



# education

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Department:  
Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**MATHEMATICS P2  
ADDITIONAL EXEMPLAR 2008**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 11 pages and 3 diagram sheets.**

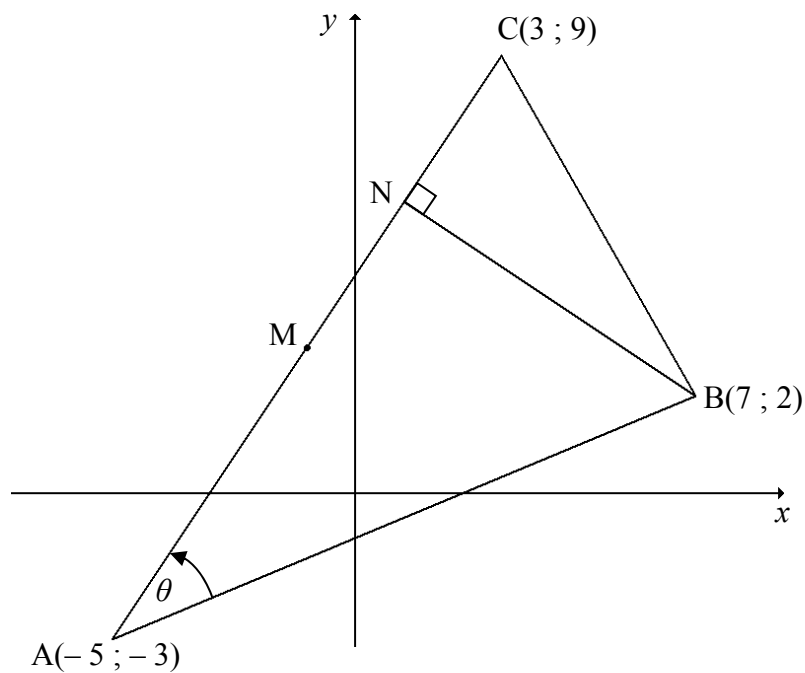
**INSTRUCTIONS AND INFORMATION**

Read the following instructions carefully before answering the questions.

1. This question paper consists of 11 questions. Answer ALL the questions.
2. Show ALL calculations, diagrams, graphs, et cetera. clearly, which you have used in determining the answers.
3. An approved scientific calculator (non-programmable and non-graphical) may be used, unless stated otherwise.
4. If necessary, answers should be rounded off to TWO decimal places, unless stated otherwise.
5. THREE diagram sheets for answering QUESTION 3.2, QUESTION 6.1, QUESTION 8.3, QUESTION 9.1 and QUESTION 11 are included at the end of this question paper. Write your examination number on these sheets in the spaces provided and hand them in together with your ANSWER BOOK.
6. Number the answers correctly according to the numbering system used in this question paper.
7. Diagrams are not necessarily drawn to scale.
8. Write neatly and legibly.

**QUESTION 1**

$A(-5 ; -3)$ ,  $B(7 ; 2)$  and  $C(3 ; 9)$  are the vertices of  $\triangle ABC$  in the Cartesian plane.  
 $BN \perp CA$  and  $M$  is the midpoint of  $AC$ .

