

GAUTENG DEPARTMENT OF EDUCATION  
SENIOR CERTIFICATE EXAMINATION

OCTOBER / NOVEMBER 2005  
OKTOBER / NOVEMBER 2005

FUNCTIONAL MATHEMATICS SG  
(Second Paper: Geometry)

TIME: 3 hours

MARKS: 150

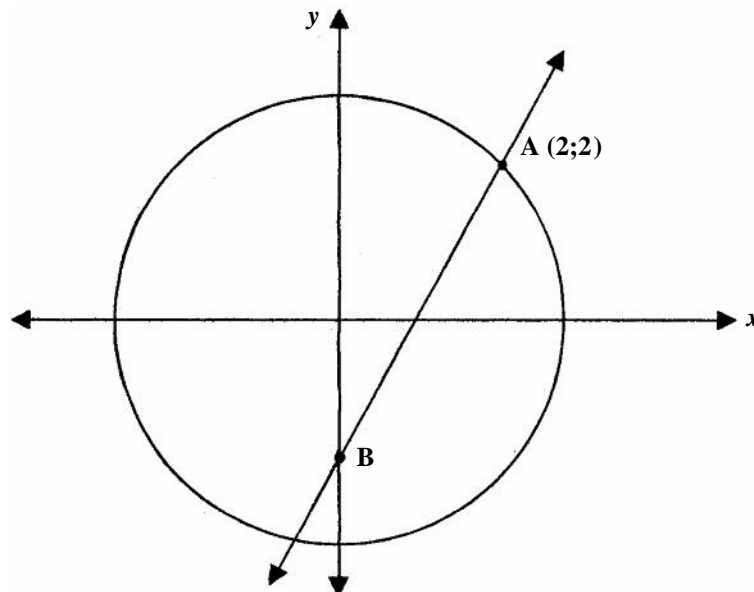
**INSTRUCTIONS:**

- 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, then the final answer must be rounded off to **TWO** decimal digits.
- All appropriate calculations must be shown.
- No answers may be determined by construction and measurement.
- A formula sheet **and** graph paper have been provided.

SECTION A

CO-ORDINATE GEOMETRY  
COMPULSORY

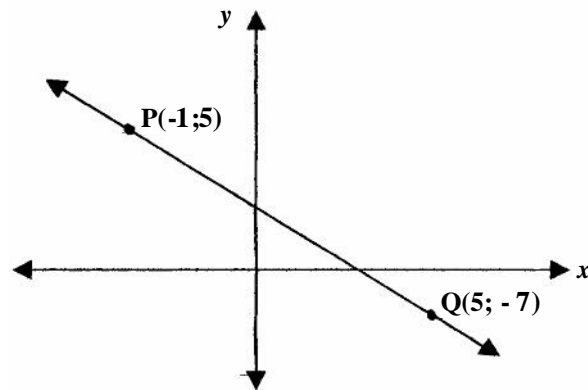
QUESTION 1



The equation of the straight line B is  $y + 2 = 2x$ . The centre of the circle is  $(0;0)$ .

- 1.1 Rewrite the equation of AB in the form  $y = mx + c$ . (1)
  - 1.2 Write down the co-ordinates of B, the y intercept of AB. (1)
  - 1.3 Determine the length of AB (leave the answer in surd form). (4)
  - 1.4 Determine the midpoint of AB. (4)
  - 1.5 Determine the equation of the circle. (5)
- [15]**

### QUESTION 2



The points  $P(-1; 5)$  and  $Q(5; -7)$  are on the straight line PQ.

- 2.1 Determine the equation of PQ in the form  $y = mx + c$  (6)
  - 2.2 Write down the gradient of PQ. (1)
  - 2.3 Determine the equation of the straight line parallel to PQ and intercepting the y axis at -3. (3)
  - 2.4 Determine the equation of the straight line perpendicular to PQ and intercepting the y axis at -1. (4)
- [14]**

### QUESTION 3

- 3.1 Calculate the co-ordinates of the point(s) of intersection of the circle  $x^2 + y^2 = 5$  and the straight line  $y = 5 - 2x$ . (8)
- 3.2 Is  $y = 5 - 2x$  a tangent to the circle? Give a reason for your answer. (1)

[9]

