Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2015

CIVIL TECHNOLOGY

MARKS: **200**

TIME: **3 hours**

This question paper consists of 15 pages, including 4 answer sheets and a formula sheet.

REQUIREMENTS:

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

INSTRUCTIONS AND INFORMATION

1. This question paper consists of SIX questions.
2. ALL questions are COMPULSORY.
3. Answer each question as a whole. DO NOT separate subsections of questions.
4. Start each question on a NEW page.
5. Sketches may be used to illustrate your answers.
6. ALL calculations and written answers must be done in the ANSWER BOOK.
7. Use the mark allocation as a guide for the length of your answer.
8. Drawings and sketches in pencil, must be fully dimensioned and neatly finished off with titles and labels to conform to *SANS SABS Recommended Practice for Building Drawings.*
9. For the purpose of this examination, the size of a brick should be taken as 220 mm x 110 mm x 75 mm.
10. Use your discretion where dimensions and/or details have been omitted.
11. A non-programmable calculator may be used.
12. Answer QUESTIONS 4.10, 5.2, 5.3 and 6.1 on the ANSWER SHEETS provided.
13. Drawings in the question paper are NOT to scale due to electronic transfer.

QUESTION 1: CONSTRUCTION PROCESSES

1.1 FIGURE 1.1 shows the outline of a house which must be measured out on a site. Answer the following questions with regard to the measuring-out procedure.

1.1.1 Name lines 1.1.A to 1.1.C. (3 x 1) (3)

1.1.2 What is part 1.1.D called? (1)

1.1.3 Which TWO measurements must be marked out on part 1.1.D? (2 x 1) (2)

1.1.4 Name TWO methods to measure the corners of a structure to make sure it is square. (2 x 1) (2)

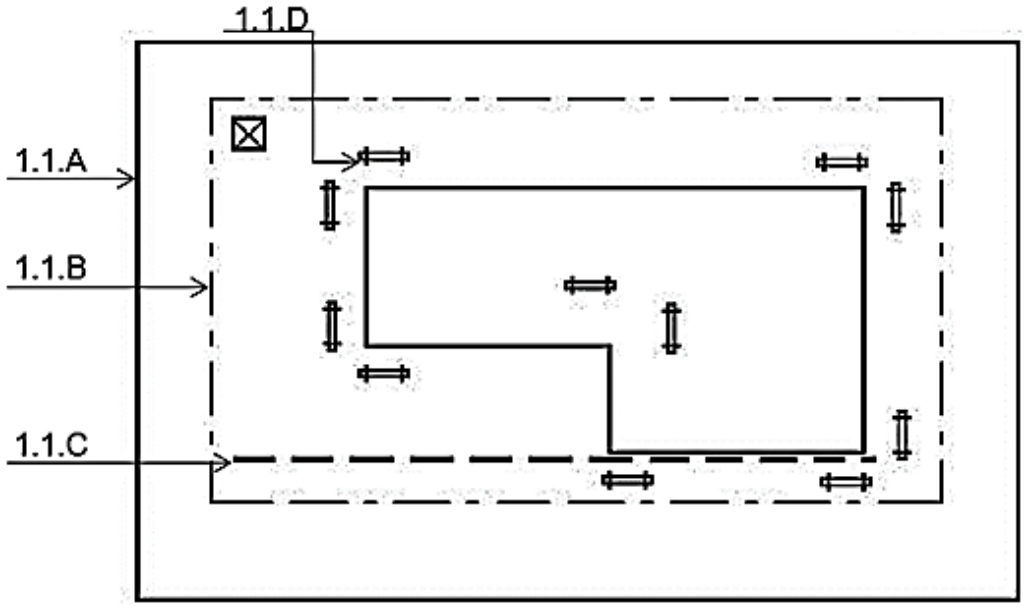

FIGURE 1.1

1.2 Briefly motivate why foundations must be placed underground. (2)

1.3 Name FOUR factors which will have an influence on the choice of foundation to be used. (4 x 1) (4)

1.4 Make a neat sketch to illustrate the construction of a raft foundation. (2)

1.5 Name ONE use of each of the following tools:

15.1 Line block (1)

1.5.2 Tingle (1)

1.5.3 Long jointer (1)

1.5.4 Belt sander (1)

1.5.5 Thicknesser (1)

1.6 Briefly motivate why the ventilation holes of electrical machines must be regularly cleaned. (2)

1.7 Name TWO uses of a dumpy level. (2 x 1) (2)

1.8 What is meant by the setting of the dumpy level? (2)

1.9 Name THREE advantages of a cavity wall. (3 x 1) (3)

[30]