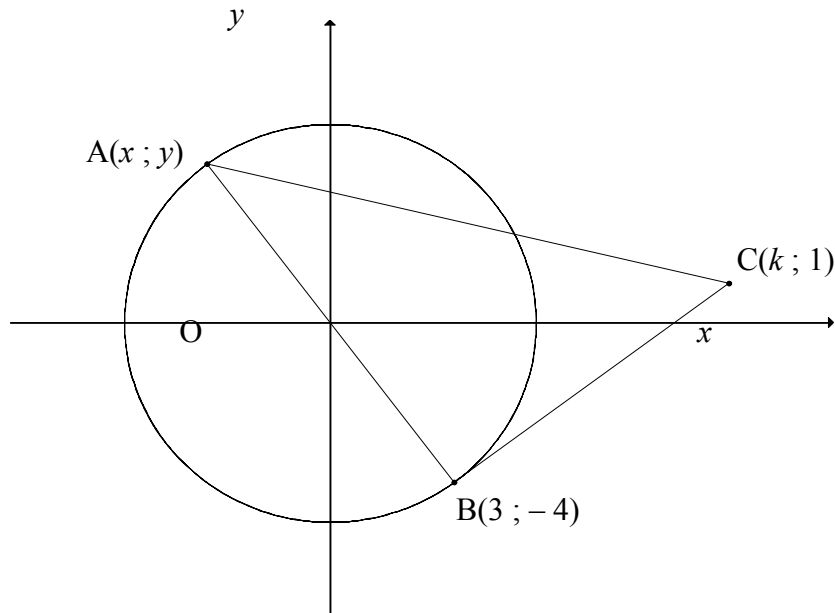


- 1.1 Calculate the length of  $AC$ . (Leave your answer in surd form.) (3)
- 1.2 Determine the coordinates of  $M$ , the midpoint of  $AC$ . (2)
- 1.3 Calculate the gradient of  $AC$ . (2)
- 1.4 Hence, determine the equation of  $BN$ . (3)
- 1.5 Calculate the area of  $\triangle ABC$  if  $N$  is the point  $(1 ; 6)$ . (4)
- 1.6 Calculate the measure of  $\theta$  correct to 1 decimal place. (4)

**[18]**

**QUESTION 2**

In the figure below, the origin is the centre of the circle.  $A(x ; y)$  and  $B(3 ; -4)$  are two points on the circle.  $AB$  is a diameter of the circle and  $BC$  is a tangent to the circle at  $B$ .  $C$  is the point  $(k ; 1)$ .



- 2.1 Determine the equation of the circle with centre  $O$ . (3)
- 2.2 Show that the length of  $AB$  is 10. (2)
- 2.3 Write down the equation of the circle with centre  $B$  and radius  $AB$  in the form  $Ax^2 + Bx + Cy^2 + Dy + E = 0$ . (3)
- 2.4 Explain why the coordinates of the point  $A$  are  $(-3 ; 4)$ . (2)
- 2.5 Calculate the gradient of line  $AB$ . (2)
- 2.6 Determine the equation of the tangent  $BC$ . (5)
- 2.7 Determine the value of  $k$ . (3)
- [20]**

**QUESTION 3**

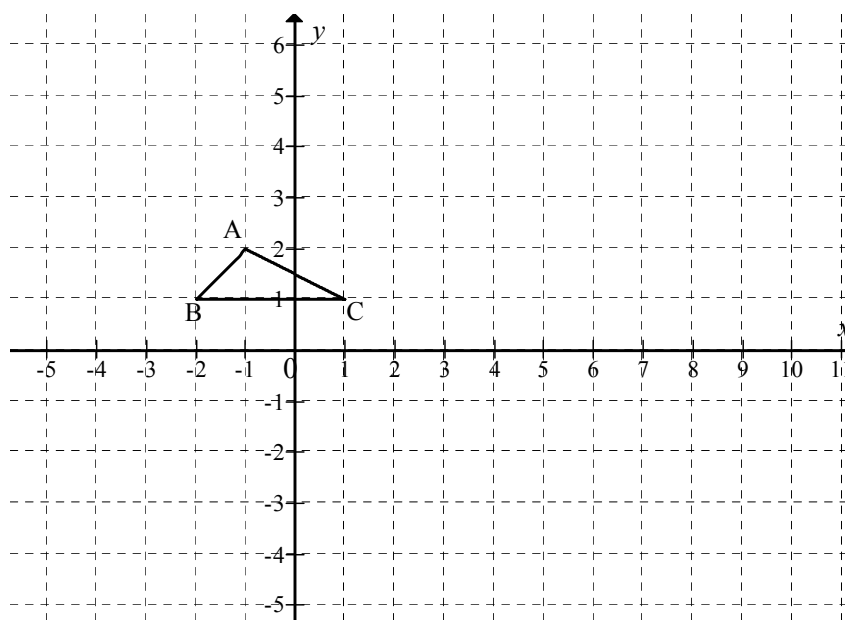
3.1 In each case below, the given coordinates are for the image,  $R'$ , after the point  $R(3 ; -4)$  has undergone a single transformation. In each case describe, in words, the type of transformation that took place.

