

GAUTENG DEPARTMENT OF EDUCATION  
SENIOR CERTIFICATE EXAMINATION

FUNCTIONAL MATHEMATICS SG  
(Second Paper: Geometry)

FEB / MAR 2006

TIME: 3 hours

MARKS: 150

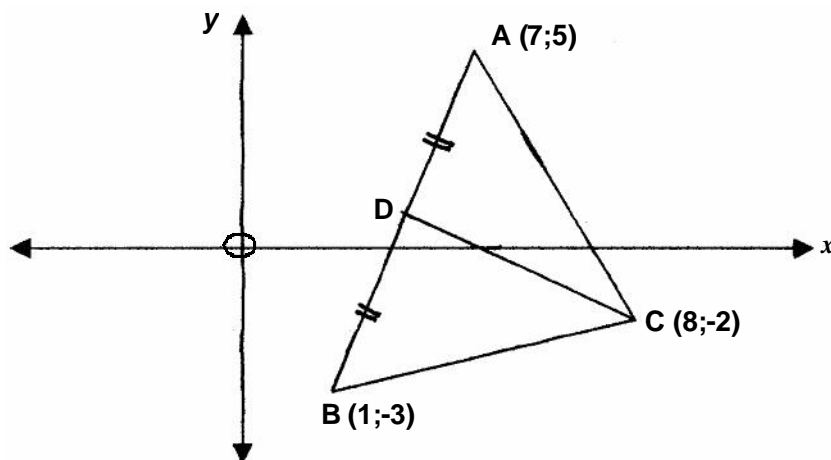
**INSTRUCTIONS:**

- 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, then 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



A (7 ; 5), B (1 ; -3) and C (8 ; -2) are the vertices of  $\triangle ABC$ . D is the midpoint of AB.

Determine:

- 1.1 The length of AB (4)
- 1.2 The coordinates of D (4)
- 1.3 The gradient of AC (3)
- [11]**

**QUESTION 2**

Prove that A (2 ; -4); B (4 ; -3) and C (-2 ; -6) are points in the same straight line (are collinear). **[5]**

**QUESTION 3**

Calculate the value(s) of m, if (-4 ; m) lies on the circumference of a circle with equation  $x^2 + y^2 = 20$ . **[5]**

**QUESTION 4**

Calculate the equation of the straight line parallel to  $3y - 12x = 15$  and passing through the point (1 ; 2). **[5]**

**QUESTION 5**

- 5.1 Determine the equation of a circle with the origin as the centre and passing through the point (-3 ; 2). (4)
- 5.2 Calculate the coordinates of the point(s) of intersection of the circle  $x^2 + y^2 = 26$  and the straight line with equation  $y = -5x$ . (8)
- [12]**

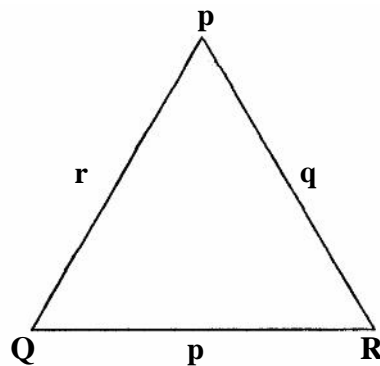
**TOTAL FOR SECTION A: [38]**

SECTION B

TRIGONOMETRY  
COMPULSORY

QUESTION 6

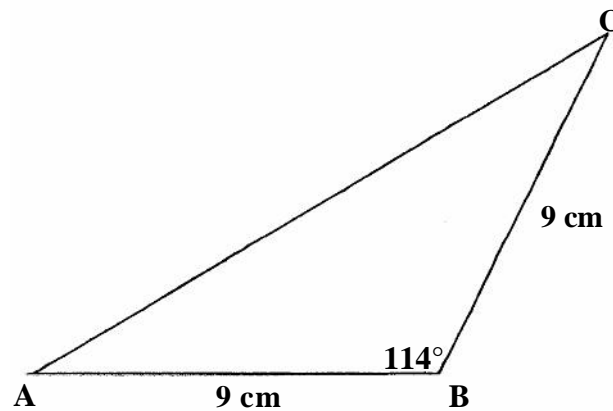
6.1 Complete the following for  $\triangle PQR$ :