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

### SECTION B

### TRIGONOMETRY COMPULSORY

### QUESTION 4

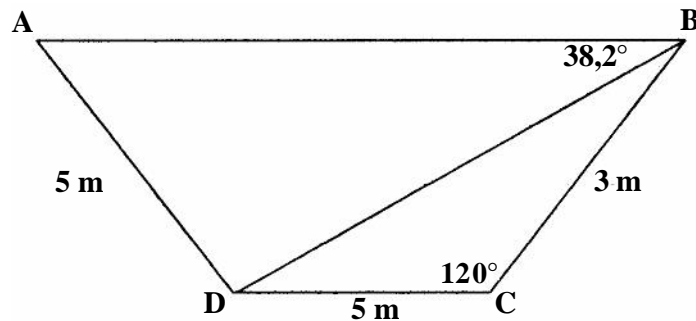
- 4.1 Complete for any  $\triangle PQR$  :

4.1.1  $\frac{\sin P}{\dots\dots} = \frac{\sin R}{\dots\dots} = \frac{\dots\dots}{q}$  (3)

4.1.2  $q^2 = p^2 + r^2 - \dots\dots \cos Q$  (1)

4.1.3 The area of  $\triangle PQR = \frac{1}{2} \dots\dots \sin P$  (1)

- 4.2

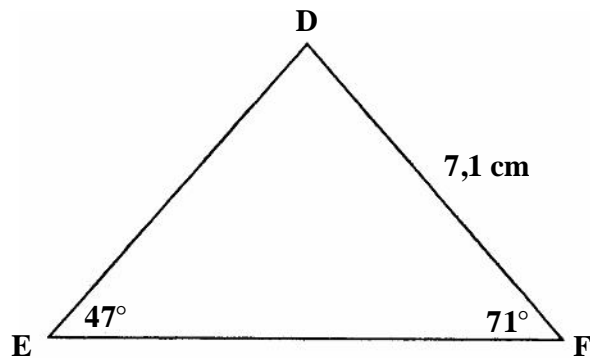


The figure ABCD is a quadrilateral with  $DC = 5$  m,  $BC = 3$  m,  $AD = 5$  m,  $\hat{A}BD = 38,2^\circ$  and  $\hat{B}CD = 120^\circ$ .

- 4.2.1 Calculate the length of BD. (5)
- 4.2.2 Calculate the size of  $\hat{A}$  if  $BD = 7$  m, rounded off to the nearest degree. (5)
- 4.2.3 Calculate the area of  $\triangle BCD$ , rounded off to 1 decimal digit. (3)

[18]

QUESTION 5



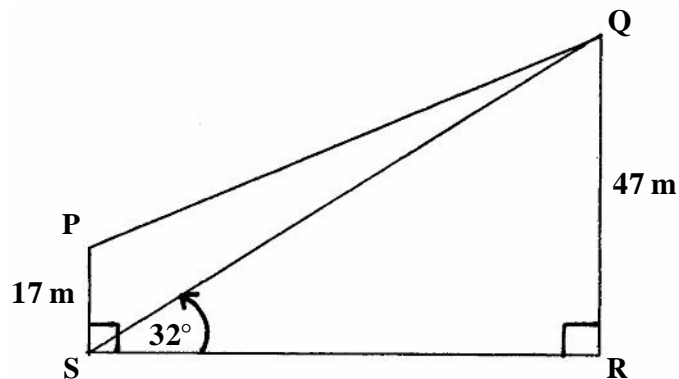
In the figure,  $\hat{D}EF = 47^\circ$ ,  $\hat{D}FE = 71^\circ$  and  $DF = 7,1$  cm.

Calculate the following, rounded off to two decimal digits:

- 5.1 The length of DE (4)
  - 5.2 The size of  $\hat{D}$  (2)
  - 5.3 The area of  $\triangle DEF$ , if  $DE = 9,18$  cm (3)
- [9]

QUESTION 6

In the figure, PS and QR are perpendicular to SR.  
Furthermore  $\hat{Q}SR = 32^\circ$ ,  $PS = 17$  m and  $QR = 47$  m.



- 6.1 Show that  $SQ = 88,69$  m. (4)
- 6.2 Calculate the size of  $\hat{P}SQ$ . (2)

- 6.3 Calculate the length of PQ, rounded off to two decimal digits. (5)  
[11]

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

**SECTION C**

**CONSUMER MATHEMATICS  
OPTIONAL**

**QUESTION 7**

Use the following Tax table to answer the questions.

