each question as a whole. Do NOT separate subsections of questions.
4. Start the answer to EACH question on a NEW page.
5. Do NOT write in the margin of the ANSWER BOOK.
6. You may use sketches to illustrate your answers.
7. Write ALL calculations and answers in the ANSWER BOOK or on the attached ANSWER SHEETS.
8. Use the mark allocation as a guide to the length of your answers.
9. Make drawings and sketches in pencil, fully dimensioned and neatly finished off with descriptive titles and notes to conform to the *SANS/SABS Code of Practice for Building Drawings*.
10. For the purpose of this question paper, the size of a brick should be taken as 220 mm x 110 mm x 75 mm.
11. Use your own discretion where dimensions and/or details have been omitted.
12. Answer QUESTIONS 4.7, 5.2, 5.3, 6.1 and 6.2 on the attached ANSWER SHEETS using drawing instruments, where necessary.
13. Write your CENTRE NUMBER and EXAMINATION NUMBER on every ANSWER SHEET and hand them in with your ANSWER BOOK, whether you have used them or not.
14. Drawings in the question paper are NOT to scale due to electronic transfer.

**QUESTION 1: CONSTRUCTION, SAFETY AND MATERIAL**

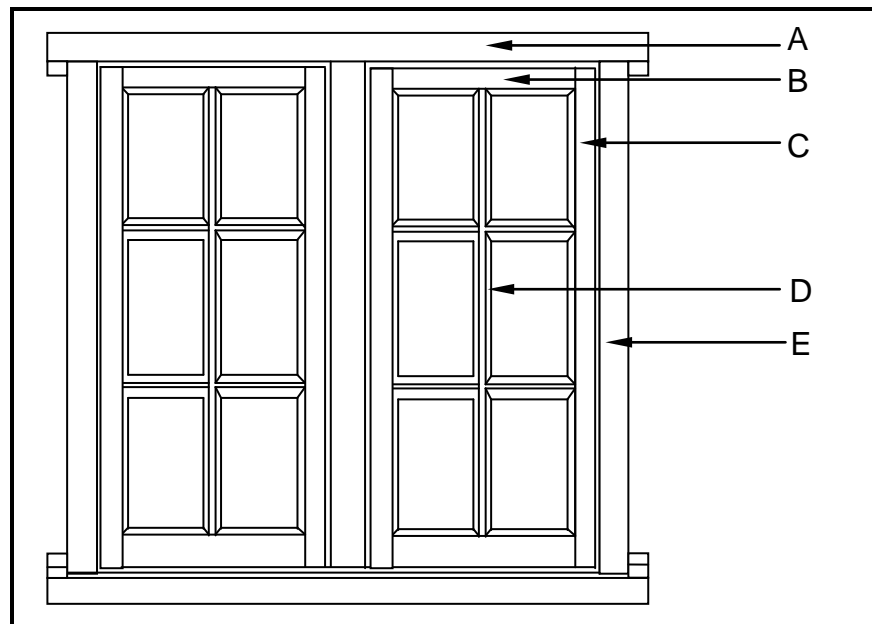
- 1.1 FIGURE 1.1 below shows an artisan using an angle grinder to finish a dry wall construction.



**FIGURE 1.1**

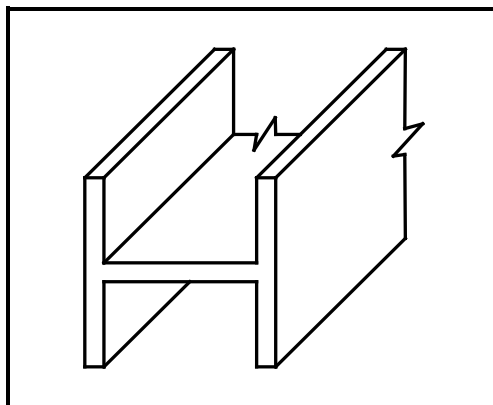
- Study FIGURE 1.1 and recommend THREE additional pieces of safety equipment that the worker can use to protect himself. (3)
- 1.2 Explain ONE aspect of ladders under each of the following criteria:
- 1.2.1 Safe handling (1)
- 1.2.2 Maintenance (1)
- 1.3 Explain TWO precautions that should be taken by workers when working in an area with floors and stairs with open sides. (2)
- 1.4 Explain TWO safety precautions that should be taken when using a builder's hoist. (2)
- 1.5 Describe the first THREE steps that must be followed to prepare and paint a new piece of metal. (3)

- 1.6 FIGURE 1.6 below shows the front elevation of a window. Study the drawing and answer the questions that follow.



**FIGURE 1.6**

- 1.6.1 Identify the type of window. (1)
- 1.6.2 Identify parts **A–E**. (5)
- 1.7 Give **FOUR** reasons for finishing concrete surfaces such as floors. (4)
- 1.8 FIGURE 1.8 below shows a sketch of a steel profile.



**FIGURE 1.8**

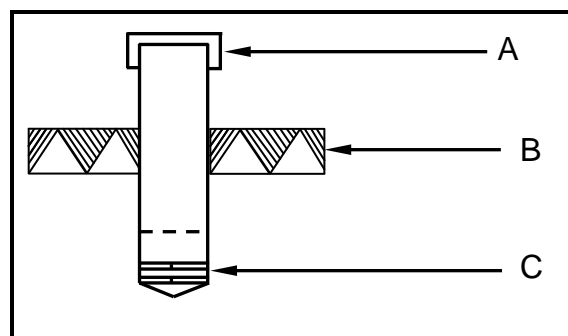
- 1.8.1 Identify the type of steel profile. (1)
- 1.8.2 Name **ONE** property of the steel profile. (1)
- 1.8.3 Where will you use this steel profile when building a school hall? (1)

- 1.9 Name ONE advantage of beam filling. (1)
- 1.10 Name ONE disadvantage of beam filling. (1)
- 1.11 Explain where in construction concrete with the following strength will be used:
- 1.11.1 Low strength (1)
- 1.11.2 Medium strength (1)
- 1.11.3 High strength (1)
- [30]**

**QUESTION 2: ADVANCED CONSTRUCTION AND EQUIPMENT**

Start this question on a NEW page.