3.1.1  $R'(-3 ; -4)$  (2)

3.1.2  $R'(0 ; 2)$  (2)

3.1.3  $R'(4 ; 3)$  (2)

3.2  $\triangle ABC$  is a triangle with vertices  $A(-1 ; 2)$ ,  $B(-2 ; 1)$  and  $C(1 ; 1)$  in the Cartesian plane.



3.2.1  $\triangle A'B'C'$  is an enlargement of  $\triangle ABC$  through the origin by a scale factor of 2. Write down the general rule for the transformation from  $\triangle ABC$  to  $\triangle A'B'C'$ . (1)

3.2.2 Use the grid on DIAGRAM SHEET 1 to sketch  $\triangle A'B'C'$ . (2)

3.2.3 If  $AC = \sqrt{5}$  units, write down the length of  $A'C'$  without doing any further calculations. (2)

3.2.4 The area of  $\triangle ABC$  is  $\frac{3}{2}$  square units. Write down the area of  $\triangle A'B'C'$ . (2)

3.2.5  $\triangle A''B''C''$  is the image of  $\triangle ABC$  under the glide reflection defined by  $(x ; y) \rightarrow (x + 8 ; -y)$ . Determine the coordinates of  $A''$ . (2)

3.2.6 Sketch  $\triangle A''B''C''$  on the same grid used in QUESTION 3.2.2. (2)

3.3 Answer the following:

3.3.1 The point  $C(x ; y)$  is rotated about the origin through an angle of  $60^\circ$  .

Show that the image of C has coordinates  $\left(\frac{x}{2} - \frac{y\sqrt{3}}{2}; \frac{y}{2} + \frac{x\sqrt{3}}{2}\right)$ . (5)

3.3.2 The point  $R(-6 ; 4)$  is rotated about the origin through an angle of  $60^\circ$  in an anticlockwise direction to a new point S. Determine the coordinates of S. Leave your answer in simplified surd form. (3)

[25]

#### QUESTION 4

4.1 Simplify each of the following to a numerical value. Show ALL workings.

$$4.1.1 \quad \frac{\cos 330^\circ \tan 150^\circ \sin 12^\circ}{\tan 315^\circ \cos(-258^\circ)} \quad (6)$$

$$4.1.2 \quad \frac{\sin(180^\circ - 2x) \cos x}{2 \cos(90^\circ - x)} - \tan(180^\circ - x) \cos(180^\circ + x) \sin(-x - 720^\circ) \quad (7)$$

$$4.2 \quad \text{Show that } \sin 15^\circ = \frac{\sqrt{3} - 1}{2\sqrt{2}}. \quad (4)$$

[17]

**QUESTION 5**

5.1 If  $\cos x = \sqrt{t}$ , express each of the following in terms of  $t$ :

5.1.1  $\tan x$  (2)

5.1.2  $\sin 2x$  (4)

5.2 Answer the following:

5.2.1 Prove that  $\frac{\sin x \cos x}{1 - \sin^2 x + \cos^2 x} = \frac{1}{2} \tan x$ . (4)

5.2.2 Determine the general solution for  $\frac{\sin x \cos x}{1 + \cos^2 x - \sin^2 x} = 0$ . (4)  
**[14]**

**QUESTION 6**

Given:  $f(x) = 2 \sin x$  and  $g(x) = \cos 2x$

6.1 On the same system of axes provided, sketch the graphs of  $f$  and  $g$  for the domain  $x \in [-180^\circ; 180^\circ]$  on DIAGRAM SHEET 1. (6)