R 0 - 5 000	17% of each R1
R 5 000 - 10 000	R 850 + 19% of the amount over R 5 000
R10 000 - 15 000	R 1 800 + 21% of the amount over R10 000
R15 000 - 20 000	R 2 850 + 24% of the amount over R15 000
R20 000 - 30 000	R 4 050 + 28% of the amount over R20 000
R30 000 - 40 000	R 6 850 + 36% of the amount over R30 000
R40 000 - 50 000	R10 450 + 38% of the amount over R40 000

Mrs Y is appointed in January 2004 at a monthly salary of R3 200,00. At the end of 2004 she receives an increase in salary of 18%.

- 7.1 Determine her total tax amount payable at the end of 2004. (4)
- 7.2 Determine her total tax amount payable at the end of 2005. (4)  
[8]

**QUESTION 8**

An amount of R28 450,00 is invested at 8,5% simple interest.

- 8.1 Complete the following table:

<b>Year</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Interest</b>	2 418				

- 8.2 Represent the data in Question 8.1 graphically. (3)

- 8.3 Use your graph in Question 8.2 to determine the following and show on your graph where the answer is read off.
- 8.3.1 Determine the interest after 33 months. ( Use A). (2)
- 8.3.2 How long will it take to receive R10 800,00 interest? (Use B.) (2)
- 8.4 Calculate the total amount of money available after 10 years, use the formula  

$$I = \frac{krt}{100}$$
 (3)
- 8.5 If the same amount was invested at 8,5% compounded interest, calculate the total amount available after 10 years. (3)  
**[17]**

**QUESTION 9**

R56 000,00 was invested at a compounded interest rate of 12,8%. The rate is compounded quarterly.

- 9.1 Show that the following formula may be used in **n** years.

$$A = 56000[1,032]^{4n} \quad (5)$$

- 9.2 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>	63519				

(4)

- 9.3 Represent the data in Question 9.2 graphically. (3)  
**[12]**

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

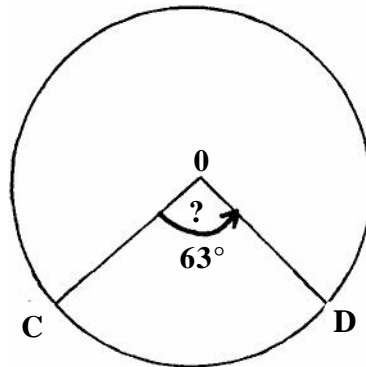
SECTION D

**CIRCULAR MEASUREMENT  
OPTIONAL**

**QUESTION 10**

- 10.1 1 rad = .....° (2)
- 10.2 Convert:
- 10.2.1 0,87 rad to degrees. (2)
- 10.2.2 23,7° to radians. (2)
- 10.2.3  $\frac{\pi}{4}$  rad to degrees, without using a calculator. (2)
- 10.2.4 135° to radians, without using a calculator. (2)
- [10]**

**QUESTION 11**



O is the centre of the circle with a diameter of 18 cm and an angle at the centre of 63°.

- 11.1 Convert 63° to radians. (2)
- 11.2 Determine the radius. (1)
- 11.3 Use the formula  $s = r\theta$  and determine the length of the arc. (3)
- 11.4 Use the formula  $A = \frac{1}{2}r^2\theta$  and determine the area of the sector (part of the circle). (3)
- [9]**

**QUESTION 12**

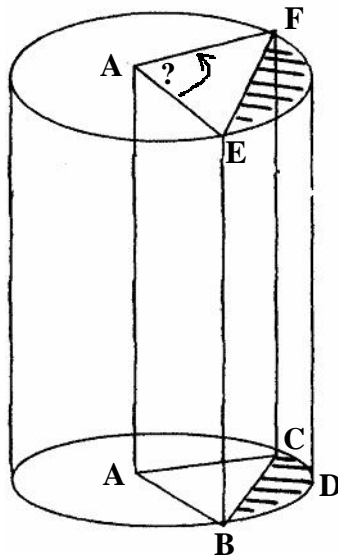
12.1 A wheel rotates at 4 revolutions per minute.

