

**GAUTENG DEPARTMENT OF EDUCATION  
SENIOR CERTIFICATE EXAMINATION**

**FUNCTIONAL MATHEMATICS SG  
(Second Paper: Geometry)**

**TIME: 3 hours**

**MARKS: 150**

**INSTRUCTIONS:**

- Sections A and B are **COMPULSORY**.
- Answer any **TWO** of the following Sections: C, D, E or F.
- Non-programmable calculators may be used. If the question does not specify, the final answer must be rounded off to **TWO** decimal digits.
- All appropriate calculations must be shown.
- No answer may be determined by construction and measurement.
- A formula sheet **and** graph paper have been provided.

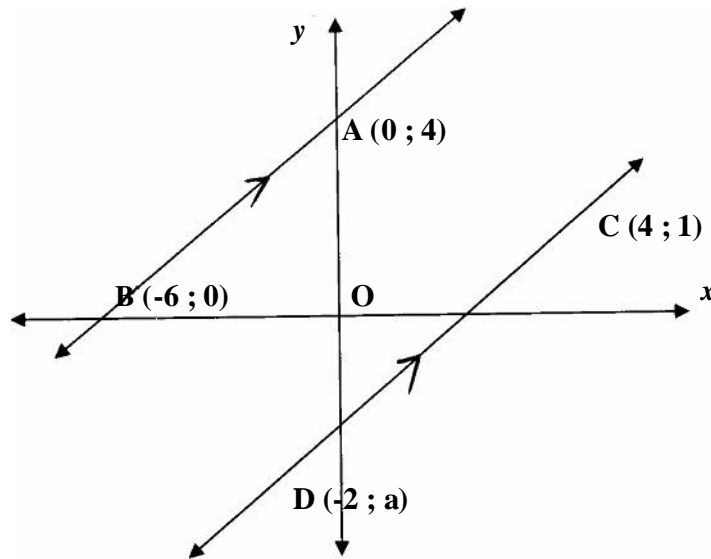
**SECTION A  
CO-ORDINATE GEOMETRY  
COMPULSORY**

**QUESTION 1**

- 1.1 Two straight lines  $2x + 3y = -4$  and  $x - 2y = 5$  are given. Determine the point of intersection by solving  $x$  and  $y$  simultaneously. Write your answer in coordinate form. (7)
- 1.2 Given:  $3x - 2y + 6 = 0$
- 1.2.1 Write the equation in the standard form,  $y = mx + c$ . (2)
- 1.2.2 What is the gradient of the line? (1)
- 1.2.3 Find the gradient of any other line parallel to  $3x - 2y + 6 = 0$ . (1)
- 1.2.4 Find the gradient of any other line perpendicular to  $3x - 2y + 6 = 0$ . (1)
- [12]**

### QUESTION 2

Given: Line  $AB \perp CD$  with  $A(0; 4)$ ,  $B(-6; 0)$ ,  $C(4; 1)$  and  $D(-2; a)$ .



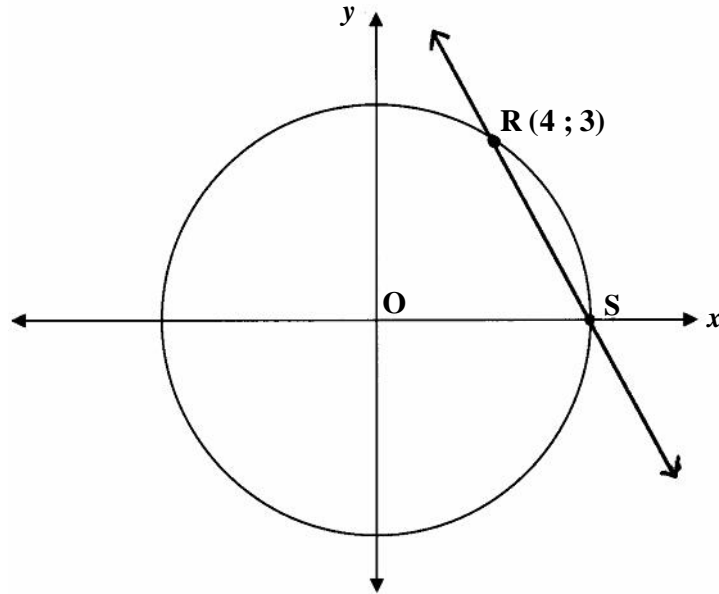
Determine:

- 2.1 The gradient of  $AB$  (3)
- 2.2 The gradient of  $CD$  in terms of  $a$  (2)
- 2.3 The value of  $a$  if  $AB \perp CD$  (3)
- 2.4 The midpoint of  $AB$  (3)
- 2.5 The length of  $AB$ . Leave the answer in the simplest surd form. (5)

**[16]**

**QUESTION 3**

O is the centre of the circle with R(4 ; 3) on the circumference of the circle.