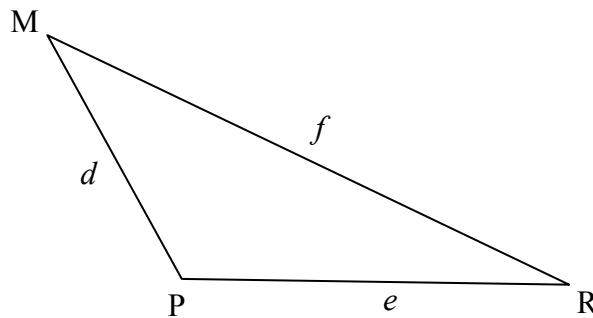
6.2 Solve by calculation for  $x \in [-180^\circ; 180^\circ]$ ,  $2 \sin x = \cos 2x$ , correct to 1 decimal place. (6)

6.3 Write down, from your graph, the value of  $x$  for which  $f(x) - g(x) = 3$ . (1)  
**[13]**

**QUESTION 7**

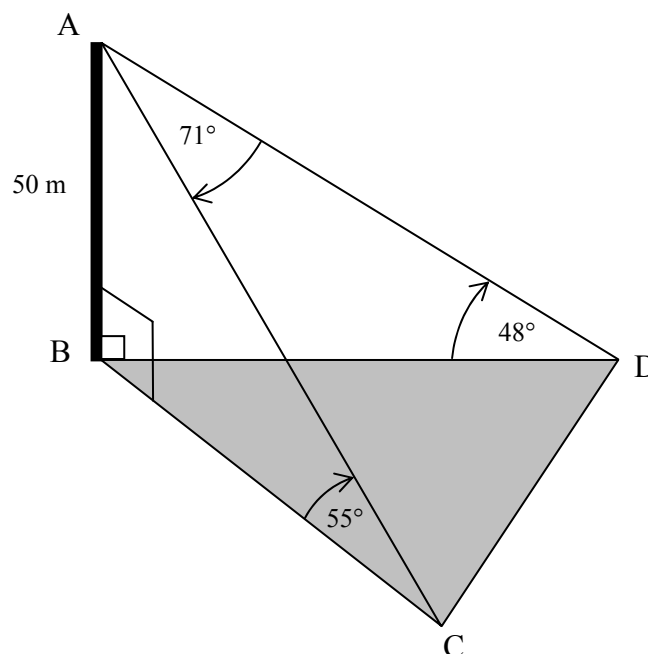
7.1 In  $\triangle MPR$ ,  $\hat{P} = 150^\circ$ ,  $MP = d$ ,  $PR = e$  and  $MR = f$ .

Show, without using a calculator, that  $\sin M = \frac{e}{2f}$ .



(3)

7.2 In the figure below Hector is standing at point A on top of building AB that is 50 m high. He observes two cars, C and D, that are in the same horizontal plane as B. The angle of elevation from C to A is  $55^\circ$  and the angle of elevation from D to A is  $48^\circ$ .  $\hat{CAD} = 71^\circ$ .



7.2.1 Calculate the lengths AC and AD, correct to 1 decimal place. (4)

7.2.2 Calculate the distance between the two cars, that is the length of CD. (5)

7.2.3 Calculate the area of  $\triangle ACD$ . (4)

**[16]**



**QUESTION 8**

The city of Beijing hosted the 29<sup>th</sup> Summer Olympic Games during August 2008. Of the 204 nations that participated in the Games, athletes from 55 nations won at least one gold medal.

The table below shows the number of gold medals won by these countries.