Use the formula  $\omega = 2\pi f$  and determine the angular velocity. (2)

12.2 If the radius of the wheel is 60 cm and the angular velocity is 25,1 rad/sec, use the formula  $v = \omega r$  and determine the circumference velocity in m/s. (4)

[6]

**QUESTION 13**



The figure represents a solid cylinder with a radius of 45 cm and a height of 80 cm. The arc length is 22 cm.

13.1 Use the formula  $S = r\theta$  and calculate the angle in degrees. (4)

13.2 If  $\theta = 28^\circ$ , use the formula  $A = \frac{1}{2}r^2(\theta - \sin\theta)$  and calculate the area of segment BCD. (5)

13.3 Calculate the volume of the section of the solid cylinder with base BCD. (3)

[12]

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

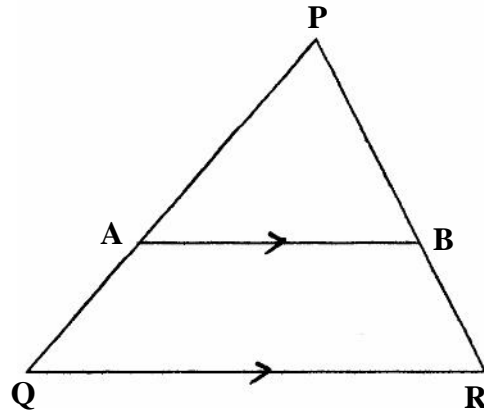


SECTION E

RATIO, PROPORTION AND SIMILARITY  
OPTIONAL

QUESTION 14

14.1



14.1.1 Complete the following theorem:

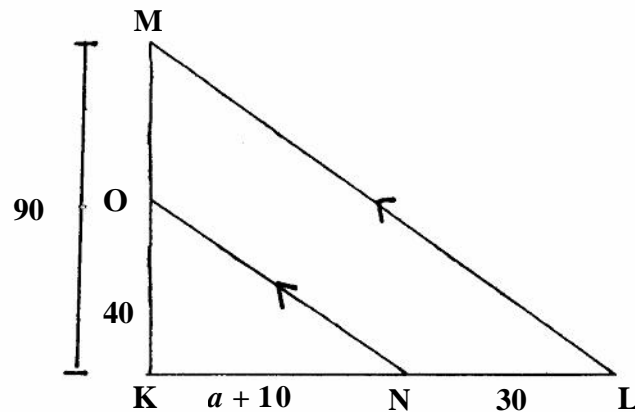
A line parallel to a side of a triangle, divides the other two sides in the same \_\_\_\_\_.

14.1.2 Write down one proportionality that applies to the above diagram.

..... = .....

..... : .....

14.2



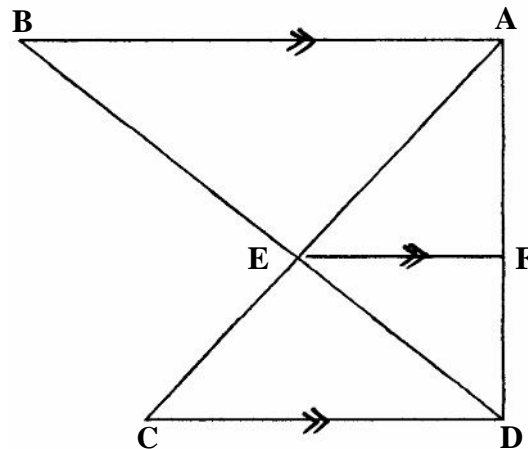
In  $\triangle KLM$ ,  $KM = 90$  cm,  $KN = a + 10$ ,  $NL = 30$  cm,  $KO = 40$  cm and  $NO \parallel ML$ .

Calculate

14.2.1 the length of OM. (1)

14.2.2 the value of a. (4)  
[8]

QUESTION 15



In the sketch,  $BA \parallel EF \parallel CD$ . Complete the following by means of the sketch.