- 3.1 Determine the equation of the circle. (4)
  - 3.2 Write down the coordinates of S. (1)
  - 3.3 Determine the gradient of the straight line RS. (2)
  - 3.4 Determine the equation of the straight line RS. (3)
- [10]**

**TOTAL FOR SECTION A: [38]**

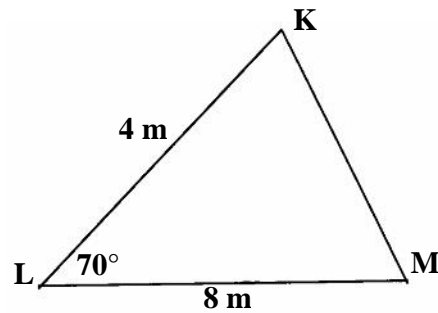
**SECTION B**  
**TRIGONOMETRY**  
**COMPULSORY**

**QUESTION 4**

4.1 Complete the cosine rule for any triangle KLM

$$l^2 = \_\_\_\_ + \_\_\_\_ - 2 \_\_\_\_ \cos \_\_\_\_ \quad (2)$$

4.2 In the figure,  $KL = 4 \text{ m}$ ,  $LM = 8 \text{ m}$  and  $\hat{L} = 70^\circ$



4.2.1 Calculate the length of KM, rounded off to 2 decimal digits. (4)

4.2.2 Calculate the area of  $\triangle KLM$  if  $KM = 7,6 \text{ m}$ , rounded off to 2 decimal digits. (3)

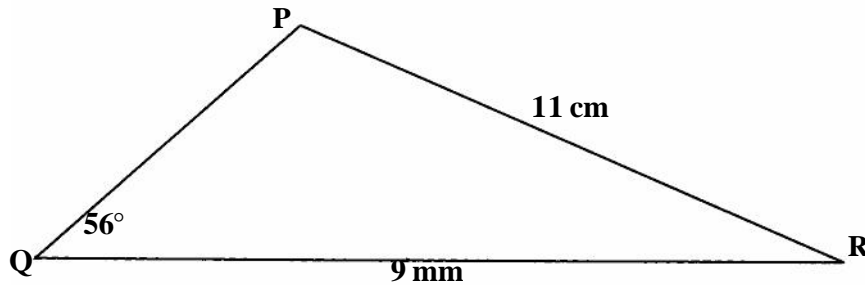
**[9]**

**QUESTION 5**

5.1 Complete the sine rule for any triangle PQR

$$\frac{\sin P}{\dots\dots} = \frac{\sin R}{r} = \frac{\dots\dots}{q} \quad (2)$$

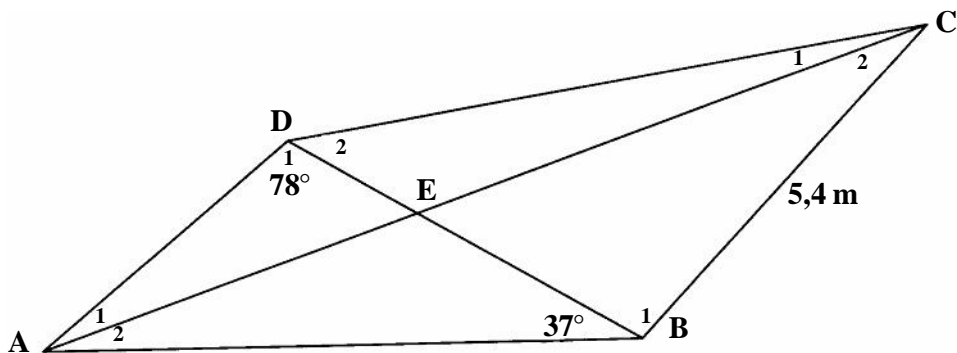
5.2 In the figure,  $\hat{Q} = 56^\circ$ ,  $PR = 11$  cm and  $QR = 9$  cm.