NATION	GOLD MEDALS WON	NATION	GOLD MEDALS WON	NATION	GOLD MEDALS WON	NATION	GOLD MEDALS WON
China	51	United States (USA)	36	Russia	23	Great Britain	19
Germany	16	Australia	14	South Korea	13	Japan	9
Italy	8	France	7	Ukraine	7	Netherlands	7
Jamaica	6	Spain	5	Kenya	5	Belarus	4
Romania	4	Ethiopia	4	Canada	3	Poland	3
Hungary	3	Norway	3	Brazil	3	Czech Republic	3
Slovakia	3	New Zealand	3	Georgia	3	Cuba	2
Kazakhstan	2	Denmark	2	Mongolia	2	Thailand	2
North Korea	2	Argentina	2	Switzerland	2	Mexico	2
Turkey	1	Zimbabwe	1	Azerbaijan	1	Uzbekistan	1
Slovenia	1	Bulgaria	1	Indonesia	1	Finland	1
Latvia	1	Belgium	1	Dominican Republic	1	Estonia	1
Portugal	1	India	1	Iran	1	Bahrain	1
Cameroon	1	Panama	1	Tunisia	1		

[Source: [www.results.beijing2008.cn](http://www.results.beijing2008.cn)]

- 8.1 Determine the median number of medals for the data. (1)
- 8.2 Write down the upper and lower quartiles. (2)
- 8.3 Draw a box and whisker diagram for the data on the DIAGRAM SHEET 2. (3)
- 8.4 Comment on the spread of the number of gold medals won by the different countries. (2)

**[8]**

**QUESTION 9**

The consumer price index (CPI) is a series of figures (numbers) showing how the average price level of all those goods and services bought by a typical consumer/household changes over time. The CPI for the month of June for recent years is given in the table below.

YEAR	2002	2003	2004	2005	2006	2007	2008
CPI	9,2	6,4	5,0	3,5	4,8	6,4	11,6

[Source: *Stats SA*]

- 9.1 On DIAGRAM SHEET 2, draw a scatter diagram for the data. (3)
- 9.2 Suggest whether a linear, quadratic or exponential function would best fit the data. Draw this line or curve of best fit on the same system of axes as QUESTION 9.1. (2)
- 9.3 Estimate, by using a curve of best fit, the CPI for January 2008. (1)  
**[6]**

**QUESTION 10**

The data below are the maximum daily temperatures, in °C, for Durban for the period 24 June 2008 to 9 July 2008.

22	21	22	23	21	20	19	24
25	22	22	24	24	22	25	21

[Source: [www.weatherunderground.com](http://www.weatherunderground.com)]

- 10.1 Calculate the standard deviation for the data. (3)
- 10.2 Comment on the variation in the maximum temperatures for the period. (1)  
**[4]**

**QUESTION 11**

160 teenagers has cellular phones that were purchased as a pay-as-you-go package. The table below reflects the various amounts of money, in rands, spent by groups of these teenagers on airtime in a certain month.

<b>AMOUNT OF MONEY SPENT ON AIRTIME) (IN RANDS)</b>	<b>NUMBER OF TEENAGERS</b>
0 to less than 20	19
20 to less than 40	46
40 to less than 60	54
60 to less than 80	30
80 to less than 100	8
100 to less than 120	3

- 11.1 Complete the cumulative frequency column in the table provided on DIAGRAM SHEET 3. (2)
- 11.2 Draw an ogive for the data on the grid on DIAGRAM SHEET 3. (2)
- 11.3 Estimate the number of teenagers who spent R50 and less on airtime in this month. (1)
- 11.4 Estimate the mean amount of money that these teenagers spent on airtime for this month. (4)