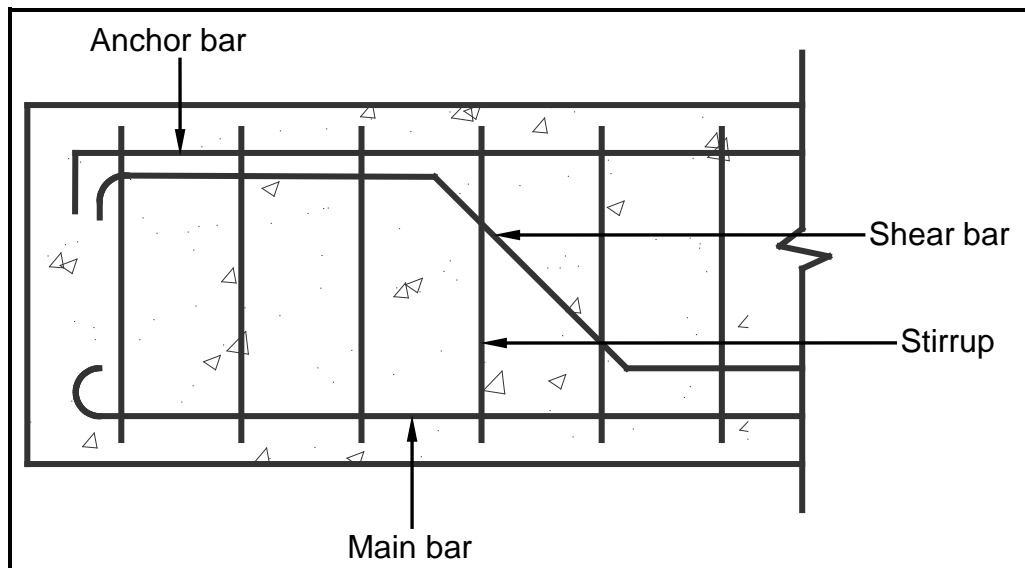
- 2.1 Discuss TWO requirements that shuttering (formwork) should comply with. (2)
- 2.2 Describe the purpose of the following hand tools when a wooden door frame is built into a brick wall:
- 2.2.1 Spirit level (1)
- 2.2.2 Steel square (1)
- 2.3 A portable electric plane is used for planing wood. Describe TWO precautions to be taken into account in the maintenance of this machine. (2)
- 2.4 Differentiate between a *rough arch* and a *gauged arch* according to the following criteria. Tabulate your answer.
- 2.4.1 Material (2)
- 2.4.2 Labour (2)
- 2.5 Name the TWO main types of forces acting on reinforced concrete beams which should be taken into consideration during the design process. (2)
- 2.6 FIGURE 2.6 below shows a sketch of a precast concrete pile driven into the ground.



**FIGURE 2.6**

- 2.6.1 Name parts **A–C**. (3)
- 2.6.2 What is used to drive this type of pile into the ground? (1)
- 2.6.3 Explain when this type of piling will be used. (1)

2.7 FIGURE 2.7 below shows a section through a reinforced concrete beam.



**FIGURE 2.7**

Explain the purpose of the following parts of reinforcement found in a concrete beam:

2.7.1 Main bars (1)

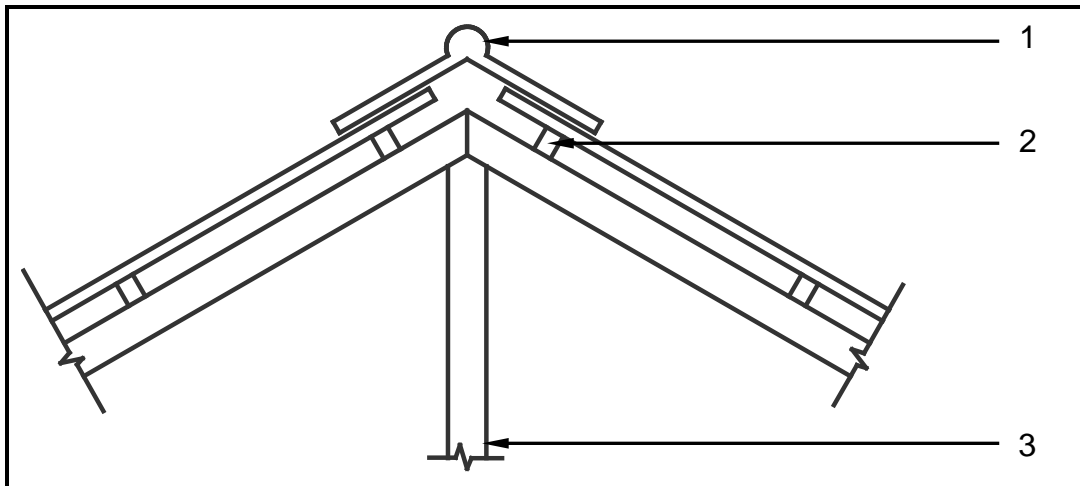
2.7.2 Anchor bars (1)