- 5.2.1 Calculate the size of  $\hat{P}$ , rounded off to 1 decimal digit. (4)
- 5.2.2 Calculate the size of  $\hat{R}$ . (1)
- 5.2.3 If  $\hat{P} = 43^\circ$ , determine the length of  $PQ$ , rounded off to the nearest integer. (3)

[10]

### QUESTION 6



In the figure  $ABCD$ ,  $AD \perp BC$ ,  $E$  is the point of intersection of  $AC$  and  $BD$ .  
 $\hat{ADB} = 78^\circ$ ,  $\hat{ABD} = 37^\circ$ ,  $BD = 4,3$  m and  $BC = 5,4$  m.

- 6.1 Calculate the size of  $\hat{DAB}$ . (1)
- 6.2 Calculate the size of  $\hat{B}_1$ . (1)
- 6.3 Calculate the length of  $AB$ , rounded off to 2 decimal digits. (4)
- 6.4 If  $AB = 4,6$  m, calculate the length of  $AC$ , rounded off to 2 decimal digits. (5)

P.T.O.

6.5 If  $AC = 8,4$  m, calculate the size of  $\hat{C}_2$ , rounded off to the nearest degree. (5)

6.6 Calculate the area of  $\triangle ABC$ , rounded off to 1 decimal digit. (3)

**[19]**

**TOTAL FOR SECTION B: [38]**

**SECTION C**  
**CONSUMER MATHEMATICS**  
**OPTIONAL**

**QUESTION 7**

Mrs S earns a monthly salary of R5 800,00.

7.1 Determine her annual salary. (2)

7.2 Determine the annual tax she should pay. (4)

<b>MARRIED PERSON</b>	
<b>Taxable income</b>	<b>Rates of tax</b>
R 0 - 5 000	17% of each R1
R 5 000 - 10 000	R 850 + 18% of the amount over R 5 000
R 10 000 - 15 000	R 1 750 + 19% of the amount over R 10 000
R 15 000 - 25 000	R 2 700 + 20% of the amount over R 15 000
R 25 000 - 30 000	R 3 700 + 21% of the amount over R 25 000
R 30 000 - 40 000	R 5 800 + 28% of the amount over R 30 000
R 40 000 - 50 000	R 8 600 + 36% of the amount over R 40 000
R 50 000 - 60 000	R 12 200 + 41% of the amount over R 50 000
R 60 000 - 80 000	R 16 300 + 42% of the amount over R 60 000
R 80 000 +	R 24 700 + 43% of the amount over R 80 000

7.3 If her annual tax is R20 332, determine the monthly tax she must pay. (2)

7.4 Determine her monthly salary after tax. (2)

**[10]**

### QUESTION 8

An amount of R356 000 is invested at 12% compound interest, the interest is compounded half-yearly.

8.1 Show that the following formula,  $P = 356\,000 (1,06)^{2n}$ , can be used to determine the investment of  $n$  years. (4)

8.2 Use the formula in Question 8.1 to complete the following table:  
(Round off to closest rand.)

n	1	2	3	4	5
P	400 002				

(4)

8.3 Represent the table graphically on the graph paper supplied. (3)

8.4 Determine the interest earned after 3,5 years. (2)

8.5 Determine how long it would take to earn a total investment of R804 881. (4)

**[17]**

### QUESTION 9

You receive an amount of R56 325 and decide to invest it at of 9,3% simple interest.

9.1 Complete the table using the formula  $I = \frac{krt}{100}$

Time	1	2	3	4	5
Interest	5 243				

(4)

9.2 Represent the table graphically on the graph paper supplied. (4)

9.3 Indicate with the letter A where on the graph you would determine the interest after 54 months. (2)

**[10]**

**TOTAL FOR SECTION C: [37]**

**SECTION D**  
**CIRCULAR MEASUREMENT**  
**OPTIONAL**

**QUESTION 10**

10.1 Complete the table.

Degrees		$225^\circ$	
Radians	$\frac{\pi}{2}$		$\pi$

(3)

10.2 Convert

10.2.1  $78,4^\circ$  to radians.

(2)

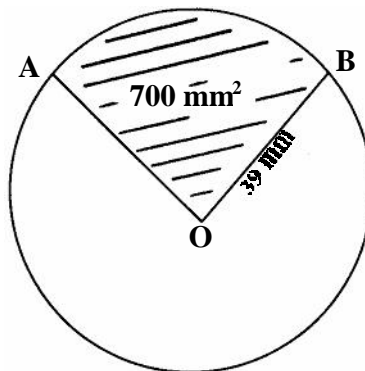
10.2.2 4,91 radians to degrees.