15.1 In  $\triangle ACD$ :  $\frac{AE}{EC} = \dots$  (2)

15.2 In  $\triangle BDA$ :  $\frac{BE}{ED} = \dots$  (2)

15.3 What can be derived from Question 15.1 and 15.2?

$\frac{AE}{\dots} = \frac{\dots}{ED}$  (2)

15.4 If  $EC = 4$  cm,  $BE = 18$  cm and  $ED = 6$ , calculate the length of  $AE$ . (4)

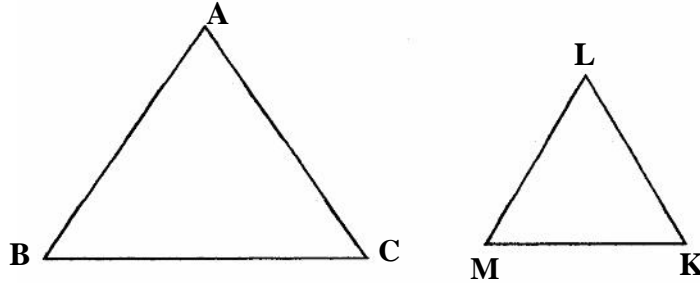
15.5 Calculate:  $\frac{AF}{DF}$  (2)

15.6 If  $AD = 32$  cm, calculate the length of  $AF$ . (3)

[15]

QUESTION 16

16.1 In the figures below,  $\triangle ABC \parallel \triangle KLM$ .



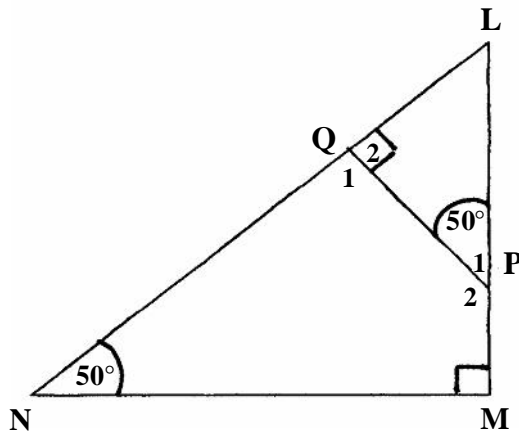
Complete: 16.1.1  $\hat{A} = \hat{\dots}$

16.1.2  $\hat{B} = \hat{\dots}$

16.1.3  $\frac{\dots}{\dots} = \hat{M}$  (3)

16.1.4  $\frac{AB}{KL} = \frac{BC}{\dots} = \frac{\dots}{MK}$  (2)

16.2



NML is a right-angled triangle with  $PQ \perp LN$ .  $\hat{N} = \hat{P}_1 = 50^\circ$ .

16.2.1 Name, with reasons, 3 pairs of **angles** which are equal in  $\triangle LQP$  and  $\triangle LMN$ . (3)

16.2.2 If  $\triangle LQP \parallel \triangle LMN$ , complete the following proportionality:

$$\frac{LQ}{LM} = \frac{\dots}{LN} = \frac{MN}{\dots} \quad (2)$$

- 16.2.3 If  $LQ = 2$  cm,  $NQ = 8$  cm and  $PL = 4$  cm, calculate the length of MP. (Let  $MP = x$ ) (4)  
**[14]**

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

**SECTION F**

**STATISTICS  
 OPTIONAL**

**QUESTION 17**

The temperature in Johannesburg at 12:00 during the second week of January 2005 was as follows :

<b>DAY</b>	<b>TEMPERATURE IN °C</b>
Monday	33
Tuesday	30
Wednesday	31
Thursday	32
Friday	30
Saturday	27
Sunday	23

- 17.1 Which day of the week was the hottest? (1)  
 17.2 Which day of the week was the coldest? (1)  
 17.3 Was there an increase or a decrease in temperature during the week? (1)  
 17.4 Which days had the same temperatures at 12:00? (1)  
 17.5 Calculate the arithmetic mean for the week, rounded off to 1 decimal digit. (3)  
 17.6 Determine the range of the temperature change. (3)

- 17.7 Determine the standard deviation of the temperatures, using the following formula:

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

Round off your answer to 1 decimal digit.

