Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2011

MATHEMATICS P2

MARKS: **150**

TIME: **3 hours**

This question paper consists of 9 pages and 5 page annexure.

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. Clearly show ALL calculations, diagrams, graphs, et cetera, 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. Round off your answers to TWO decimal places if necessary, unless stated otherwise.

5. Diagrams are NOT necessarily drawn to scale.

6. FOUR diagram sheets for answering QUESTION 1.2, QUESTION 2.1, QUESTION 2.2, QUESTION 3.1, QUESTION 6.1 and QUESTION 10.1 are attached at the end of this question paper. Write your name on these and insert them in your answer book.

7. Number the answers correctly according to the numbering system used in this question paper.

8. Write legibly and to present your work neatly.

QUESTION 1

The following are the ages of the first 12 people who went to vote in Lota voting station on 18 May 2011:

31 60 25 19 44 53 25 36 42 18 49 55

1.1 Determine the following:

1.1.1 the mode (1)

1.1.2 the five number summary (5)

1.1.3 the inter-quartile range (1)

1.2 Use the information in QUESTION1.1.2 above to draw a box and whisker diagram. Use DIAGRAM SHEET 1. (3)

1.3 Hence, comment on the distribution of data. (1)

1.4 Determine the mean and standard deviation. (4)

1.5 At another voting station the mean age was 37 and the standard deviation was 20. How do the ages of voters at this station compare to those of Lota? Motivate your answer by referring to the mean and standard deviation of the ages. (2)

[17]

QUESTION 2

The following table represents the percentages of 75 grade 11 learners of Future Private school:

Interval	Frequency	Cumulative frequency
$10 \leq x < 20$	3	
$20 \leq x < 30$	6	
$30 \leq x < 40$	10	
$40 \leq x < 50$	12	
$50 \leq x < 60$	15	
$60 \leq x < 70$	13	
$70 \leq x < 80$	9	
$80 \leq x < 90$	5	
$90 \leq x < 100$	2	

2.1 Complete the cumulative frequency table using DIAGRAM SHEET 1. (3)

2.2 Draw the ogive (cumulative frequency curve) for the above data. Use DIAGRAM SHEET 1. (3)

2.3 The ogive curve is used to determine the median of the percentages. The school decides that 5% should be added on. What is the new median? (2)

[8]

QUESTION 3

An athlete is preparing for a 10 km fun run and is practicing every morning. The following table shows the kilometres she ran on eight consecutive days.

Day	1	2	3	4	5	6	7	8
Distance (in km)	2,5	4,0	4,5	4	6	6	6,5	7,5

3.1 Draw a scatter plot for the above data using DIAGRAM SHEET 2. (3)

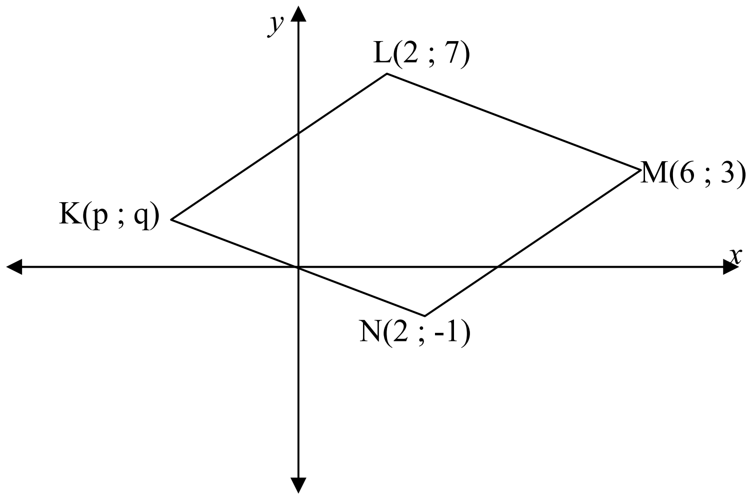
3.2 Draw a line of best fit. (2)

3.3 The athlete says that she will run about 8,5 km on the 9^{th} day. Is she likely to achieve this? Give a reason for your answer. (2)

[7]

QUESTION 4

K(p ; q), L(2 ; 7), M(6 ; 3) and N(2 ; -1) are the vertices of a parallelogram KLMN as shown below:



4.1 Determine:

4.1.1 the gradient of MN. (3)

4.1.2 the coordinates of G, the midpoint of NL. (2)

4.1.3 the equation of KL. (4)

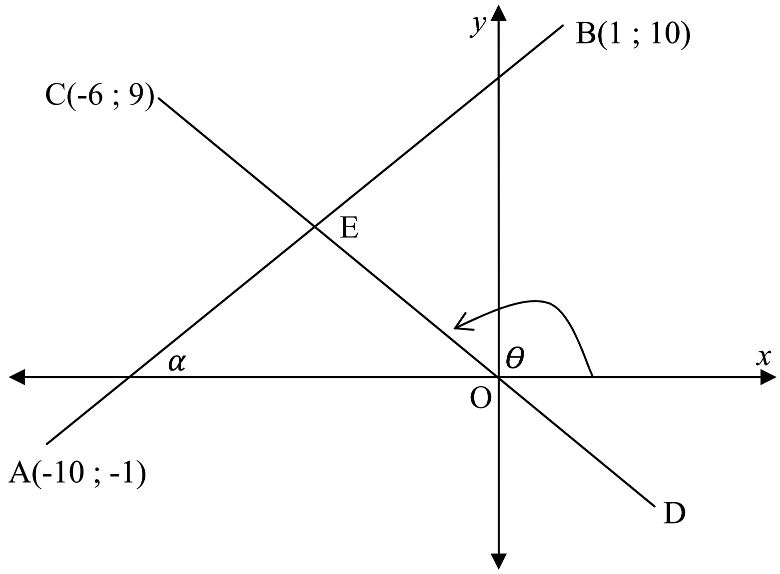
4.1.4 the values of p and q. (2)

4.2 Calculate the lengths of LM and MN and hence determine whether KLMN is a rhombus or not. (4)

[15]

QUESTION 5

5.1 The diagram below shows two straight lines AB and CO intersecting at point E.



5.1.1 Determine the equations of AB and CD. (6)

5.1.2 Determine the coordinates of E. (4)

5.1.3 Calculate the size of θ, the angle of inclination of CD. (2)

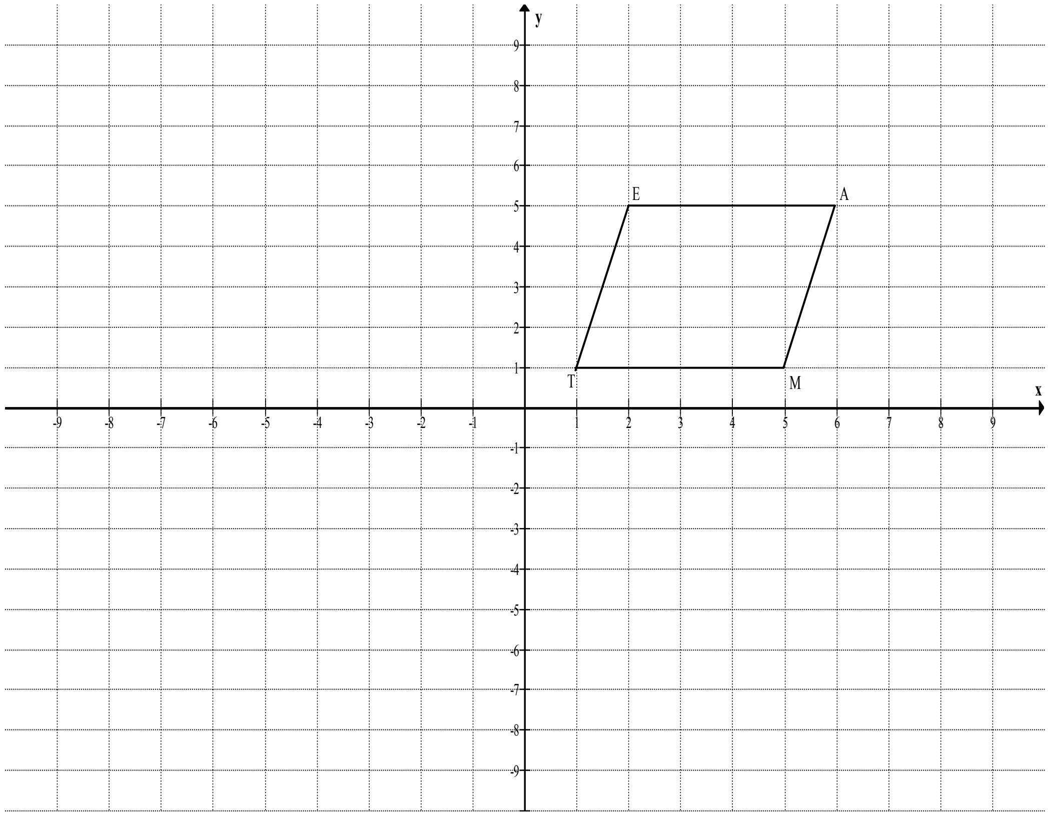
5.1.4 Hence, determine the size of $A\hat{E}D$. (4)