2.7.3 Shear bars (1)

2.7.4 Stirrups (1)

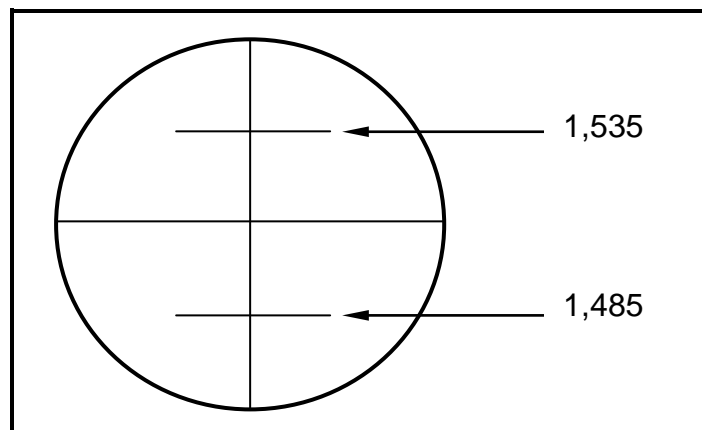
2.8 Name FOUR steps to be followed when tiling a newly plastered wall. (4)

- 2.9 FIGURE 2.9 below shows the top part of a roof construction. Study the illustration and answer the questions that follow.



**FIGURE 2.9**

- 2.9.1 Identify part 1. (1)
- 2.9.2 What is the purpose of part 1? (1)
- 2.9.3 What is the name and standard size of part 2? (2)
- 2.9.4 What will the standard size of part 2 be if it is a tile roof? (1)
- 2.9.5 Identify the type of roof covering that is used. (1)
- 2.9.6 Identify part 3. (1)
- 2.10 Explain what is meant by the term *formwork*. (2)
- 2.11 Describe TWO advantages of steel shuttering over timber shuttering. (2)
- 2.12 FIGURE 2.12 below shows a reading on the top stage line and bottom stage line as viewed through the eye piece of a dumpy level.



**FIGURE 2.12**

Calculate the distance from the dumpy level to the measuring staff.

(4)  
[40]



**QUESTION 3: CIVIL SERVICES**

Start this question on a NEW page.

- 3.1 Boreholes are an alternative source of drinking water instead of a municipal connection.
- 3.1.1 Describe TWO advantages of a borehole. (2)
- 3.1.2 State TWO instances when a borehole can become ineffective. (2)
- 3.2 State TWO functions of a pressure control valve (pressure-reducing valve). (2)
- 3.3 The thermostat on a geyser used for domestic purposes can be set at a certain temperature.
- 3.3.1 Recommend a suitable temperature for domestic purposes. (1)
- 3.3.2 Name the part in a geyser that heats the water. (1)
- 3.4 In South Africa electricity is becoming a scarce resource and the use of gas appliances is on the increase.
- 3.4.1 Describe any THREE factors to be considered when installing a gas geyser. (3)
- 3.4.2 Describe TWO advantages of a gas geyser. (2)
- 3.5 FIGURE 3.5 below shows an electrical device used in households.



**FIGURE 3.5**

- 3.5.1 Identify the electrical device in FIGURE 3.5. (1)
- 3.5.2 What is the function of the numeric keypad? (1)

3.5.3 Who should seal the device during installation? (1)

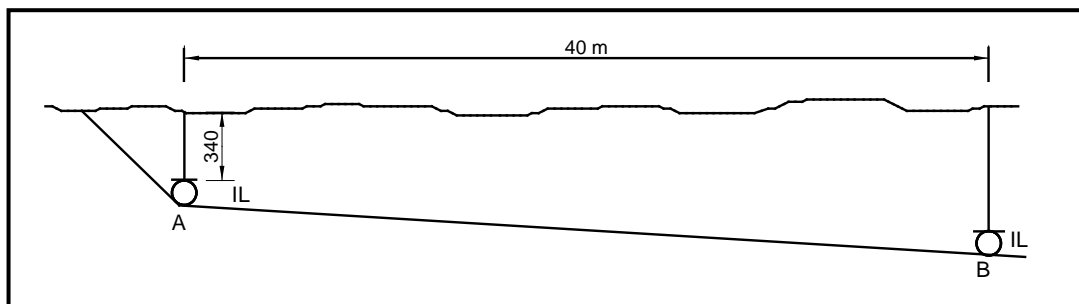
3.5.4 Select a room in a house where you will mount the device. Justify your answer. (2)

3.5.5 You have the option of mounting the device against a wall or in a cupboard. Where would you prefer to mount it? Justify your answer. (2)

3.6 Discuss the purpose of conduits for electrical wiring in a building. (1)

3.7 Distinguish between *chased conduits* and *surface-mounted conduits*. (2)

3.8 FIGURE 3.8 below shows a sewer pipeline that must be laid. The minimum soil cover of the pipeline at A is 340 mm. The pipe has a diameter of 110 mm and the pipeline is 40 m long.



**FIGURE 3.8**

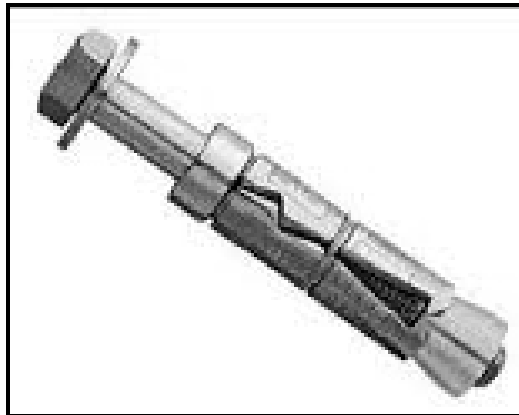
3.8.1 Calculate the invert levels at **A** and **B** if the slope of the pipe is 1 : 40. (6)

3.8.2 Name the sewer fitting that is installed every 24 m in a sewer pipeline to gain access to the system. (1)  
**[30]**

**QUESTION 4: QUANTITIES, MATERIALS AND JOINING**

Start this question on a NEW page.