(2)

[7]

**QUESTION 11**

In the sketch O is the centre of the circle with  $BO = 39 \text{ mm}$  and the area of the sector AOB is  $700 \text{ mm}^2$ .



Use the formula  $\text{Area} = \frac{1}{2} r^2 \theta$  and determine the enclosed angle  $\hat{A}OB$  in degrees and radians.

[5]



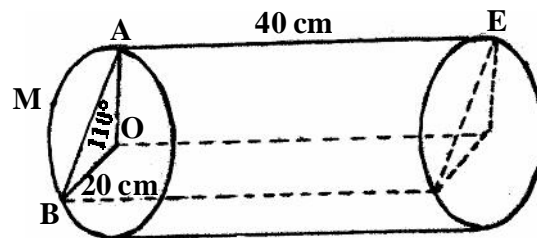
### QUESTION 12

The wheel of a bicycle, with radius 0,41 m, rotates at 3 revolutions per second.

- 12.1 Use  $\omega = 2\pi f$  and calculate the angular velocity in rad/sec. (2)
- 12.2 Use  $v = \omega r$  and calculate the circumference velocity in m/s. (2)
- 12.3 Calculate the distances that the bicycle travels in 30 sec with  $S = vt$ . (2)
- [6]**

### QUESTION 13

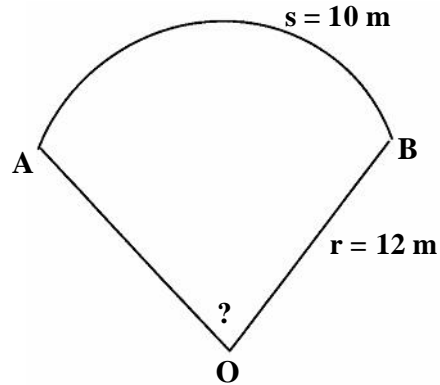
In the figure below  $O$  is the centre with radius 20 cm and  $AE$  the length of the cylinder 40 cm.  $\widehat{AOB} = 110^\circ$  with  $M$  on the circumference of the circle.



- 13.1 Convert  $110^\circ$  to radians. (2)
- 13.2 Use the formula  $s = r\theta$  and calculate the length of arc  $AMB$ . (3)
- 13.3 Use the formula  $\text{Area} = \frac{1}{2} r^2 (\theta - \sin \theta)$  and calculate the area of segment  $AMB$ . (4)
- 13.4 Calculate the volume of segment  $AMB$  of the cylinder. (3)
- [12]**

**QUESTION 14**

In the figure, the arc is 10 m and the radius is 12 m.



14.1 Use the formula  $s = r\theta$  and prove that  $\hat{A}OB$  is  $47,8^\circ$ . (4)

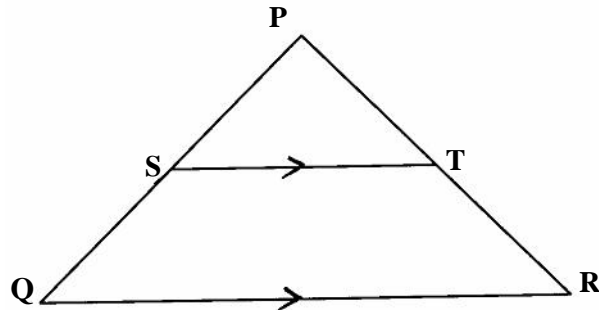
14.2 Determine the area with formula  $\text{Area} = \frac{1}{2}rs$ . (3)  
[7]

**TOTAL FOR SECTION D: [37]**

SECTION E  
RATIO, PROPORTION AND SIMILARITY  
OPTIONAL

QUESTION 15

15.1 In the accompanying diagram  $ST \parallel QR$ .

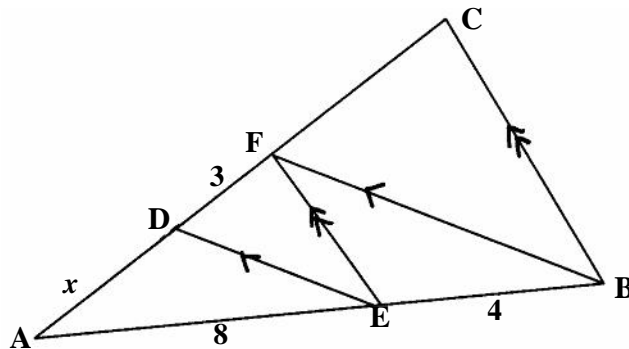


Complete:

15.1.1  $\frac{PS}{\dots} = \frac{\dots}{TR}$  (2)

15.1.2  $\frac{\dots}{PS} = \frac{PR}{\dots}$  (2)

15.2 In  $\triangle ABC$   $DE \parallel FB$ ,  $FE \parallel CB$ ,  $AE = 8$  cm,  $AD = x$ ,  $EB = 4$  cm and  $DF = 3$  cm.