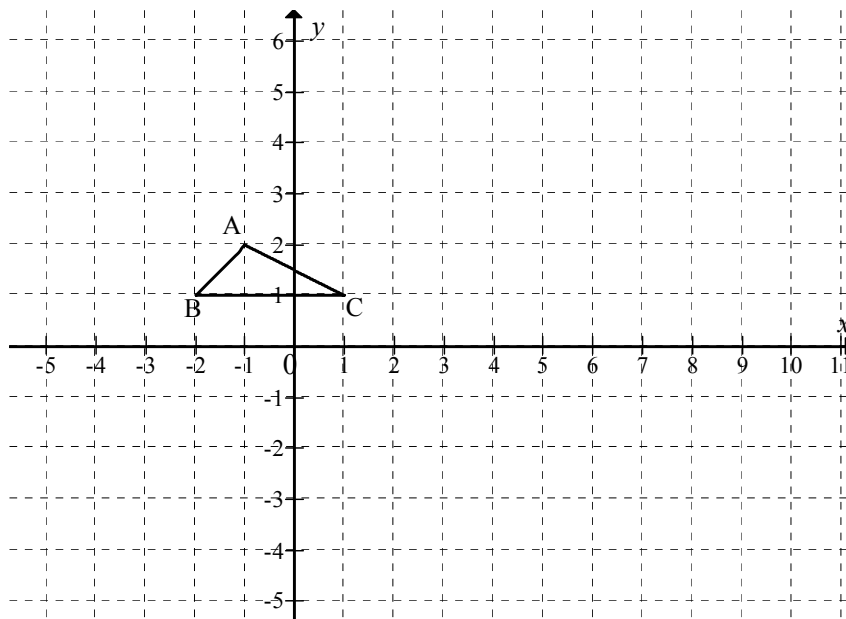
**[9]****TOTAL: 150**

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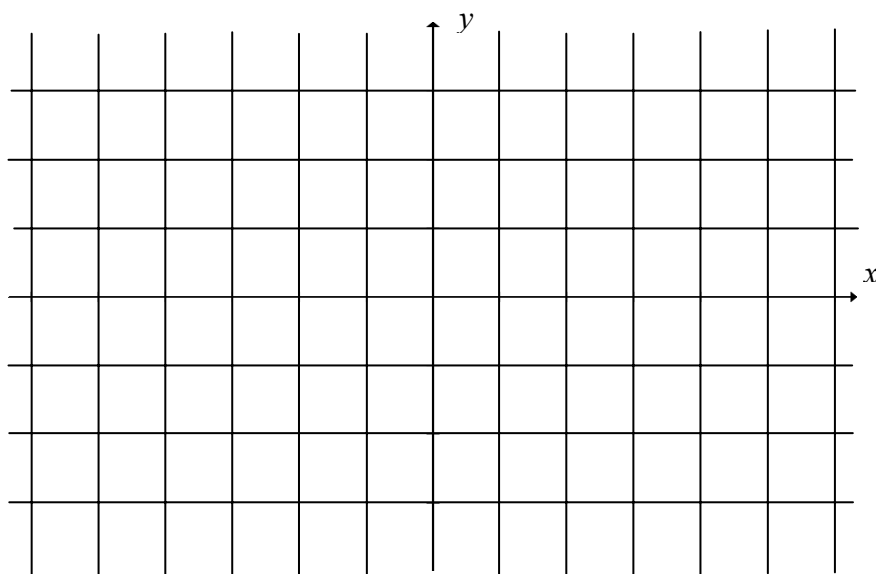
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**DIAGRAM SHEET 1**