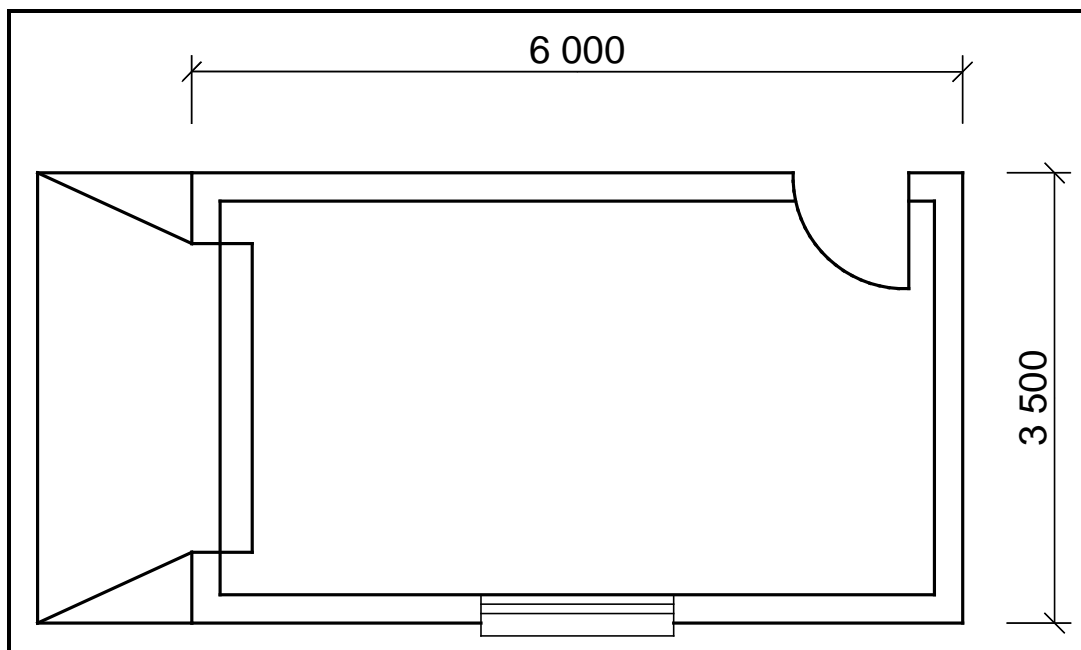
- 4.1 Name TWO fasteners that can be used to secure a roof truss to the brick walls of a building. (2)
- 4.2 FIGURE 4.2 below shows a fastener. Write down the correct name and ONE use of the fastener.



**FIGURE 4.2**

- 4.3 Name ONE method of joining each of the following types of pipes: (2)
- 4.3.1 Copper pipe (1)
- 4.3.2 Galvanised pipe (1)
- 4.4 Describe ONE use of each of the following nails: (1)
- 4.4.1 Masonry nail (1)
- 4.4.2 Panel pin (1)
- 4.5 Justify the use of screws rather than nails with regard to time taken to drive in and holding power. (2)
- 4.6 In order to complete a table for a cutting list, the headings of each column must be indicated. Name TWO headings of a cutting list. (2)

- 4.7 FIGURE 4.7 below shows the floor plan of a garage with a garage door, a side door and a window.



**FIGURE 4.7**

Specifications:

- The superstructure is a one-brick wall, 220 mm wide and 2 600 mm high.
- The side door opening is 2 000 mm high x 800 mm wide.
- The garage door is 2 400 mm wide x 2 100 mm high.
- The window opening is 1 500 mm wide x 900 mm high.

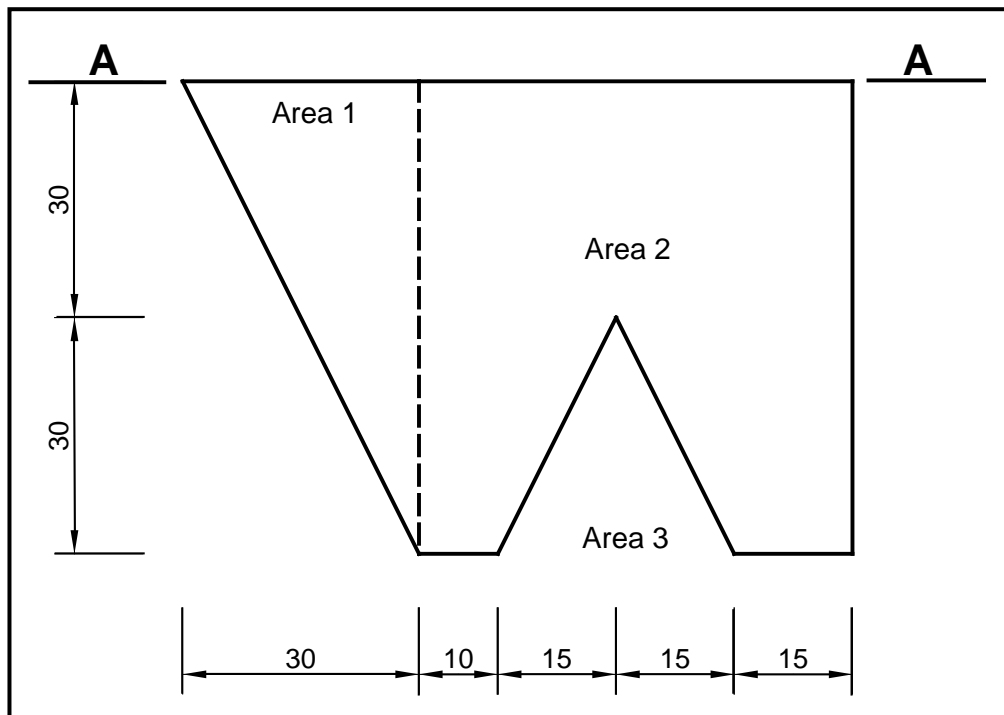
Use ANSWER SHEET 4.7 and calculate the number of bricks needed to build the superstructure if 50 bricks are used to build 1 m<sup>2</sup> of a half-brick wall (110 mm wall).