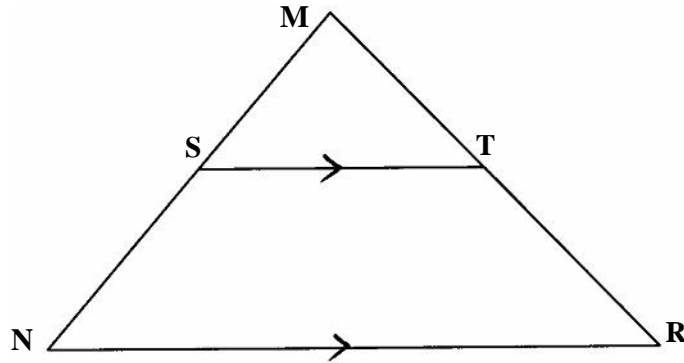
15.2.1 Calculate  $x$ . (5)

15.2.2 Calculate the length of  $FC$  if  $x = 6$  cm. (5)

[14]

**QUESTION 16**

In  $\triangle MNR$   $ST \parallel NR$ ,  $MS = 9$  cm,  $MN = 15$  cm and  $MR = 25$  cm.



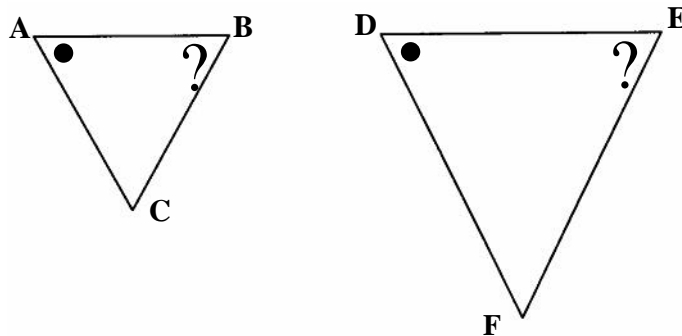
Calculate

16.1 the length of  $MT$ . (5)

16.2 the length of  $TR$ . (1)

**[6]**

**QUESTION 17**



In  $\triangle ABC$  and  $\triangle DEF$   $\hat{A} = \hat{D}$  and  $\hat{B} = \hat{E}$ .

Complete:

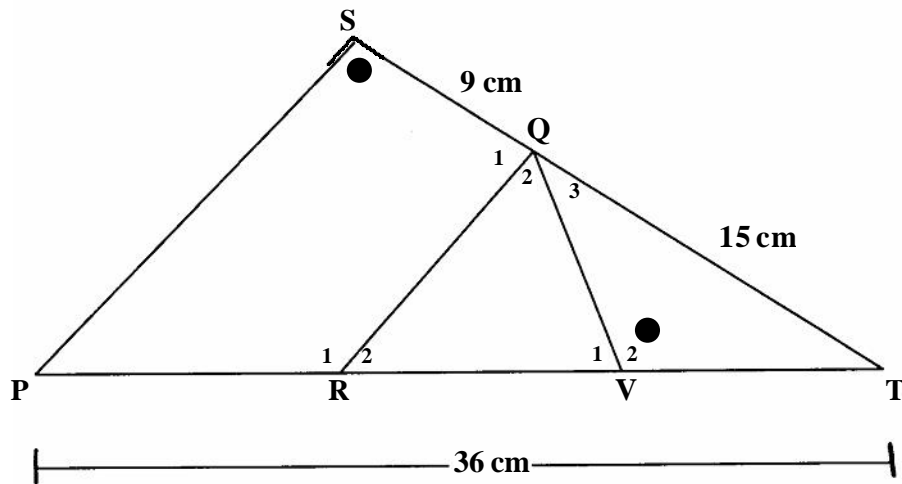
17.1  $\hat{C} = \dots$  (1)

17.2  $\triangle ABC \dots \triangle DEF$  (1)

17.3  $\frac{AB}{\dots} = \frac{BC}{DF} = \dots$  (3)

**[5]**

QUESTION 18



In  $\triangle SPT$ ,  $QR \parallel SP$ ,  $\hat{V}_2 = \hat{S}$ ,  $SQ = 9$  cm,  $QT = 15$  cm and  $PT = 36$  cm.

