

BISHOPS
DIOCESAN COLLEGE

BISHOPS

Gr 9 MATHEMATICS

Time: 2 hours
Total: 150 marks

Nov 2007
SMcP/MAB

INSTRUCTIONS:

1. Answer ALL the questions on this question paper.
 2. All the necessary work and the answer must be shown in the proper place.
 3. Answers should be given correct to 2 decimal places where appropriate.
-

Name: **Set:**

QUESTION 1

The following statements are all false. Correct the right hand side and write the correct answer in the correction column.

	Statement	Correction
1.1	$4a - a(a - b) = 3a^2 + 3ab$	$4a - a(a - b) = 3a^2 + 3ab$
1.2	$(a + 3b)^2 = a^2 + 9b^2$	$a^2 + 6ab + 9b^2$
1.3	$36x^2 - 16 = 4(3x - 4)(3x + 4)$	$4(3x - 2)(3x + 2)$
1.4	$(3x^4)^2 = 3x^8$	$9x^8$
1.5	$a^{-1} + b^{-1} = \frac{1}{a + b}$	$\frac{1}{a} + \frac{1}{b}$ or $\frac{a + b}{ab}$

[5]

QUESTION 2

2.1

	x	-2	0	2
1	$(x+2)(x+5)$	0	10	$4 \times 7 = 28$
2	$x(x+5) + 2(x+5)$	0	10	28
3	$x^2 + 7x + 10$	0	10	28

2.1.1 Substitute the given values of x into each expression and complete the table. (3)

2.1.2 What do you notice about the 3 expressions? (1)

They are equivalent - the same

2.1.3 Show algebraically what you noticed in 2.1.2 (2)

$$1 = (x+2)(x+5) = x^2 + 5x + 2x + 10 = x^2 + 7x + 10 = 3$$

$$2 = x(x+5) + 2(x+5) = x^2 + 5x + 2x + 10 = x^2 + 7x + 10 = 3$$

or they can factorise 2 + 3

2.2 The first manned spacecraft reached a height of 187 kilometers above the earth's surface

2.2.1 Convert 187 km to mm. (1)

$$187\ 000\ 000\ \text{mm}$$

2.2.2 Write your answer from Question 2.2.1 in scientific notation. (1)

$$1,87 \times 10^8$$

2.2.3 This distance (187 km) is $1,25 \times 10^{-9}$ times the distance from the earth to the sun.

Write $1,25 \times 10^{-9}$ as an ordinary number. (1)

$$0,00000000125$$

[9]

QUESTION 3

Multiply out and simplify:

$$3.1 \quad 4x(2x^2 - 1) - 6x^2\left(x - \frac{1}{2x}\right) \quad (4)$$

$$8x^3 - 4x - 6x^3 + 3x = 2x^3 - 2x$$

$$3.2 \quad (x - 2)(x + 2)(x^2 + 4) \quad (3)$$

$$(x^2 - 4)(x^2 + 4) = x^4 - 16, \quad [7]$$

QUESTION 4

Factorise the following:

$$4.1 \quad 32x^3y - 16xy = 16xy(2x^2 - 1) \quad (2)$$

$$4.2 \quad x^2 - 11x - 12 = (x - 12)(x + 1) \quad (2)$$

$$4.3 \quad 5(x - y) - 2p(x - y) = (x - y)(5 - 2p) \quad (2)$$

$$4.4 \quad 4x^2 - 12xy + 9y^2 = (2x - 3y)(2x + 3y) \quad (2)$$

[8]

QUESTION 5

Simplify:

$$5.1 \quad -3x^2 \times (-3x^2)^2 = -3x^2 \times 9x^4 \quad (3)$$

$$= -27x^6 \quad \checkmark \checkmark$$

$$5.2 \quad \frac{12x^{-2}y^3}{6x^2y^2} = 2x^{-4}y = \frac{2y}{x^4} \quad (2)$$

$$\checkmark \checkmark$$

$$5.3 \quad 2^{-2} + 2^0 + 2^2 = \frac{1}{4} + 1 + 4 = 5\frac{1}{4} \quad (3)$$

$$5.4 \quad \frac{2x^3 + 4x^2}{x^2 - 4} = \frac{2x^2(x+2)}{(x+2)(x-2)} = \frac{2x^2}{x-2} \quad (3)$$

$$\checkmark \checkmark$$

$$5.5 \quad \frac{x+2}{3} - \frac{2x}{5} - \frac{x-1}{6} \quad (5)$$

[16]

$$= \frac{10(x+2) - 6(2x) - 5(x-1)}{30} \quad \checkmark$$

$$= \frac{10x + 20 - 12x - 5x + 5}{30}$$

$$= \frac{-7x + 25}{30}$$

QUESTION 66.1 Solve for x :