QUESTION 2: ADVANCED CONSTRUCTION PROCESSES

2.1 Briefly motivate why the main reinforcement must be placed at the bottom of a reinforced concrete beam. Refer also to the properties of steel and concrete. (3)

2.2 Name TWO methods to prevent shear stress in a concrete beam. (2 x 1) (2)

2.3 What is meant by the concrete covering in reinforced concrete structures? (2)

2.4 What is the minimum number of main bars in the following types of concrete columns?

2.4.1 Right angular column (1)

2.4.2 Round column (1)

2.5 Name FIVE advantages of laminated shuttering boards. (5 x 1) (5)

2.6 Draw a neat sketch to scale 1 : 10 of an open-eave construction with beam filling and indicate the following parts:

2.6.1 Single brick wall construction (1)

2.6.2 Wall plate (1)

2.6.3 Rafter (1)

2.6.4 Tie beam (1)

2.6.5 Purlin (1)

2.6.6 Roof sheet (1)

2.6.7 Fascia board (1)

2.6.8 Beam filling (1)

2.6.9 Correct scale (2)

2.7 What determines the spacing of roof trusses? (1)

2.8 Describe THREE situations where shoring may be needed. (3 x 2) (6)

2.9 Name THREE types of shoring which are generally used. (3 x 1) (3)

2.10 FIGURE 2.10 indicates a semi-circular gauged arch. Name parts numbered 2.10. 1 to 2.10.6 of the gauged rough arch.

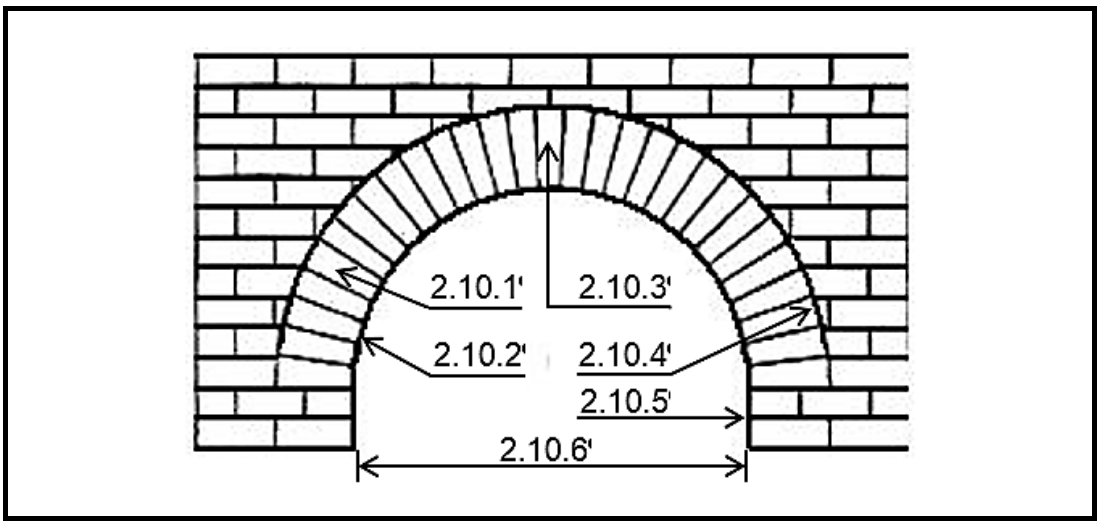

FIGURE 2.10 (6)

[40]

QUESTION 3: CIVIL SERVICES

3.1 What is the purpose of the water tank in the indirect hot water system? (1)

3.2 What is the section diameter size of the following water pipes?

3.2.1 Water supply to the geyser (1)

3.2.2 Water supply to the tap points (1)

3.3 Briefly motivate why the inside of the solar absorber must be painted black. (2)

3.4 What is the purpose of the glass lid on the solar absorber? (2)

3.5 Name THREE advantages of using polythene pipes for water supply. (3 x 1) (3)

3.6 Which method is used to join the following types of pipe?

3.6.1 Galvanised steel pipes (1)

3.6.2 Polythene pipes (1)

3.6.3 Copper pipes (1)

3.7 Indicate whether the following statements are TRUE or FALSE.
Write only the word 'true' or 'false' next to the number in the ANSWER BOOK.