18.1 Show that  $\triangle TVQ \parallel \triangle TSP$ . (3)

18.2 Calculate

18.2.1 the length of  $TV$ . (4)

18.2.2 the length of  $TR$ . (4)

18.2.3 the length of  $VR$ . (1)

[12]

**TOTAL FOR SECTION E: [37]**

**SECTION F**  
**STATISTICS**  
**OPTIONAL**

**QUESTION 19**

South Africa has eleven official languages. About four out of ten people speak either isiZulu or isiXhosa as a home language, while Afrikaans and English are widely used as second languages. English is commonly used in education and the business sector.

<b>Home Languages</b>	
Afrikaans	13,3%
English	8,2%
IsiNdebele	1,6%
IsiXhosa	17,6%
IsiZulu	23,8%
Sepedi	9,3%
Sesotho	7,9%
Setswana	8,2%
SiSwati	2,7%
Tshivenda	2,3%
Xitsonga	4,5%
Other	0,5%

- 19.1 Which language is most used as a home language? (1)
- 19.2 Which official language is least used as a home language? (1)
- 19.3 Which percentage (%) of people speak IsiZulu more than IsiNdebele? (2)
- 19.4 Which two home languages differ the least in percentage? (2)
- 19.5 Name THREE "other" languages that are used as a home language. (3)
- 19.6 Arrange the home languages from the least to the most in percentage and determine then which home language represents the median. (3)
- 19.7 More people speak IsiZulu as a home language than those who speak either Afrikaans or English. What percentage more? (2)

**[14]**

**QUESTION 20**

A survey was conducted at a school to determine the learners' weekly allowance from their parents. The information was collected from 25 learners.

Weekly allowance				
R10	R15	R10	R10	R45
R15	R20	R25	R40	R18
R12	R25	R18	R30	R20
R15	R10	R15	R25	R16
R35	R12	R15	R12	R20

- 20.1 Rearrange the information in ascending order. (1)
- 20.2 Write down the mode of the information. (1)
- 20.3 Calculate the average allowance a learner gets per week. (3)
- 20.4 Determine the median, the first and third quartile of the information. (3)
- 20.5 Calculate the standard deviation, rounded off to one decimal digit. Make use of the following formula:

$$s = \sqrt{\frac{\sum x^2 - nx^2}{n-1}}$$
(5)

- 20.6 Use the above information and complete the following table in your answer book.

INTERVAL	SCORE	FREQUENCY	CUMULATIVE FREQUENCY
10 – 14			
15 – 19			
20 – 24			
25 – 29			
30 – 34			
35 – 39			
40 – 44			
45 – 49			

- (5)
- 20.7 Draw a cumulative frequency curve on the graph paper supplied. (5)

**[23]**

**TOTAL FOR SECTION F: [37]**

**TOTAL: 150**

**INFORMATION SHEET / INLIGTINGSBLAD**

**1. CO-ORDINATE GEOMETRY /  
 KOÖRDINAA TMEETKUNDE**

$$M_{(x;y)} = \left( \frac{x_A + x_B}{2}, \frac{y_A + y_B}{2} \right)$$

$$d_{AB} = \sqrt{(x_B - x_A)^2 + (y_B - y_A)^2}$$

$$m_{AB} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

$$\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\frac{x}{a} + \frac{y}{b} = 1$$

$$x^2 + y^2 = r^2$$

**4. CONSUMER MATHEMATICS /  
 VERBRUIKERSWISKUNDE**

$$I = \frac{krt}{100}$$

$$A = P \left( 1 + \frac{r}{100} \right)^n$$

**5. STATISTICS / STATISTIEK**

$$S = \sqrt{\frac{\sum x^2 - nx^2}{n-1}}$$

$$? = \sqrt{\frac{\sum x^2 - N\mu^2}{N}}$$

**2. TRIGONOMETRY /  
 TRIGONOMETRIE**

For any ? ABC: / Vir enige ? ABC:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