6.1.1 $2(x-5) = 5 - 2(x+5)$ (3)

$$2x - 10 = 5 - 2x - 10 \checkmark$$

$$4x = 5 \checkmark$$

$$x = 5/4 \checkmark$$

6.1.2 $\frac{3x}{5} - \frac{5x}{4} = 3\frac{1}{4}$ (4)

$$\frac{3x}{5} - \frac{5x}{4} = \frac{13}{4} \checkmark \quad (\times 20)$$

$$12x - 25x = 65 \checkmark$$

$$-13x = 65 \therefore x = -5 \checkmark$$

6.2 Mr Knight is six times as old as his son, Marcus.

6.2.1 If Marcus' present age is x , write down in terms of x , the age Mr Knight will be in 12 years time. (2)

$$6x + 12$$

6.2.2 In 12 years time Mr Knight will be three times as old as his son. Set up and solve an equation to find Marcus' present age. (3)

$$6x + 12 = 3(x + 12)$$

$$6x + 12 = 3x + 36$$

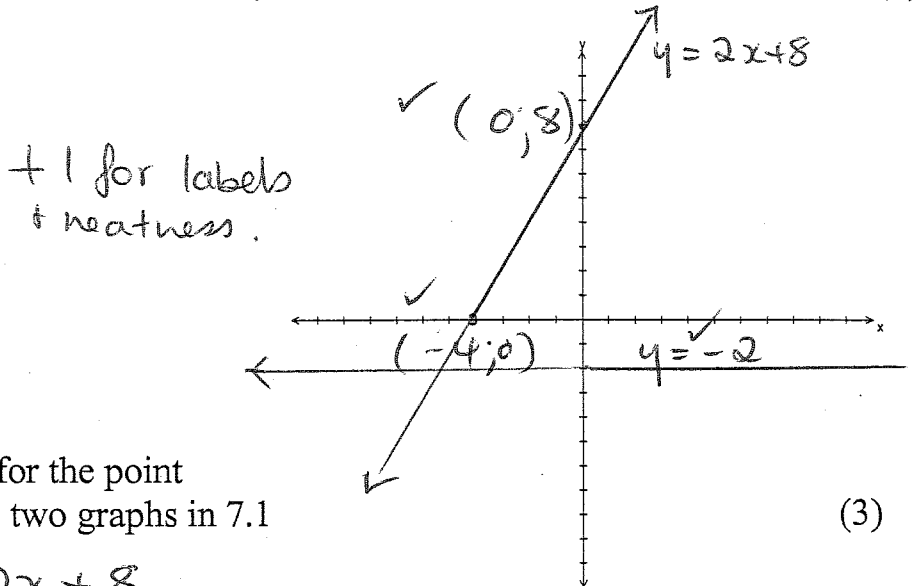
$$3x = 24$$

$$x = 8$$

[12]

QUESTION 7

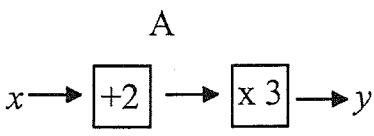
7.1 Draw the graphs of $y = 2x + 8$ and $y = -2$ on the set of axes below. (4)



7.2 Solve algebraically for the point of intersection of the two graphs in 7.1 (3)

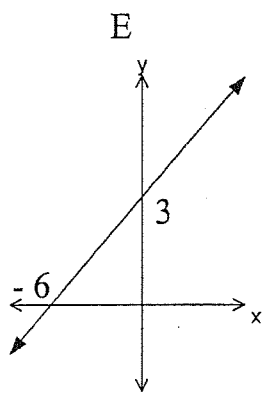
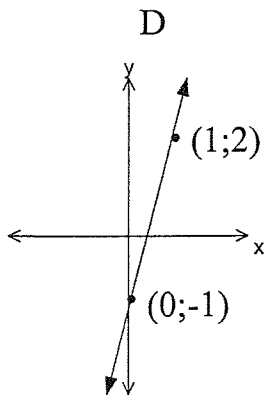
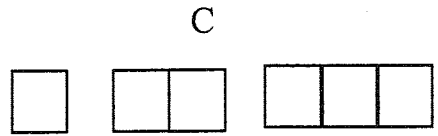
$$\begin{aligned}
 -2 &= 2x + 8 \\
 2x &= -10 \\
 x &= -5 \\
 \therefore (-5, -2) &= \text{Point}
 \end{aligned}$$