(18)  
[30]

**QUESTION 5: APPLIED MECHANICS**

Start this question on a NEW page.

- 5.1 FIGURE 5.1 below shows a shaped lamina. All dimensions are in millimetres. The area of the right-angled triangle (Area 1) is  $900 \text{ mm}^2$ , the rectangle (Area 2) is  $3\,300 \text{ mm}^2$  and the isosceles triangle (Area 3) is  $450 \text{ mm}^2$ .



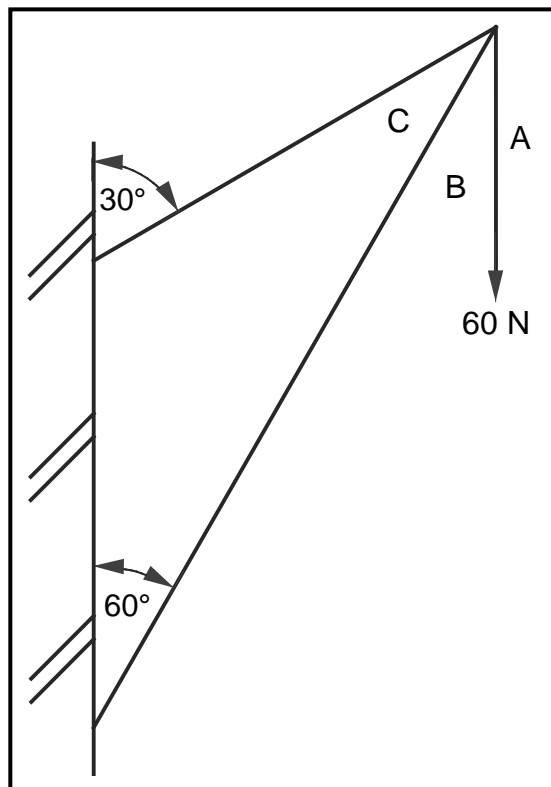
**FIGURE 5.1**

Calculate the position of the centroid of the lamina from A–A. Round off your answer to TWO decimal places.

**HINT:** Use the formula on the FORMULA SHEET.

(7)

5.2 FIGURE 5.2 below shows the space diagram of a cantilever frame.



**FIGURE 5.2**

- 5.2.1 On ANSWER SHEET 5.2, develop and draw a vector diagram to graphically determine the magnitude and nature of the forces in each member (part) of the frame. Use scale 1 mm = 1 N. (5)
- 5.2.2 Show the nature of the forces of parts BC and CA on the space diagram on ANSWER SHEET 5.2. (2)
- 5.2.3 Use the information in the space and vector diagrams and complete the table on ANSWER SHEET 5.2. (4)

- 5.3 FIGURE 5.3 below shows the space diagram of a beam with a span of 8 metres with two point loads and a uniformly distributed load. Study the diagram and answer the questions that follow.