$$\text{Area / Oppervlakte } ?ABC = \frac{1}{2} a \cdot b \cdot \sin C$$

**3. CIRCULAR MEASUREMENT /  
 BOOGMAAT**

$$S = r ?$$

$$A = \frac{1}{2} r^2 ?$$

$$A = \frac{1}{2} rs$$

$$V = r ?$$

$$? = 2pf$$

$$A = \frac{1}{2} r^2 (? - \sin ?)$$

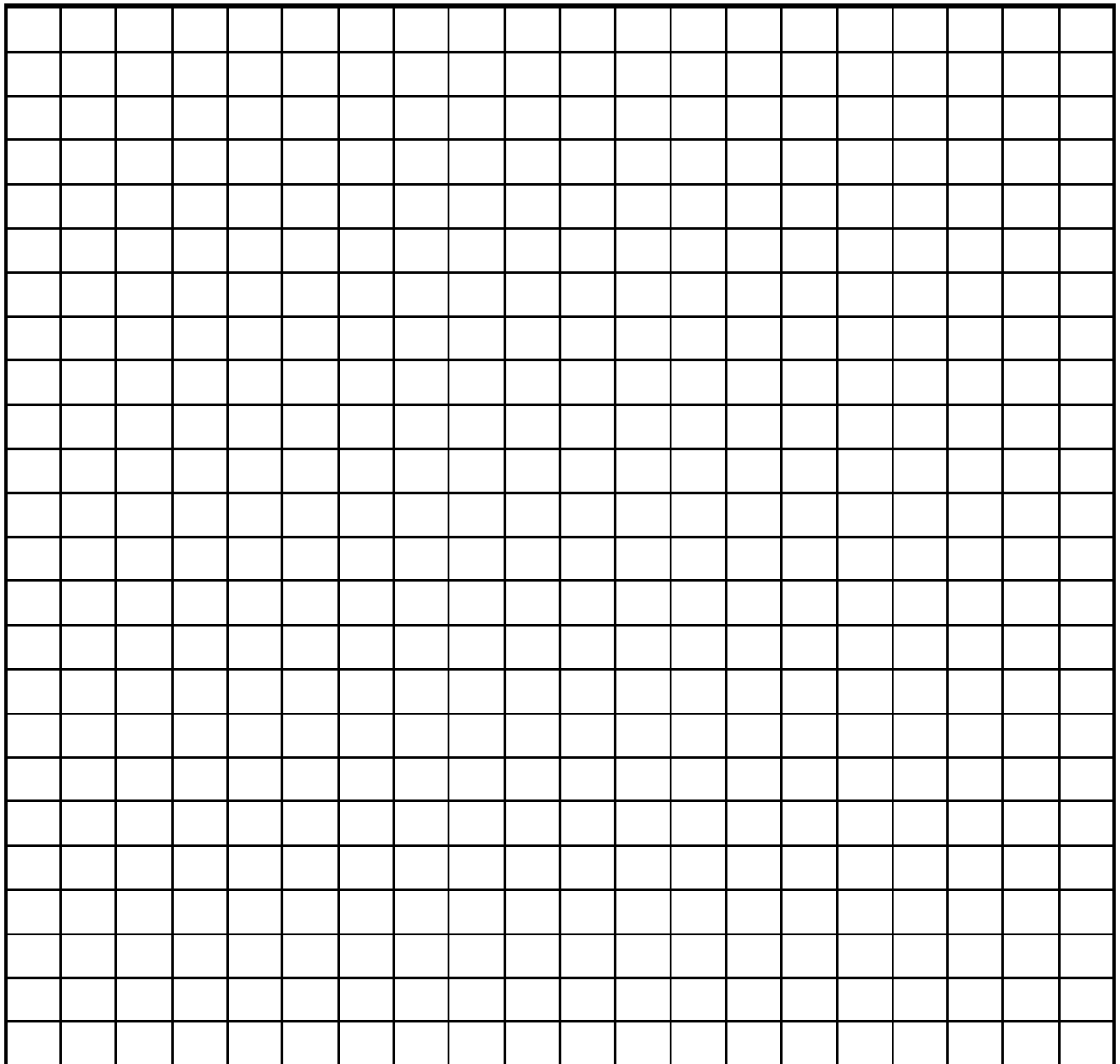


**INSTRUCTION / INSTRUKSIE**

- Use this graph paper for Question 8.3 and place it at the back of your answer book.
- *Gebruik hierdie grafiekpapier vir Vraag 8.3 en plaas dit agter in jou antwoordboek*