7.3 In the table below write the letters A to E next to the equation that matches each of the representations given below. Leave the non-matching rows blank. (10)



B

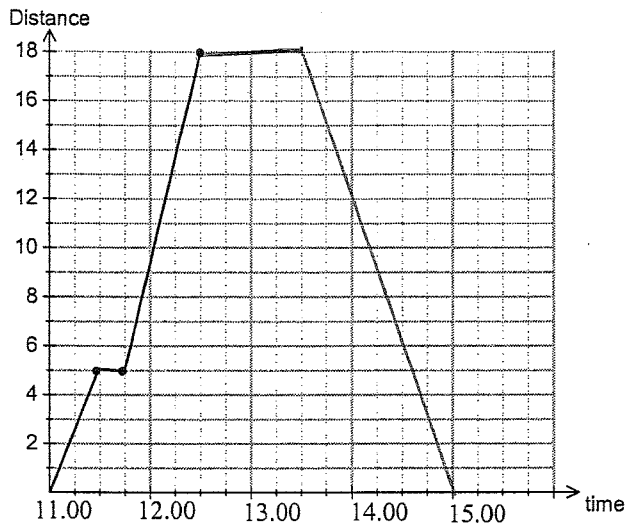
x	3	5	7	9
y	11	17	23	29



$x = \text{pattern number}$
 $y = \text{number of sticks}$

1	$y = 2x - 3$	
2	$y = 2x + 3$	
3	$y = 3x + 1$	C ✓✓
4	$y = 3x + 2$	B ✓✓
5	$y = 3x - 1$	D ✓✓
6	$y = 3(x + 2)$	A ✓✓
7	$y = 3 - \frac{1}{2}x$	
8	$y = 3 + \frac{1}{2}x$	E ✓✓

- 7.4 James cycled a distance of 18 km from his school to his house. The graph below represents his ride. On the way he stopped to buy a cooldrink at a shop.



- 7.4.1 Write down the distance of the shop from his school. (1)

5 km

- 7.4.2 Write down the time at which James stopped. (1)

11.30

- 7.4.3 For how long did he stop? (1)

15 minutes

- 7.4.4 Was James' speed faster before he stopped at the shop or after? How does your graph confirm this observation or calculation. (2)

Speed before = $\frac{5}{\frac{1}{2}} = 10 \text{ km/h}$

Speed after = $\frac{13}{\frac{45}{60}} = 17,3 \text{ km/h}$

Faster after stop ✓
Gradient steeper ✓

- 7.4.5 James stayed at his house for lunch and left again at 13.30. He reached his school at 15.00. Complete the graph above to show the rest of his journey. (1)

see graph

- 7.4.6 Calculate the average speed at which he cycled back to school. (2)

$$S = \frac{18}{1,5} = 12 \text{ km/h}$$

[25]

QUESTION 8

8.1 If the area of a square is $64x^2y^2$ square units, write down an algebraic expression for :

8.1.1 the side of the square

$$8xy$$

(2)

8.1.2 the perimeter of the square

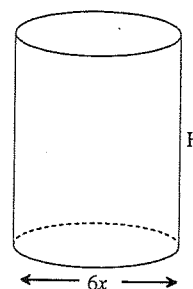
$$32xy$$

(1)

8.2 If the volume of the cylinder alongside is $108\pi x^3$ determine the height H in terms of x if the diameter of the base is $6x$ units.

$$108\pi x^3 = \pi 9x^2 \times H$$

$$\therefore H = 12x$$



(3)

8.3 A company that makes fruit juice decides to sell its product in 500 ml cuboid containers. Two possibilities are shown. Note $1 \text{ cm}^3 = 1000 \text{ ml}$

Figure 1

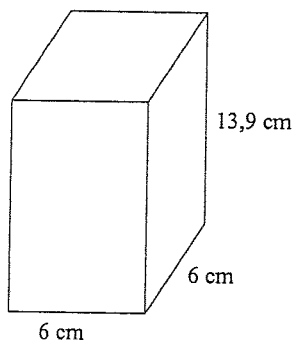
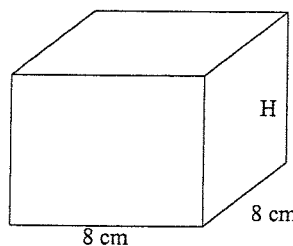


Figure 2



8.3.1 Confirm that the box represented in figure 1 can hold 500 ml of juice.

$$V = 6 \times 6 \times 13,9 = 500,4 \text{ cm}^3 > 500 \text{ ml}$$

(2)

8.3.2 Calculate the smallest possible height, to 1 decimal place, of figure 2 so that it can also hold 500 ml of juice.

$$500 = 8 \times 8 \times H$$

$$H = 7,81 \text{ cm}$$

$\therefore 7,9 \text{ cm}$ to be greater than 500 ml.