6.1.1  $r^2 = \dots + \dots - 2pq \cos R$  (2)

6.1.2 The area of  $\triangle PQR = \frac{1}{2} pq \dots$  (1)

6.2



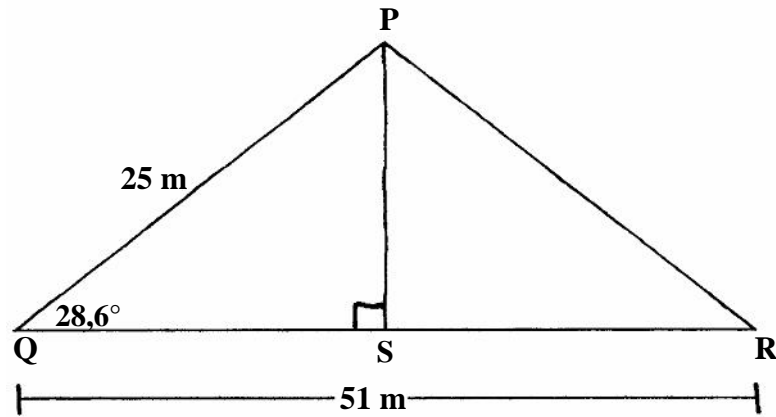
In  $\triangle ABC$ ,  $AB = BC = 9 \text{ cm}$  and  $\hat{B} = 114^\circ$ . Calculate, rounded off to one decimal,

6.2.1 the length  $AC$ . (5)

6.2.2 the area of  $\triangle ABC$ . (3)

[11]

QUESTION 7



In  $\triangle PQR$   $PQ = 25$  m,  $QR = 51$  m and  $\hat{PQR} = 28,6^\circ$ .

7.1 Calculate the following, rounded off to 2 decimal digits:

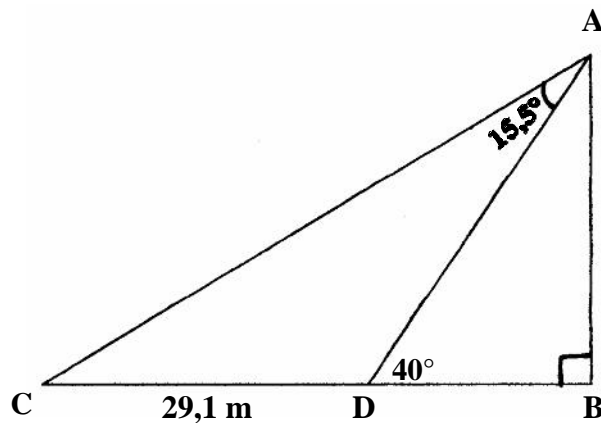
7.1.1 The distance between P and R. (5)

7.1.2 The length of PS. (4)

7.2 Calculate the size of  $\hat{QPR}$  if  $\hat{QPR} > 90^\circ$  and  $PR = 31,4$  m, rounded off to the nearest degree. (5)

[14]

QUESTION 8



In the figure, AB represents a vertical tower and the points C and D lie in the same horizontal plane as B, the foot of the tower. B, D and C lie in a straight line.

If  $CD = 29,1$  m,  $\hat{CAD} = 15,5^\circ$  and  $\hat{ADB} = 40^\circ$ , calculate each of the following, rounded off to one decimal digit:

- 8.1 The size of  $\hat{C}$  (1)
  - 8.2 The length of AD (4)
  - 8.3 The height of the tower AB, if  $AD = 45,2$  m (4)
  - 8.4 The size of  $\hat{BAD}$  (1)
  - 8.5 The area of  $\triangle ABD$  if  $AB = 29,1$  m (3)
- [13]**

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

SECTION C

**CONSUMER MATHEMATICS  
 OPTIONAL**

**QUESTION 9**

Use the following annual Tax table to answer the questions.