3.7.1 A septic tank should be regularly pumped out. (1)

3.7.2 Vacuum tanks must be connected to a french drain. (1)

3.7.3 Manholes serve as access openings to drain systems. (1)

3.7.4 A rodding eye is installed at the top end of each site drain. (1)

3.7.5 An inspection eye is a removable cover on a pipe junction. (1)

3.8 Name TWO factors which will determine the width and depth of a french drain. (2 x 1) (2)

3.9 Describe in point form how the water test method is executed to test the drain for leaks. (6)

3.10 Name FOUR advantages of PVC-drain pipes. (4 x 1) (4)

[30]

QUESTION 4: MATERIALS AND QUANTITIES

4.1 Name TWO circumstances where rapid-hardening cement will be used. (2)

4.2 Which TWO reactions take place when water is mixed with cement? (2)

4.3 Briefly motivate why cement must be used as quickly as possible after manufacturing. (2)

4.4 Describe the circumstances in which the following additivess mixtures for concrete will be used:

4.4.1 Plasticisers (1)

4.4.2 Air-retaining agents (1)

4.4.3 Retarders (1)

4.5 Describe the steps which must be followed when concrete is mixed in a concrete mixer. (5)

4.6 What is the purpose of compacting concrete? (1)

4.7 What is the purpose of the slump test for concrete? (1)

4.8 Identify the following types of board product:

4.8.1 Owing to its thickness, it can seldom be used on its own (1)

4.8.2 Uneven numbers of layers are glued to one another (1)

4.8.3 The core section consists of strips of timber glued together (1)

4.9 Name THREE advantages of hard board. (3 x 1) (3)

4.10 FIGURE 4.10 on ANSWER SHEET A shows the foundation plan for a structure. Use the quantity list on ANSWER SHEET A and answer the following questions with regard to the foundation:

4.10.1 Calculate the centre line of the foundation. (4)

4.10.2 Determine the volume of concrete needed to cast TWO foundations. (4)

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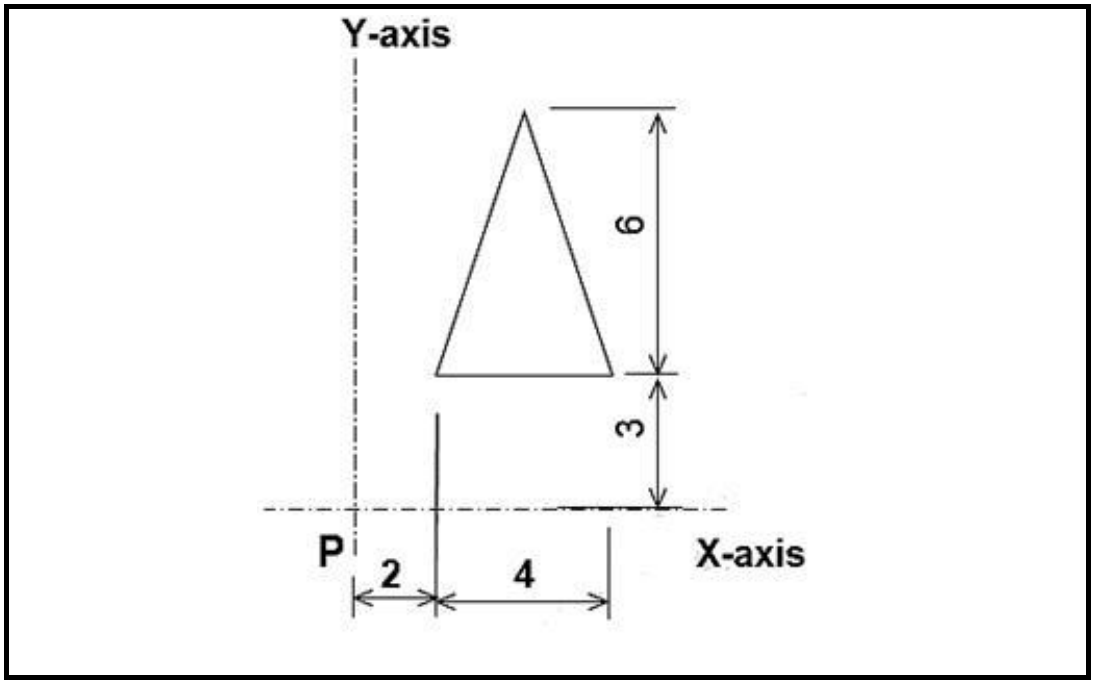
QUESTION 5: APPLIED MECHANICS