(2)

8.3.3 Calculate the surface area of the container in figure 1.

$$SA = 36 \times 2 + 4 \times (6 \times 13,9) = 405,6 \text{ cm}^2$$

(3)

- 8.4 Determine the perimeter and area of the figure below.
Show all steps and give your answers correct to 2 decimal places. (6)

$$BD = 15 \text{ cm pythag } \checkmark$$

$$\text{let } AD = AB = x$$

$$\therefore x^2 + x^2 = 15^2$$

$$2x^2 = 225$$

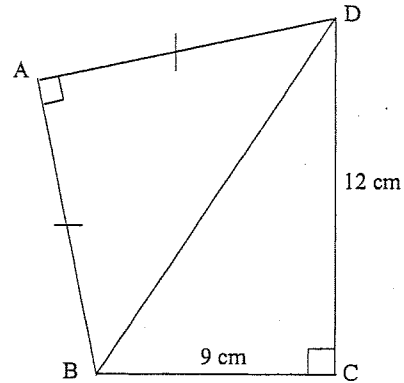
$$x = 10,61 \checkmark$$

$$\text{Perimeter} = 12 + 9 + 2 \times 10,61$$

$$= 42,22 \text{ cm } \checkmark$$

$$\text{Area} = \frac{1}{2} 9 \times 12 + \frac{1}{2} 10,61 \times 10,61 \checkmark$$

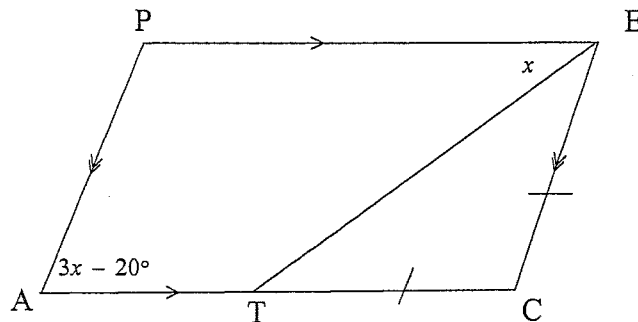
$$= 110,29 \text{ cm}^2 \checkmark$$



[19]

QUESTION 9

- 9.1 In the diagram below PACE is a parallelogram with $EC = TC$



- 9.1.1 Name, with reasons, two other angles equal to x . (4)

$$\hat{ETC} = x \quad \text{alt } \angle\text{'s } PE \parallel AC \checkmark \checkmark$$

$$\hat{TEC} = x \quad \text{iso's } \Delta \quad TC = CE \checkmark \checkmark$$

- 9.1.2 Write, with reasons, \hat{C} in terms of x . (2)

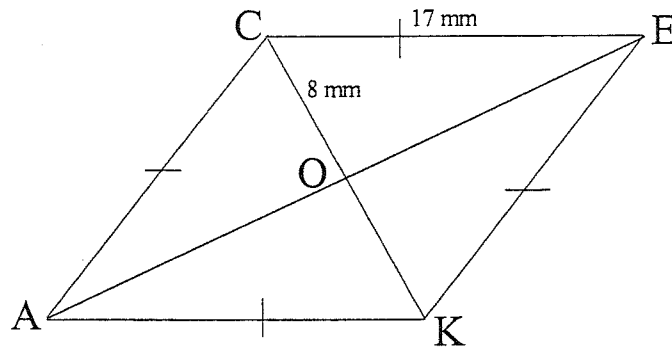
$$\hat{C} = 180^\circ - 2x \quad \text{sum } \angle \text{ in } \Delta \checkmark$$

- 9.1.3 Set up an equation to determine the value of x .
All steps and reasons must be given. (3)

$$3x - 20^\circ + 180^\circ - 2x = 180^\circ \quad \text{co int } \angle\text{'s } PA \parallel EC \checkmark$$

$$\therefore x = 20^\circ \checkmark$$

9.2 Quadrilateral CAKE has $AC = CE = EK = KA = 17$ mm and $CO = 8$ mm.



9.2.1 What type of quadrilateral is CAKE? Give a reason for your answer. (2)

Rhombus

All 4 sides equal or 2 pairs adjacent sides equal

9.2.2 Name two facts about the diagonals of this quadrilateral. (2)

- 1) Diagonals bisect
- 2) Diagonals are perpendicular
- 3) Diagonals bisect the angles into which they run.