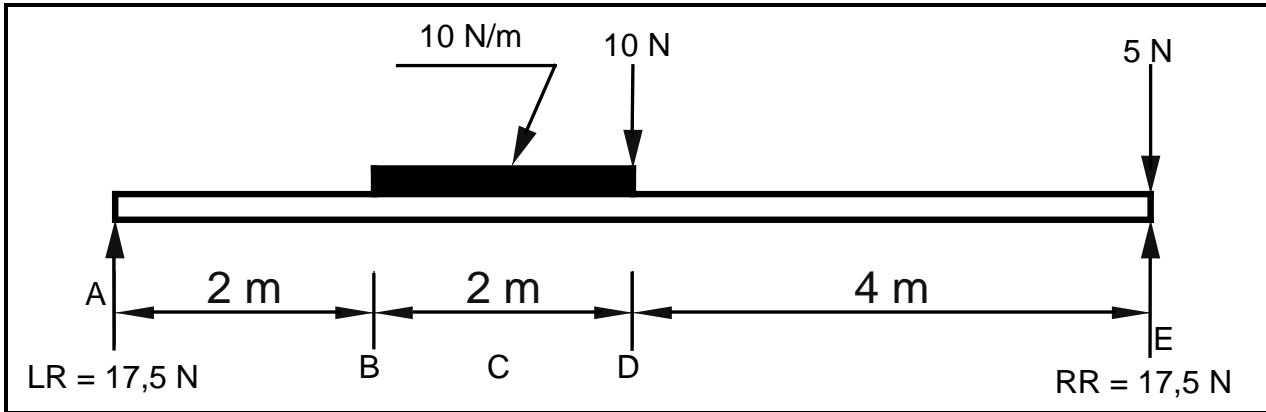
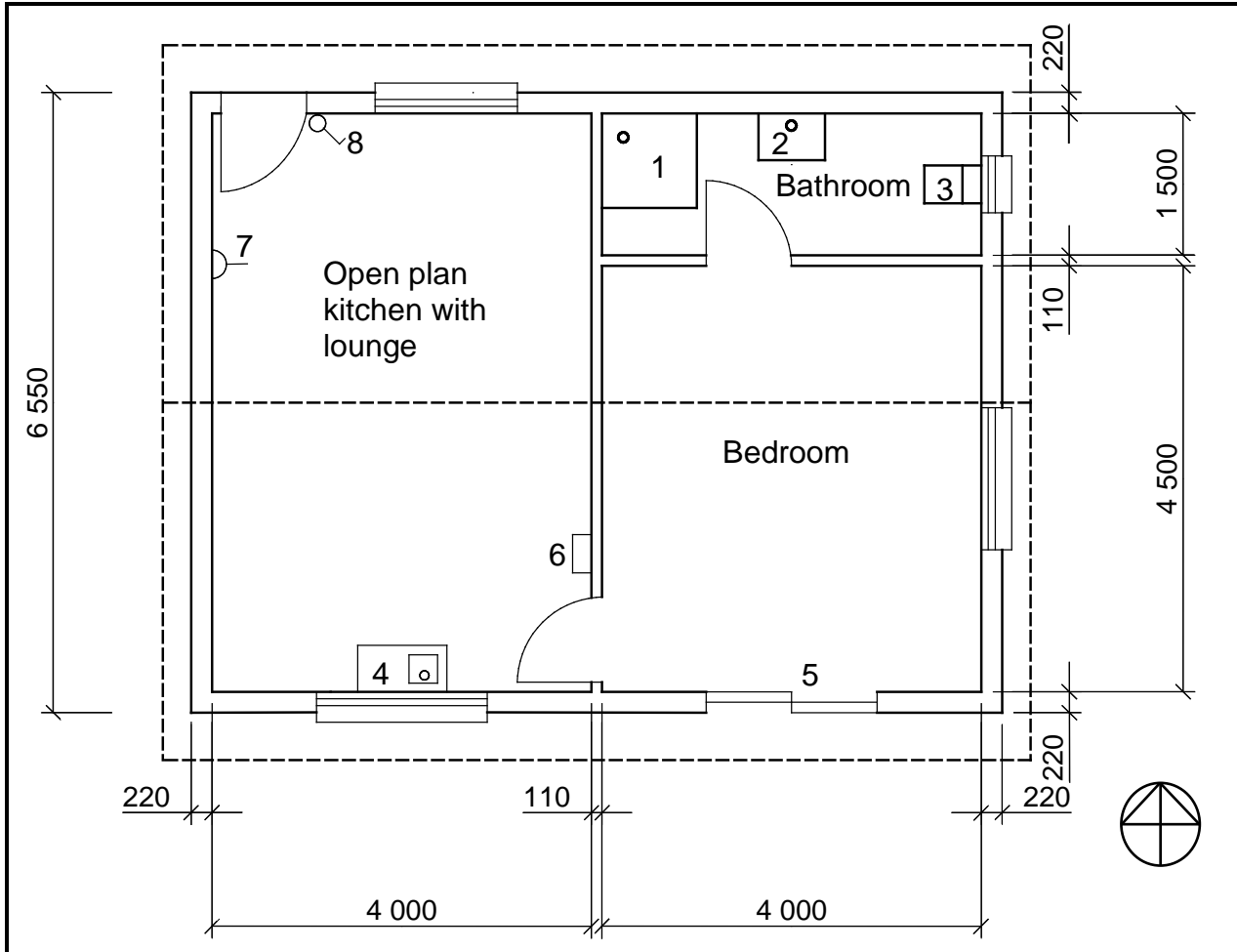


FIGURE 5.3

- 5.3.1 Convert the uniformly distributed load to a point load and write down the value of the converted point load. (1)
- 5.3.2 Determine the distance of the converted uniformly distributed load, that is now a point load, **from RR**. (1)
- 5.3.3 Prove by means of calculations that the value of the shear force at  $D = -12,5 \text{ N}$  and at  $E = 0$ . (6)
- 5.3.4 The value of the bending moments at  $A = 0 \text{ Nm}$ ,  $B = 35 \text{ Nm}$ ,  $C = 47,5 \text{ Nm}$ ,  $D = 50 \text{ Nm}$  and  $E = 0 \text{ Nm}$ . Use all available information and draw the bending moment diagram on ANSWER SHEET 5.3. Use scale  $2 \text{ mm} = 1 \text{ Nm}$ . (4)
- [30]**

**QUESTION 6: GRAPHIC COMMUNICATION**

6.1 FIGURE 6.1 below illustrates the floor plan of a one-bedroom house. Study the drawing and complete the table on ANSWER SHEET 6.1.