R 0	-	5 000	17% of each R 1
R 5 000	-	10 000	R 850 + 19% of the amount over R 5 000
R 10 000	-	15 000	R 1 800 + 21% of the amount over R 10 000
R 15 000	-	20 000	R 2 850 + 24% of the amount over R 15 000
R 20 000	-	30 000	R 4 050 + 28% of the amount over R 20 000
R 30 000	-	40 000	R 6 850 + 36% of the amount over R 30 000
R 40 000	-	50 000	R 10 450 + 38% of the amount over R 40 000

A person earns a monthly salary of R3 950,00.

- 9.1 Determine the person's yearly salary. (1)
  - 9.2 Determine the total amount of tax payable at the end of the year. (4)
  - 9.3 Determine the monthly amount of tax payable. (1)
- [6]**

**QUESTION 10**

The inflation rate is 8% per year.

10.1 Complete the following table:

<b>Price in 2004</b>	<b>R100</b>	<b>R150</b>	<b>R200</b>	<b>R250</b>
<b>Price in 2005</b>				

(4)

10.2 Represent the data in Question 10.1 graphically.

(3)

10.3 Use your graph to determine the following and show on your graph where the answer is read off.

10.3.1 If the price of an object in 2004 is R180, determine the price in 2005. (Use A).

(2)

10.3.2 If the price of an object in 2005 is R240, determine the price in 2004. (Use B).

(2)

**[11]**

**QUESTION 11**

R28 000,00 was invested at a compounded interest rate of 14%. The rate is compounded half-yearly.

11.1 Show that the following formula may be used for  $n$  years

$$A = 28\,000 [1,07]^{2n} \quad (5)$$

11.2 Complete the following table:

<b>Time</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>A</b>	32 057				

(4)

11.3 Represent the data in Question 11.2 graphically.

(3)

11.4 Use your graph to determine the following and show on your graph where the answer was read off.

11.4.1 Determine the value of the investment after 42 months (Use A).

(2)

11.4.2 Determine the time it would take for the investment to grow to R51 500 (Use B).

(2)

11.5 Determine the total amount available after 5 years if the investment was at a simple rate.

(4)

**[20]**

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

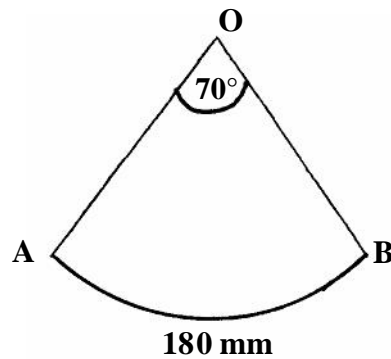
SECTION D

**CIRCULAR MEASUREMENT  
OPTIONAL**

**QUESTION 12**

- 12.1 Complete:  $57,3^\circ = \dots\dots$  radians. (1)
- 12.2 Convert  $29,6^\circ$  to radians. (2)
- 12.3 Convert 2,41 radians to degrees. (2)
- 12.4 Without using a calculator, convert
- 12.4.1  $\frac{1}{6}\pi$  rad to degrees. (2)
- 12.4.2  $120^\circ$  to radians. (2)
- [9]

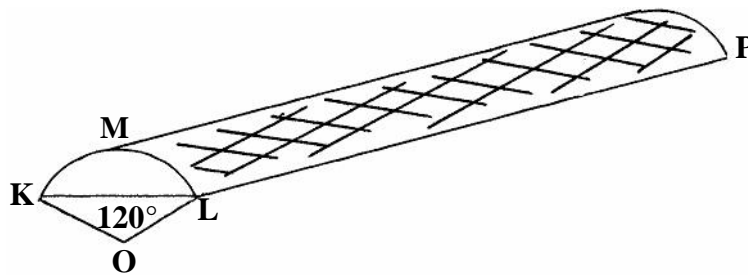
**QUESTION 13**



The weight of a pendulum of a clock swings through a distance of 180 mm while turning through an angle of  $70^\circ$ .