5.1 Determine the centroid from point P of the isosceles triangle in FIGURE 5.1. Show all formulas and calculations.



(4)

FIGURE 5.1

5.2 FIGURE 5.2 on ANSWER SHEET B shows a beam with point loads. Determine the following on ANSWER SHEET B:

5.2.1 The bending moment values (7)

5.2.2 Complete the bending moment diagram according to the bending moment values (4)

5.3 FIGURE 5.3 on ANSWER SHEET C shows a space diagram of a roof truss. Determine graphically on ANSWER SHEET C the sizes and nature of the parts of the truss by completing the force diagram and the table. (15)

[30]

QUESTION 6: GRAPHICS AND COMMUNICATION

6.1 FIGURE 6.1 on ANSWER SHEET D shows the floor plan of a building which is drawn on a scale 1 : 100 according to the following requirements:

- The gable roof construction with a pitch of 30º
- Eave incline of 400 mm at all four elevations
- Wall height of 2,6 m from floor to ceiling

Use the information on ANSWER SHEET D and draw on ANSWER SHEET D the south elevation of the building on scale 1 : 100. Draw the south elevation from the given NATURAL GROUND LEVEL line.
The following detail must be shown:

6.1.1	Roof lines	(2)
6.1.2	Barge board	(3)
6.1.3	Eave incline	(1)
6.1.4	Wall height	(2)
6.1.5	Garage door	(2)
6.1.6	Garage door handle	(1)
6.1.7	Garage ramp	(2)
6.1.8	Window	(2)
6.1.9	Window sill	(1)
6.1.10	Door	(2)
6.1.11	Door handle	(1)
6.1.12	Step	(1)
6.1.13	Floor level	(1)
6.1.14	Elevation and scale labels	(2)
6.1.15	Gutters and down pipes	(3)
6.1.1.6	Neatness	(2)

6.2 Name FOUR purposes of a site plan. (4 x 1) (4)

6.3 Make a neat sketch and indicate the symbol for each of the following appliances:

6.3.1 Water meter (2)

6.3.2 Inspection eye (2)

6.3.3 Grease trap (2)

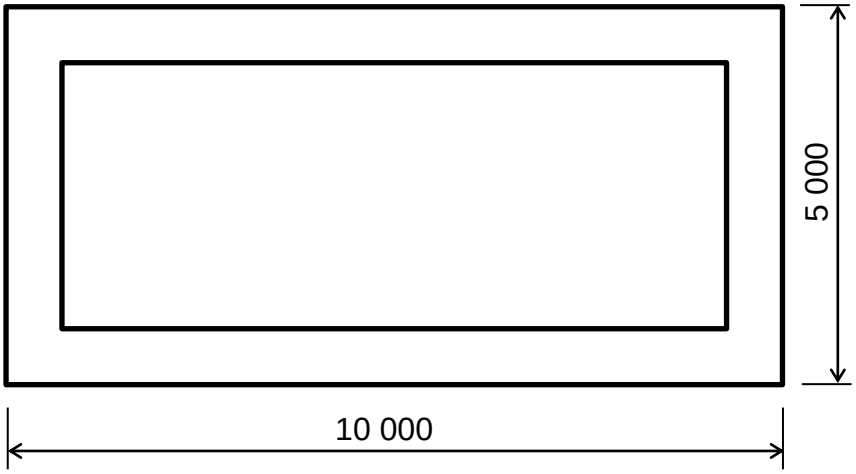
6.3.4 Hard core filling (2)

[40]

TOTAL: 200

ANSWER SHEET **ANTWOORDBLAD**	**A**	**CIVIL TECHNOLOGY** **SIVIELE TEGNOLOGIE**	**NAME:** **NAAM:**

QUESTION/VRAAG 4.10 (8)