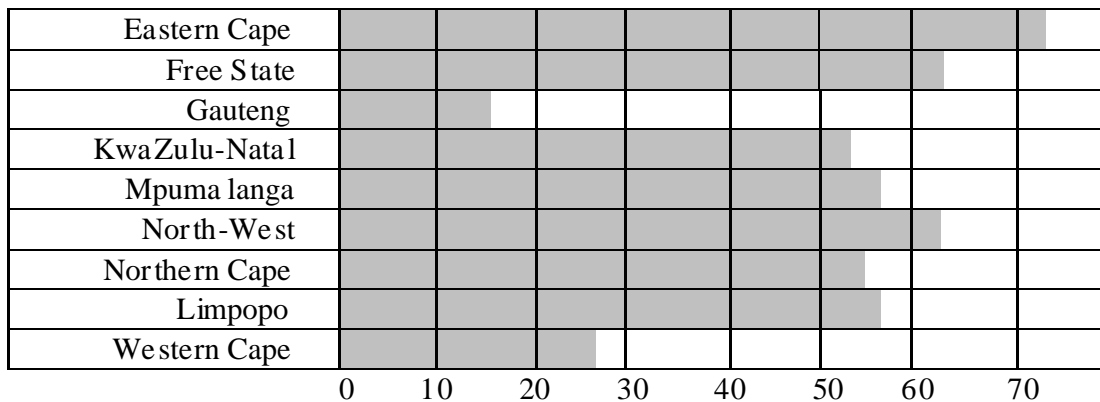
(6)  
**[16]**

**QUESTION 18**

Surveys done in South Africa have shown many South Africans are rated as being very poor. The surveys revealed a high incidence of poverty.

- 18.1 The statistics show that  $\pm 57\%$  of all citizens in the country are rated as being poor. If the total number of the population is 42 000 000, calculate how many people are rated as being poor. (2)
- 18.2 The horizontal bar chart represents the incidence of poverty per province.

**% Individuals living in poverty**

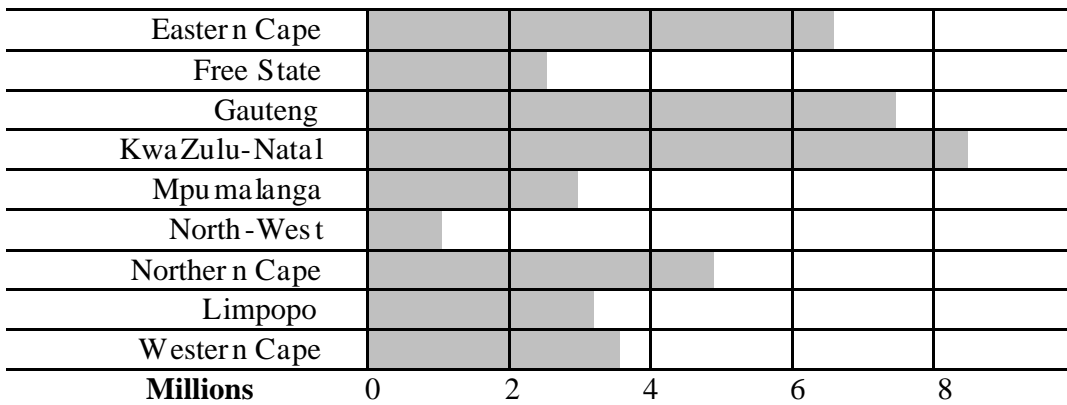


- 18.2.1 Which province has the highest percentage of people rated as being poor and approximately which percentage? (2)
- 18.2.2 Which percentage of people rated as being poor live in your province? (1)

18.2.3 Rearrange the provinces from the province with the lowest poverty percentage to the province with the highest poverty percentage and determine which province represents the median. (3)

18.3 The horizontal bar chart below represents the population per province.

**Total population: 40,5m**



Use the information provided by this bar chart together with the bar chart in Question 18.2 and calculate the number of people rated as being poor in the Northern Cape. (4)  
**[12]**

**QUESTION 19**

The age (in years) of 40 people:

- 20 17 53 65 16 18 33 69 50 45  
 66 25 43 48 45 53 26 38 19 41  
 52 60 40 38 48 53 48 27 35 38  
 50 69 27 29 35 41 36 39 42 53

19.1 Complete the following table in your answer book.

INTERVAL	SCORE	FREQUENCY	CUMULATIVE FREQUENCY
10 – 19			
20 – 29			
30 – 39			
40 – 49			
50 – 59			
60 - 69			

(4)

19.2 Use the graph paper supplied and draw a cumulative frequency curve. (3)

19.3 Use the letters A and B and indicate on the graph where the first quartile and median is read off. (2)

[9]

**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**

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

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

**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**

$$S = r \theta$$

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

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

$$V = r \theta$$

$$\theta = 2\pi f$$

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