- 13.1 Convert  $70^\circ$  to radians. (2)
- 13.2 Use the formula  $s = r\theta$  and calculate the length of the pendulum. (3)
- 13.3 Use the formula  $A = \frac{1}{2}r^2\theta$  and calculate the area of AOB if the radius is 148 mm. (3)
- [8]

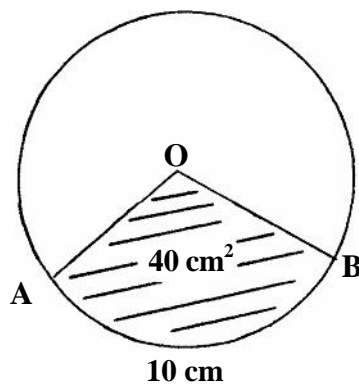
QUESTION 14



The sketch shows a chocolate log which is 125 mm long. Segment KLM is a cross-section thereof. The radius of the circle is 30 mm and the angle at the centre is  $120^\circ$ .

- 14.1 Convert  $120^\circ$  to radians. (2)
- 14.2 Use the formula  $A = \frac{1}{2}r^2(\theta - \sin\theta)$  and calculate the area of KLM. (4)
- 14.3 Calculate the volume of the chocolate log. (3)
- [9]

QUESTION 15



If the area of the figure is  $40 \text{ cm}^2$  and the arc length is 10 cm, use the formula  $A = \frac{1}{2}rs$  and calculate the radius of the figure.

[4]



**QUESTION 16**

- 16.1 A wheel turns at 35 revolutions per second. Use the formula  $\omega = 2\pi f$  to determine the angular velocity of the wheel in radians per second. (2)
- 16.2 If the wheel has a diameter of 42 cm and the angular velocity is 219,9 rad/sec calculate:
- 16.2.1 The radius in metres (2)
- 16.2.2 The circumference velocity in m/s by using the formula  $v = \omega r$  (3)
- [7]

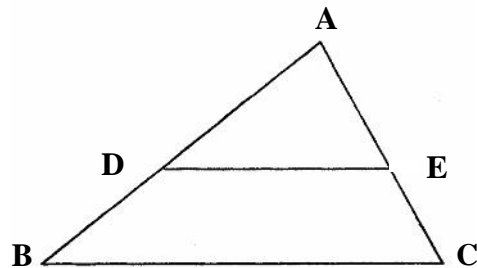
**TOTAL FOR SECTION D: [37]**

**SECTION E**

**RATIO, PROPORTION AND SIMILARITY  
OPTIONAL**

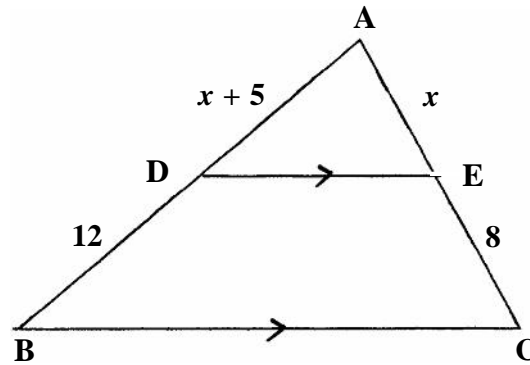
**QUESTION 17**

17.1



- 17.1.1 Complete the following theorem:  
If a line cuts two sides of a triangle as to divide them in the same ratio, then that line is \_\_\_\_\_ to the third side of the triangle. (1)
- 17.1.2 Write down one proportionality that applies to the above diagram, if  $DE \parallel BC$ .  
..... = ..... (2)
- .....

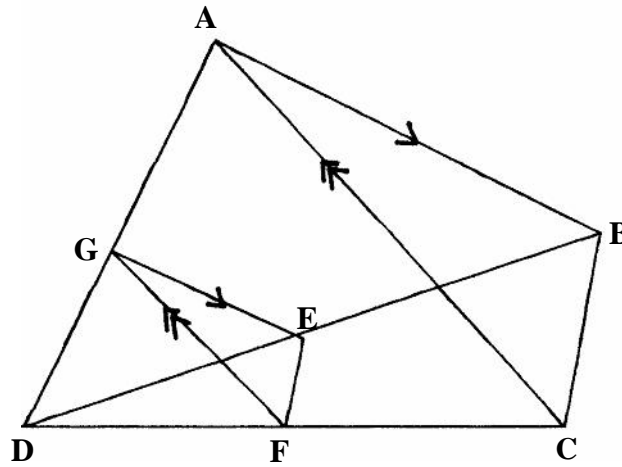
17.2



In the figure,  $AD = x + 5$ ,  $DB = 12$  cm,  $AE = x$ ,  $EC = 8$  cm,  $DE \parallel BC$ .  
Calculate