Fondament breedte = 600 mm
Fondament dikte = 200 mm
Foundation width = 600 mm
Foundation thickness = 200 mm

A	B	C	D

ANSWER SHEET **ANTWOORDBLAD**	**B**	**CIVIL TECHNOLOGY** **SIVIELE TEGNOLOGIE**	**NAME:** **NAAM:**

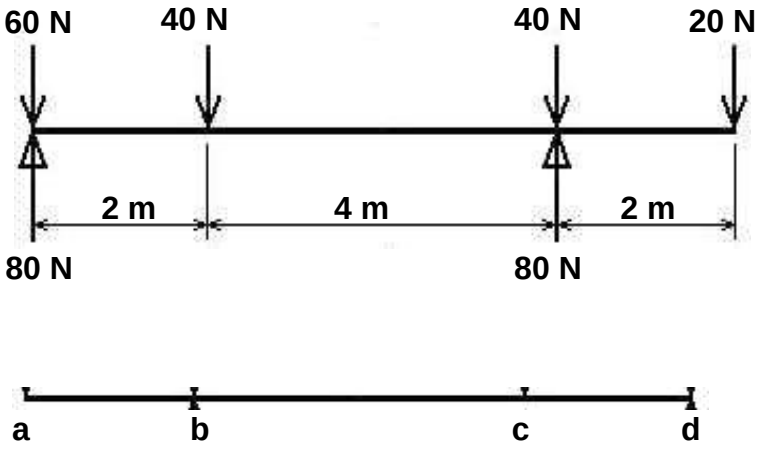
QUESTION/VRAAG 5.2

5.2.1 Die buigmomentwaardes/The bending moment values (7)

a = **……**
b = **……**
c = **……**
d = **……**

5.2.2 Die buigmomentdiagram/The bending moment diagram (5)

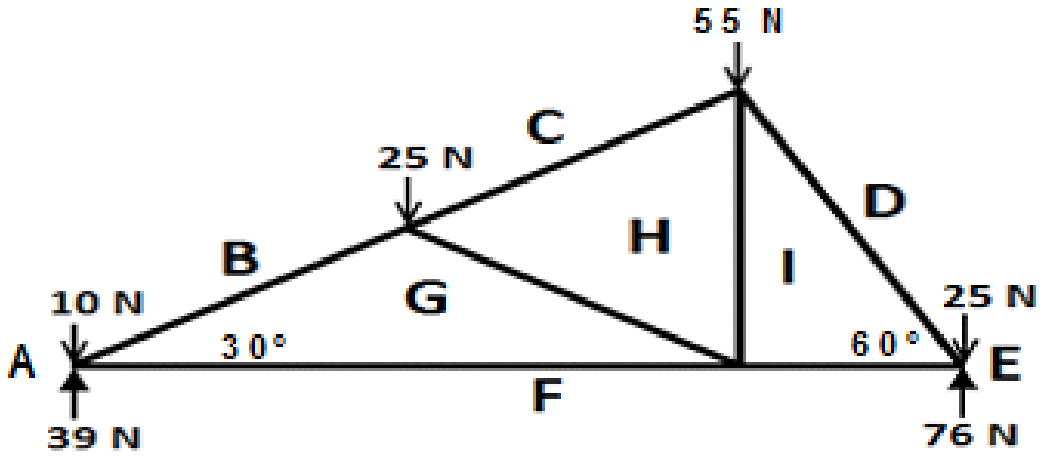
SKAAL/SCALE: 1 N = 1 mm



ANSWER SHEET ANTWOORDBLAD	C	CIVIL TECHNOLOGY SIVIELE TEGNOLOGIE	NAME: NAAM:

QUESTION/VRAAG 5.3 (15)