9.2.3 Calculate the length of diagonal AE. (2)

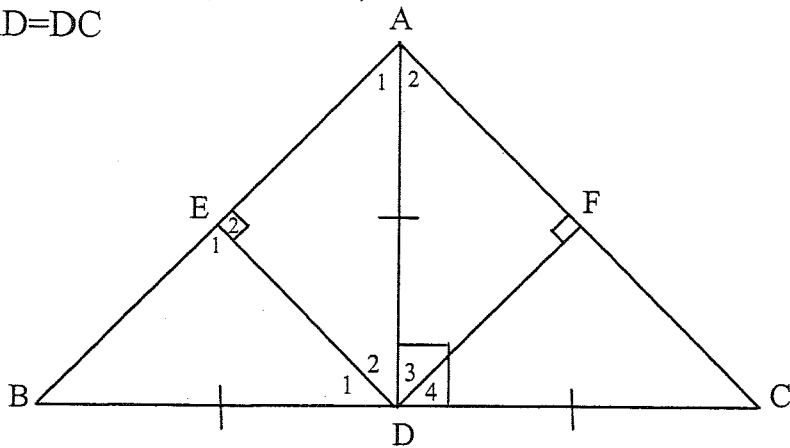
$$OE = \sqrt{17^2 - 8^2} = 15 \text{ mm} \text{ pythag}$$

$$\therefore AE = 30 \text{ mm}$$

9.2.4 Calculate the area of quadrilateral CAKE. (2)

$$\begin{aligned} \text{Area} &= \frac{d_1 \times d_2}{2} \\ &= \frac{30 \times 16}{2} \\ &= 240 \text{ mm}^2 \end{aligned}$$

9.3 In the diagram alongside $AB \perp ED$, $AC \perp FD$, $AD \perp BC$ and $BD=AD=DC$



9.3.1 Prove that $\triangle AED \cong \triangle BED$

- i) $AD = BD$ given
- ii) $ED = ED$ common
- iii) $\angle E_1 = \angle E_2 = 90^\circ$ given
- $\hat{A} = \hat{B}$ $AD = BD$ isos

$\triangle AED \cong \triangle BED$ (4)
 90° HS

or AA congruence
 NB NOT SSA
 (i) ii) + iv)

9.3.2 Determine, with reasons, the size of \hat{BAC}

$\hat{A}_1 = \hat{B} = 45^\circ$ ✓ \angle 's in 90° isos $\triangle ADB$ } ✓
 $\hat{A}_2 = \hat{C} = 45^\circ$ \angle 's in 90° isos $\triangle ADC$ } ✓
 $\therefore \hat{BAC} = 90^\circ$ ✓

9.3.3 Is $AC \parallel ED$? Give a reason

yes - co-int \angle 's supplementary

9.3.4 Is $\triangle ABD \parallel \triangle ADE$? Give a reason

yes - all \angle 's equal

9.3.5 Describe the transformation that takes place in the diagram above. Note that the order of the first triangle to the second is important.

a) If $\triangle BED$ becomes $\triangle DFC$

Translation

b) If $\triangle BED$ becomes $\triangle AED$

Reflection (about ED)

c) If $\triangle AED$ becomes $\triangle CDF$

Rotation (90° clockwise about \hat{D})