- 17.2.1 the value of  $x$ . (4)
- 17.2.2 the length of  $AB$ . (1)
- [8]

QUESTION 18



In the figure  $G$  and  $F$  are respectively points on  $AD$  and  $DC$  of quadrilateral  $ABCD$  such that  $GE \parallel AB$  with  $E$  on  $BD$  and  $GF \parallel AC$ .

- 18.1 In  $\triangle ABD$ :  $\frac{AG}{GD} = \dots$  (2)
- 18.2 In  $\triangle ACD$ :  $\frac{AG}{GD} = \dots$  (2)

18.3 What can be derived from Questions 18.1 and 18.2?

$$\begin{aligned} BE &= \dots \\ \dots &= FD \end{aligned} \quad (2)$$

18.4 From Question 18.3 it follows that  $BC \dots EF$ . (1)

18.5 If  $\frac{DE}{BE} = \frac{3}{5}$ ,  $DG = 9$  cm and  $DC = 16$  cm, calculate the length of the following:

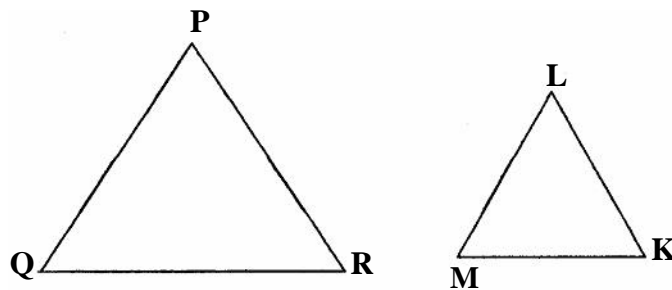
18.5.1  $FC$  (3)

18.5.2  $AG$  (3)

**[13]**

### QUESTION 19

19.1 In the figure below,  $\triangle PQR \parallel \triangle KLM$ .



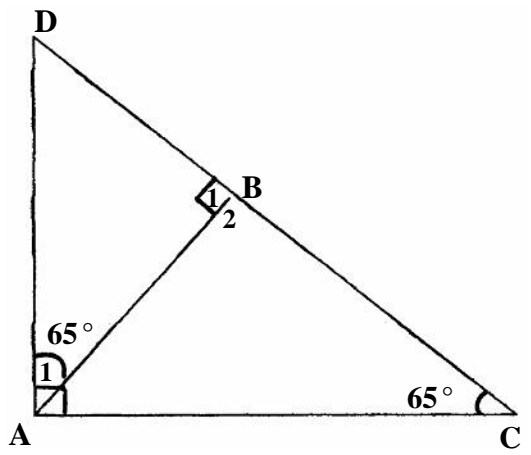
Complete: 19.1.1  $\hat{P} = \dots$  (1)

19.1.2  $\hat{Q} = \dots$  (1)

19.1.3  $\dots = \hat{M}$  (1)

19.1.4  $\frac{PQ}{KL} = \frac{QR}{\dots} = \frac{\dots}{MK}$  (2)

19.2



DAC is a right-angled triangle with  $AB \perp CD$ .  $\hat{A}_1 = \hat{C} = 65^\circ$ .