**QUESTIONS 3 3.2.2 AND 3.2.6**



**QUESTION 6.1**

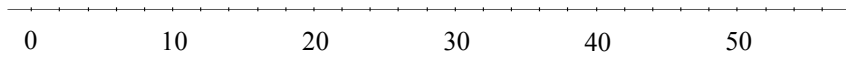


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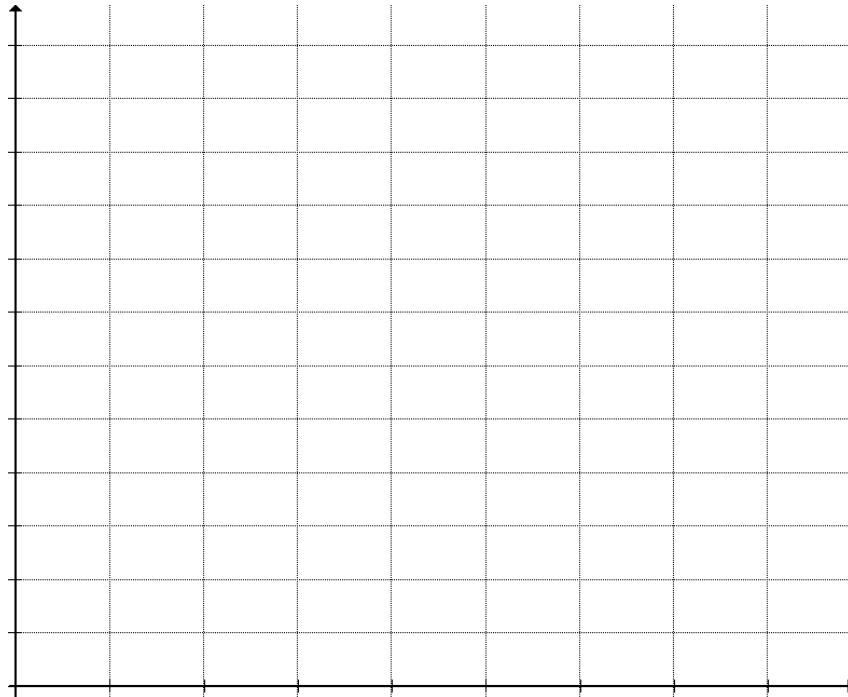
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**DIAGRAM SHEET 2**

**QUESTION 8.3**



**QUESTION 9.1**



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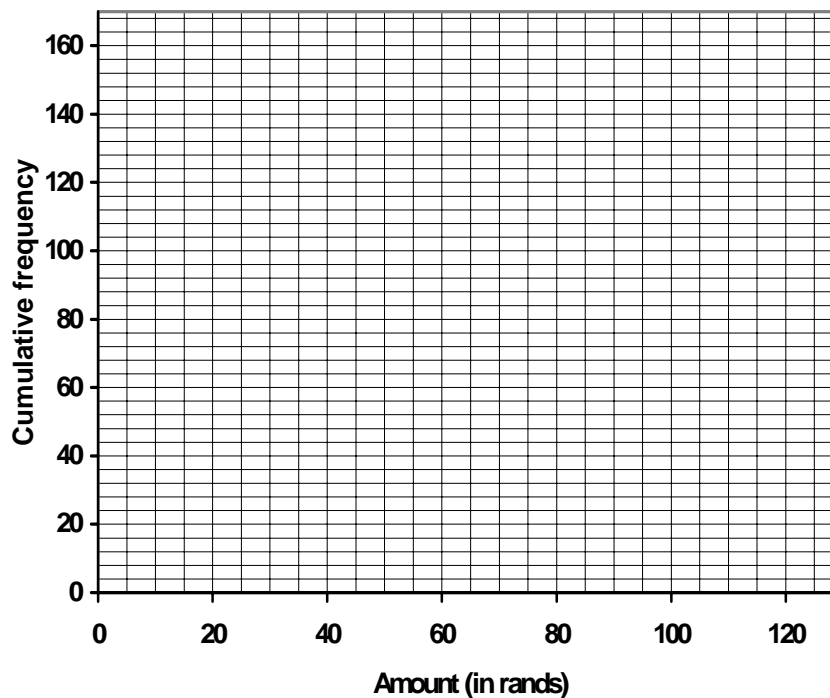
**DIAGRAM SHEET 3**

**QUESTION 11.1**

AMOUNT SPENT ON AIRTIME IN RANDS	NUMBER OF TEENAGERS	CUMULATIVE FREQUENCY
0 to less than 20	19	
20 to less than 40	46	
40 to less than 60	54	
60 to less than 80	30	
80 to less than 100	8	
100 to less than 120	3	

**QUESTION 11.2**

**Amount spent on airtime in a certain month**



**QUESTION 11.4**

AMOUNT SPENT ON AIRTIME (IN RANDS)	NUMBER OF TEENAGERS		
0 to less than 20	19		
20 to less than 40	46		
40 to less than 60	54		
60 to less than 80	30		
80 to less than 100	8		
100 to less than 120	3		