Not necessary

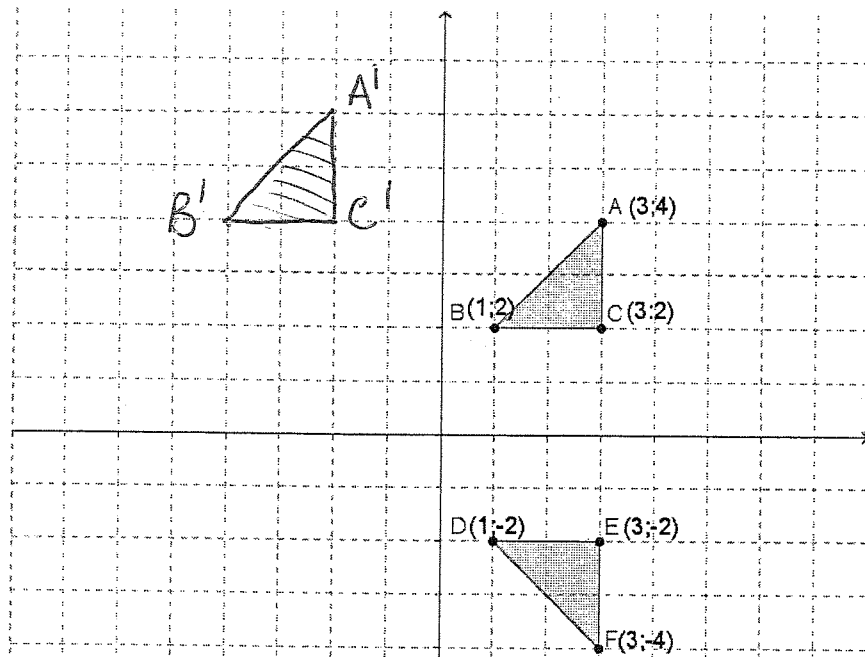
(1)

(1)

(1)

[31]

QUESTION 10



- 10.1 On the diagram above, translate ΔABC to $\Delta A'B'C'$ by $(x - 5 ; y+2)$ and write down the coordinates of $\Delta A'B'C'$. (4)

$A'(-2;6)$ $B'(-4;4)$ $C'(-2;4)$ + diag ✓

- 10.2 Write down the coordinates of ΔPQR , the reflection of ΔABC about the line $y = x$ (3)

$P(4;3)$ $Q(2;1)$ $R(2;3)$

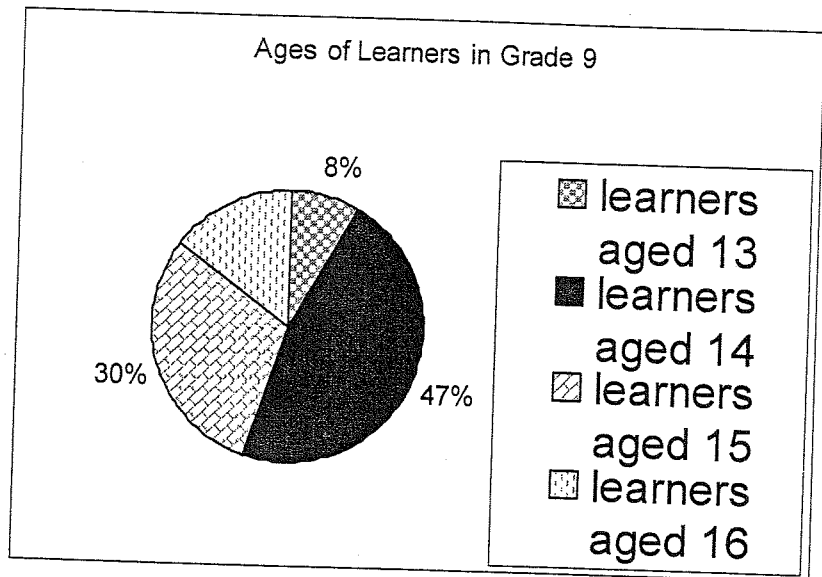
- 10.3 Describe the transformation of ΔABC to ΔFDE using the notation $(x ; y) \longrightarrow \dots\dots\dots$ (2)

$(x ; -y)$

[9]

QUESTION 11

11.1



The pie chart shows information about the age distribution of Grade 9's in a certain school. Use the graph to answer the following:

11.1.1 What % of learners in this grade is of age 16? (1)

15%

11.1.2 If a learner was chosen at random, into which age group is he or she least likely to fall? (1)

13 yrs

11.2 Below are the amounts raised by 14 people in the recent K4K charity run

R600	R100	R600	R1000	R600	R600	R800
R150	R100	R700	R200	R500	R200	R10

11.2.1 Determine the mode of the above data. (1)

R 600

11.2.2 Determine the median. (2)

$$\text{Median} = \frac{500 + 600}{2} = R550$$

11.2.3 Calculate the mean. (2)

$$\text{Mean} = \frac{6160}{14} = R440$$

11.2.4 Comment on the difference between the mean and the median and try to explain this difference. (2)

The mean is lower than the median because R10 is a very small amount compared to the other data and therefore lowers the mean

[9]