**EXAMINATION NUMBER /**  
**EKSAMENOMMER**

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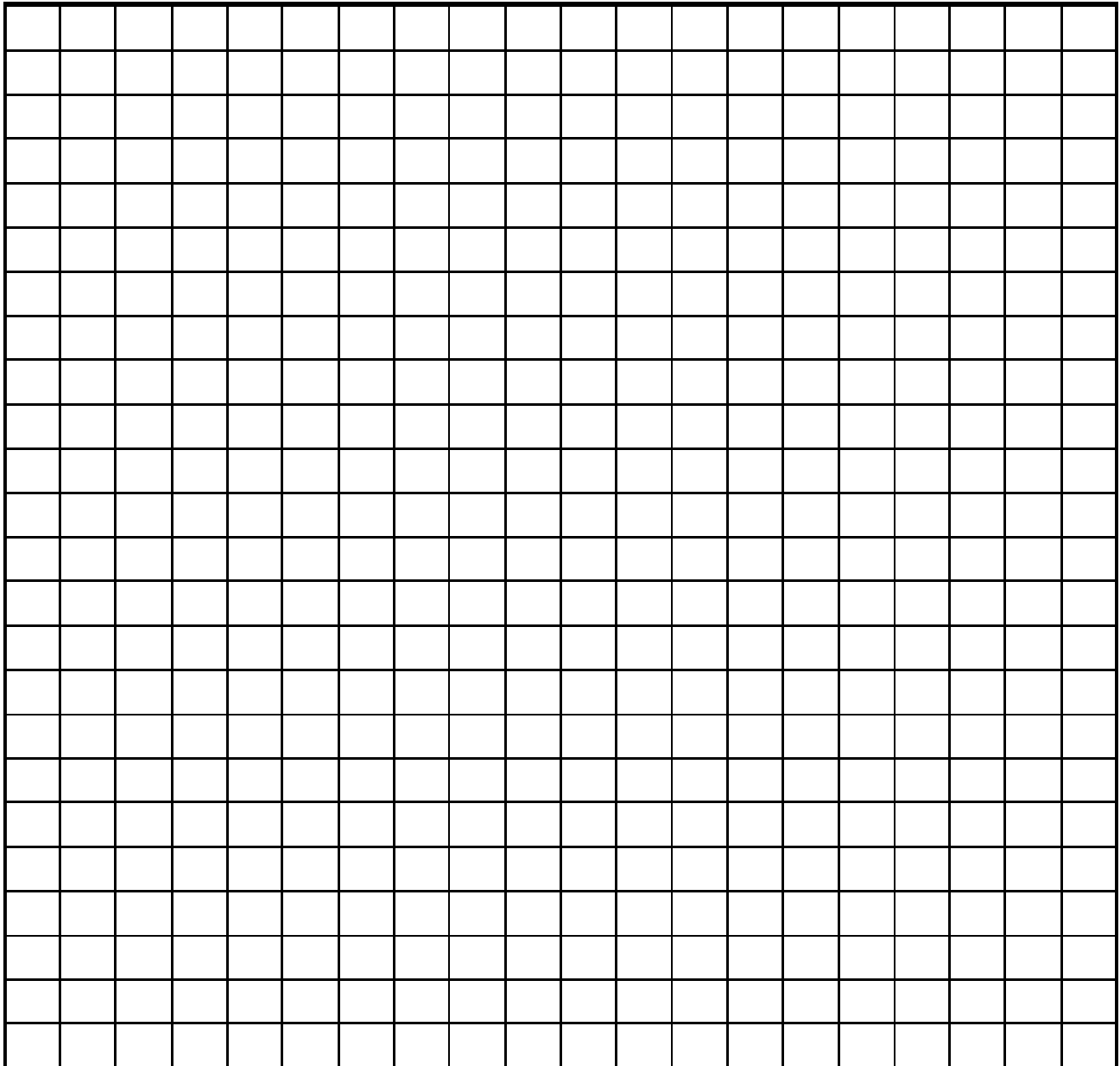


**INSTRUCTION / INSTRUKSIE**

- Use this graph paper for Question 9.2 and place it at the back of your answer book.
- *Gebruik hierdie grafiekpapier vir Vraag 9.2 en plaas dit agter in jou antwoordboek.*

**EXAMINATION NUMBER /**  
**EKSAMENNUMMER**

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**INSTRUCTION / INSTRUKSIE**

- Use this graph paper for Question 20.7 and place it at the back of your answer book.
- *Gebruik hierdie grafiekpapier vir Vraag 20.7 en plaas dit agter in jou antwoordboek*

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**EKSAMENNUMMER**

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