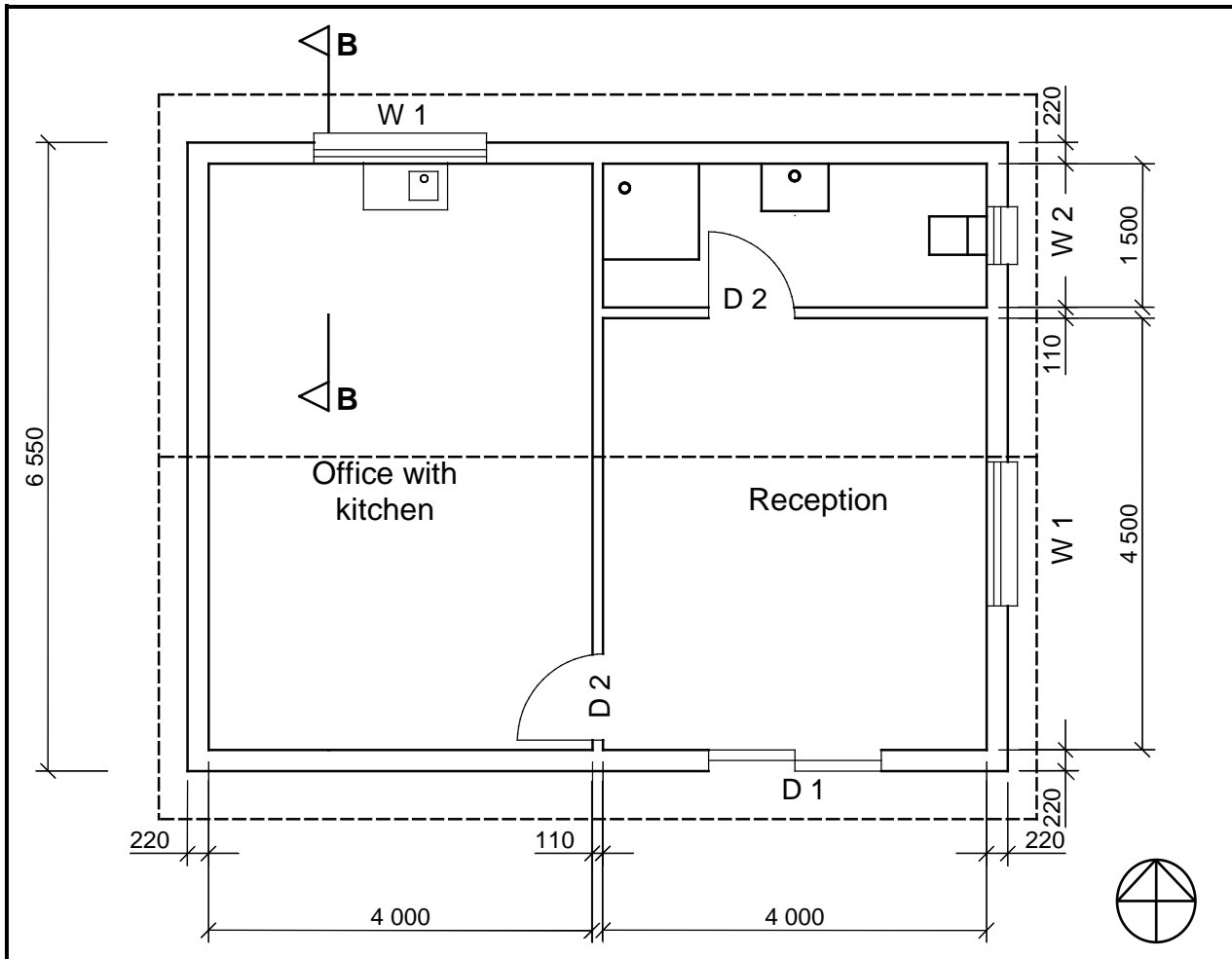


**FIGURE 6.1**

(15)



6.2 FIGURE 6.2 below shows the floor plan of an office with a reception area.



**FIGURE 6.2**

6.2.1 On ANSWER SHEET 6.2, draw to scale 1 : 20 a sectional view up to and including the wall plate of the building on section line B–B. Use the specifications below and on the next page.

Specifications:

- Foundation, 600 mm wide and 250 mm deep
- All external walls are 220 mm wide
- Top of foundation to underside of floor slab, 450 mm
- Floor slab, 75 mm thick
- Blinding layer, 50 mm thick
- Screed, 25 mm thick
- Floor slab to underside of wall plate, 2 700 mm
- Wall plate, 114 mm x 38 mm
- Hardcore filling, 150 mm thick
- Floor slab to top of window, 2 000 mm

The following must also be shown on the drawing:

- Window sill
- Dimension of width of foundation
- Labels of any THREE parts on the drawing

The following need NOT be shown:

- Frame head
- Rebate for window

Window and door schedule:

	<b>Width</b>	<b>Height</b>
Window 1 (W1)	1 500 mm	1 200 mm
Door 1 (D1)	1 800 mm	2 000 mm

(18)

6.2.2 Draw any THREE drawing symbols on the drawing. (3)

6.2.3 Print the scale below the drawing. (1)

6.2.4 THREE marks will be allocated for the application of scale. (3)  
**[40]**

**TOTAL: 200**

**CENTRE NUMBER:**

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**EXAMINATION NUMBER:**

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**QUESTION 4.7**

**ANSWER SHEET 4.7**

Complete your answers in the spaces indicated with ... and ... .

A	B	C	D
			Centre line: Superstructure
			2 / ... = ...
			2 / ... = ...
			Total = ...
			Minus 4 / ... = ...
			= ...
			Centre line: = ...
1/	...		Area of wall for superstructure:
	<u>...</u>	...	
1/	...		Area of side door:
	<u>...</u>	...	
1/	...		Area of garage door:
	<u>...</u>	...	
1/	...		Area of window:
	<u>...</u>	...	
			Total area of wall after deductions:
			= ...      ...      ...      ...
			= ...
1/	...		Bricks needed to build superstructure:
	<u>...</u>	...	... bricks are needed.
			(15)