RUIMTEDIAGRAM:
SPACE DIAGRAM:



a

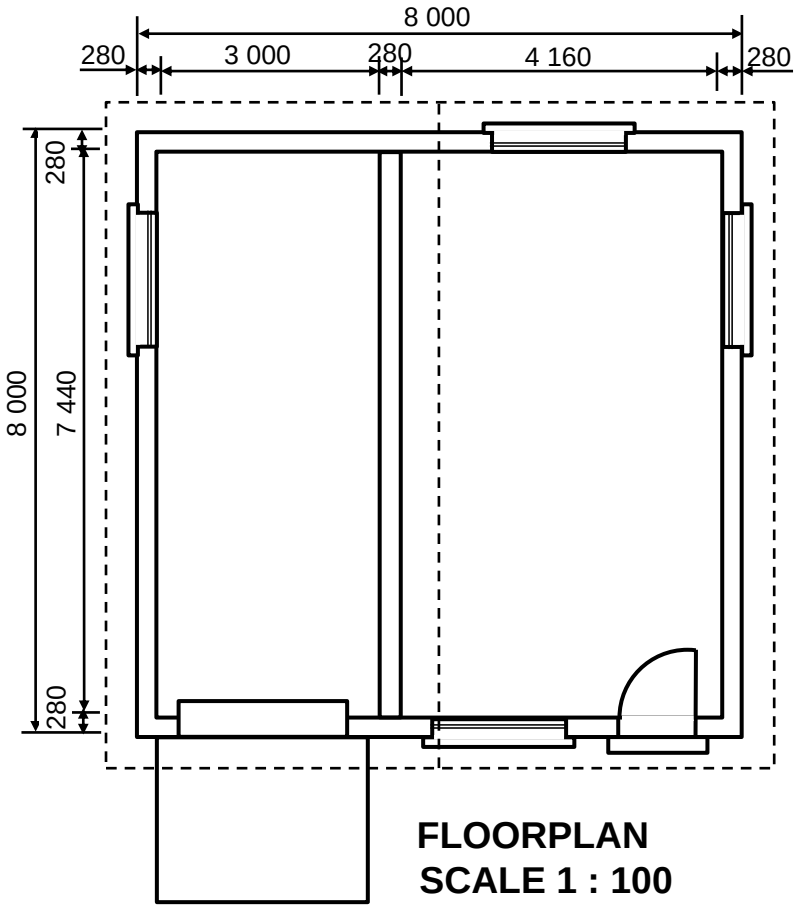
KRAGTEDIAGRAM
FORCE DIAGRAM

Skaal/Scale: 1 mm = 1 N

DEEL/PART	STUT/STRUT	STANG/TIE
BG		
CH		
DI		
FI		
FG		
GH		
HI		

ANTWOORDBLAD **D** **ANSWER SHEET**	**SIVIELE TEGNOLOGIE** **CIVIL TECHNOLOGY**	**NAAM:** **NAME:**

QUESTION/VRAAG 6.1 (28)



FLOORPLAN
SCALE 1 : 100

Roof lines	2	
Barge board	3	
Eave incline	1	
Wall height	2	
Garage door	2	
Garage handle	1	
Garage ramp	2	
Window	2	
Window sill	1	
Door	2	
Door handle	1	
Step	1	
Floor level	1	
Labels	2	
Gutters/down pipes	3	
Neatness	2	
TOTAL	28	

NGL _____

FORMULA SHEET

IMPORTANT ABBREVIATIONS

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
G	Centre of gravity	h	Height	d	Diameter
C	Centroid	b	Breadth/Width	r	Radius
L	Length	s	Side	A	Area
π	Pi = $\frac{22}{7}$ = 3,142	ø	Diameter	V	Volume

FORMULAE

AREA OF	FORMULA (in words)	FORMULA (in symbols)	FORMULA FOR THE POSITION OF CENTROIDS	
			X-axis	Y-axis
Square	Length x Breadth	l x b	$\frac{b}{2}$	$\frac{b}{2}$
Rectangle	Length x Breadth	l x b	$\frac{l}{2}$	$\frac{b}{2}$
Right-angled triangle	½ x base x height	½b x h	$\frac{b}{3}$	$\frac{h}{3}$
Equilateral triangle/Pyramid	½ x base x height	½b x h	$\frac{b}{2}$	$\frac{h}{3}$
Circle	π x radius x radius	πr^2	Centroid is in the centre	
Circle	π x diameter x diameter divided by 4	$\frac{\pi d^2}{4}$		
Semi-circle	π x radius r x radius divided by 2	$\frac{\pi r^2}{2}$	Centroid is 0,424r on the centre line	

$$\text{Position of centroid} = \frac{(A1 \times d) \pm (A2 \times d)}{\text{Total area}}$$