19.2.1 Name, with reasons, 3 pairs of **angles** which are equal in  $\triangle ACD$  and  $\triangle BAD$ . (3)

19.2.2 If  $\triangle ACD \sim \triangle BAD$ , complete the following proportional ity:

$$\frac{AC}{BA} = \frac{\dots}{AD} = \frac{AD}{\dots} \quad (2)$$

19.2.3 If  $AD = 8$  cm,  $AB = 6$  cm and  $BD = 4$  cm, calculate:

- (a) The length of AC (3)
- (b) The length of CB (let  $CB = x$ ) (3)

**[16]**

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

**SECTION F**

**QUESTION 20**

**STATISTICS**  
**OPTIONAL**

The areas of the 9 provinces of the Republic of South Africa are as follows:

<b>PROVINCE</b>	<b>AREA IN KM<sup>2</sup></b>
Free State	129 480
Mpumalanga	79 490
Western Cape	129 370
North-West	116 320
Gauteng	17 010
KwaZulu-Natal	92 100
Eastern Cape	169 558
Limpopo	123 910
Northern Cape	361 830

- 20.1 Which province is the smallest? (1)
- 20.2 Which province is the biggest? (1)
- 20.3 Determine the range of the data. (3)
- 20.4 Which 2 provinces are nearly equal in size? (1)
- 20.5 Calculate the total area of the Republic of South Africa. (1)
- 20.6 Calculate the arithmetic mean of the areas of the 9 provinces, rounded off to 1 decimal digit. (3)
- 20.7 Rearrange the provinces from the smallest in area to the largest in area and determine which province represents the median. (3)
- 20.8 How many square kilometres is the Northern Cape bigger than the Free State, North-West and KwaZulu-Natal added together? (2)

**[15]**

**QUESTION 21**

The water consumption (in kilolitres) of 30 households are as follows:

14,7   18,6   34,5   40,1   23,7   18,9   12,4   10,9   20,0   26,9  
 42,0   28,7   15,1   23,8   38,4   23,7   19,7   25,3   34,9   22,0  
 26,8   27,4   19,7   36,5   31,8   33,6   31,1   37,7   20,9   22,4

- 21.1 Rearrange the data in ascending order. (1)
- 21.2 Write down the mode of the data. (1)
- 21.3 Calculate the arithmetic mean of the water consumption of the 30 households. (3)
- 21.4 Determine the first and third quartile of the data. (2)
- 21.5 Calculate the standard deviation of the data, rounded off to 1 decimal digit, making use of the following formula:

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

(6)

21.6 Use the given data and complete the following table in your answer book.

INTERVAL	SCORE	FREQUENCY	CUMULATIVE FREQUENCY	CUMULATIVE PERCENTAGE
10 - 14,9				
15 - 19,9				
20 - 24,9				
25 - 29,9				
30 - 34,9				
35 - 39,9				
40 - 44,9				

(6)

21.7 Use the graph paper supplied to draw a histogram of the frequencies. (3)  
 [22]

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

**TOTAL: 150**

**INFORMATION SHEET / INLIGTINGSBLAD**

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

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

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

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

$$y = mx + c$$

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

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

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

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

**4. CONSUMER MATHEMATICS /  
VERBRUIKERSWISKUNDE**

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

**5. STATISTICS / STATISTIEK**

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

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

**2. TRIGONOMETRY /  
TRIGONOMETRIE**

For any  $\triangle ABC$ : / Vir enige  $\triangle ABC$ :

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

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

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

**3. CIRCULAR MEASUREMENT /  
BOOGMAAT**

$$S = r^2 \theta$$

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

$$A = \frac{1}{2} r s$$

$$v = r \omega$$

$$\theta = 2\pi p$$

$$\theta = \frac{\theta}{t}$$

$$\theta = 2\pi f$$

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

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

$$S = \sqrt{\frac{\sum fx^2 - (fx)^2}{N}}$$

<b>FUNCTIONAL MATHEMATICS SG</b> <b>(Second Paper)</b> <b>FUNKSIONELE WISKUNDE SG</b> <b>(Tweede Vraestel)</b> <b>303-2/2 L</b>	<b>17</b>
--	-----------

**INSTRUCTION / INSTRUKSIE**

- Use this graph paper for Question 11.3.
- *Gebruik hierdie grafiekpapier vir Vraag 11.3.*

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

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--



**INSTRUCTION / INSTRUKSIE**

- Use this graph paper for Question 21.7.
- *Gebruik hierdie grafiekpapier vir Vraag 21.7.*

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

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--