**CENTRE NUMBER:**

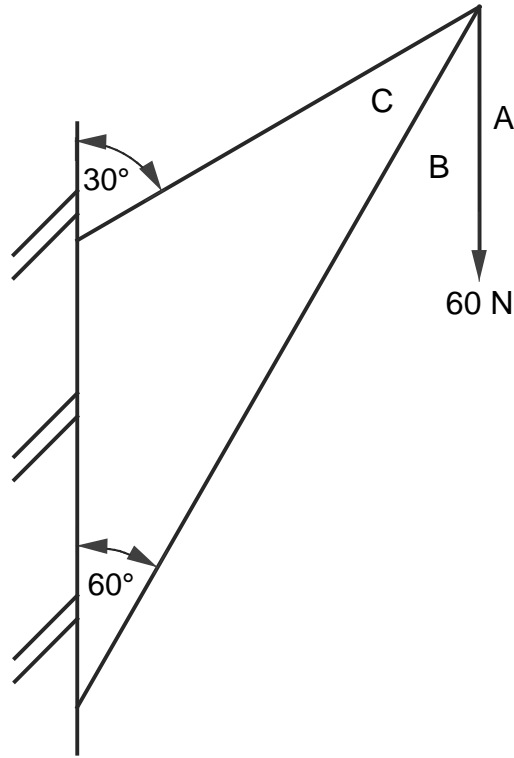
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**EXAMINATION NUMBER**

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**QUESTION 5.2**

**ANSWER SHEET 5.2**



SPACE DIAGRAM

a

MEMBER	NATURE	FORCE
BC		
CA		

Tolerance of 1 N to either side

CENTRE NUMBER: 

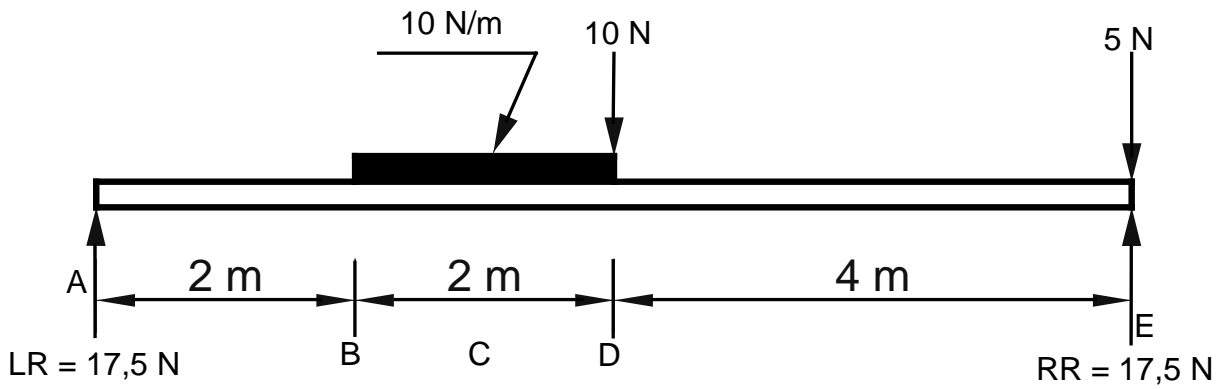
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**QUESTION 5.3**

**ANSWER SHEET 5.3**



<b>CENTRE NUMBER:</b>									
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<b>EXAMINATION NUMBER</b>														
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**QUESTION 6.1****ANSWER SHEET 6.1**

<b>NO.</b>	<b>QUESTIONS</b>	<b>ANSWERS</b>	<b>MARKS</b>
1	Identify number 1.		1
2	Calculate the perimeter of the building.		1
3	Draw the symbol for the gully.		1
4	What is the thickness of the inner walls?		1
5	Calculate the total area of the house in m <sup>2</sup> .		2
6	Describe the purpose of number 2.		1
7	Give the abbreviation for number 3.		1
8	Identify number 4.		1
9	Identify number 5.		1
10	Name the type of roof of the house.		1
11	Identify the electrical symbol at 6.		1
12	Identify number 7.		1
13	On which elevations will the gutters be placed in this house?		1
14	Identify number 8.		1
		<b>Total</b>	<b>15</b>

<b>CENTRE NUMBER:</b>									
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<b>EXAMINATION NUMBER:</b>														
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**QUESTION 6.2****ANSWER SHEET 6.2**

Aspect	Marks	Learner's mark
Correctness of substructure	6	
Correctness of super-structure	7	
Correctness of any three drawing symbols	3	
Printing of any three labels	3	
Dimension and dimension lines	2	
Print the scale	1	
Application of scale One or two incorrect = 3 Three or four incorrect = 2 More than five incorrect = 1 No measurement correct = 0	3	
<b>Total</b>	<b>25</b>	

**FORMULA SHEET****IMPORTANT ABBREVIATIONS**

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
c	Centroid	b	Breadth/Width	r	Radius
ℓ	Length	s	Side	A	Area

**FORMULAE**

AREA OF	FORMULA (in words)	FORMULA (In symbols)	FORMULA FOR THE POSITION OF CENTROIDS	
			X-axis	Y-axis
Square	side x side	s x s	$\frac{s}{2}$	$\frac{s}{2}$
Rectangle	length x breadth	ℓ x b	$\frac{\ell}{2}$	$\frac{b}{2}$
Right-angled triangle	$\frac{1}{2}$ x base x height	$\frac{1}{2}b \times h$	$\frac{b}{3}$	$\frac{h}{3}$
Equilateral triangle/ Isosceles triangle	$\frac{1}{2}$ x base x height	$\frac{1}{2}b \times h$	$\frac{b}{2}$	$\frac{h}{3}$

$$\text{Position of centroid} = \frac{(A_1 \times d) \pm (A_2 \times d)}{\text{Total area}}$$

**OR**

$$X = \frac{\sum Ay}{\sum A}$$