5.2 If P(-3 ; 5), Q(x ; -3) and R(x+5 ; -9) are collinear, determine the value of x. (4)

[20]

QUESTION 6

6.1 The diagram below shows quadrilateral TEAM with vertices T (1;1), E(2;5), A(6;5) and M(5;1).



6.1.1 If quadrilateral $T^/E^/A^/M^/$ is the image of TEAM after TEAM is reflected in the y-axis, draw $T^/E^/A^/M^/$ on DIAGRAM SHEET 3. (4)

6.1.2 Draw quadrilateral $T^{//}E^{//}A^{//}M^{//}$, the image of TEAM after it is rotated through 180° about the origin. Use DIAGRAM SHEET 3. (4)

6.1.3 TEAM is enlarged through the origin by a scale factor of 2 to CLUB. Write down the co-ordinates of C, L, U and B. (4)

6.1.4 If the area of TEAM is 20 square units, write down the area of CLUB. (2)

6.2 The point D(-½ ; 3) is given.

6.2.1 Write down the coordinates of $D^/$, the image of D, if D is reflected in the line $y = -x$. (2)

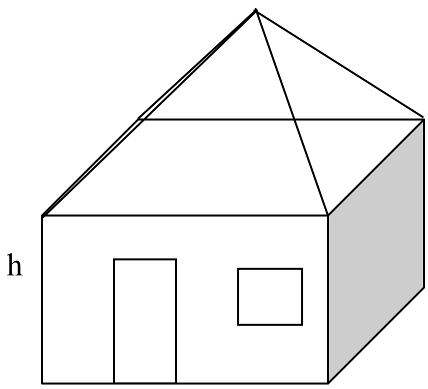
6.2.2 Write down the rule of translation which will also transform D to $D^/$. (2)

6.3 Describe the rotation which transforms P(6 ; −3) to $P^/$(−3 ; −6). (2)

[20]

QUESTION 7

A 'square' house (a house with all four sides equal) is built with a pyramid as roof as shown below. The height (H) of the pyramid is 60 cm. Each side of the house is 5,2 m long and the height (h) of the walls is 2,5 m.
(Formulae: $V = \frac{1}{3}$ area of base × H ; V = area of base × h)



7.1 Calculate the total volume of the house. (7)

7.2 Determine the surface area of the house (including the door, windows and floor) *without* the roof. (3)

[10]

QUESTION 8

8.1 If $\cos\theta = -\frac{15}{25}$ and $\sin\theta < 0$, use a suitable diagram to determine the following without using a calculator:

8.1.1 $\cos^2\theta - \sin^2\theta$ (4)

8.1.2 $\tan(\theta - 360°)$ (2)

8.2 Determine the value of θ if:
$\sin\theta - \tan 45° = -1{,}756$ and $\theta \in [90°;270°]$ (3)

8.3 Determine the general solution of:
$\frac{3}{4}\cos x + 0{,}2 = 0$ (5)

[14]

QUESTION 9

9.1 Simplify without using a calculator:

9.1.1 $\dfrac{\cos(90° + x) \cdot \sin(360° + x) - \cos^2(x - 180°)}{\cos(-x)}$ (6)

9.1.2 $(1 + \cos 510°)(1 + \cos 330°)$ (5)

9.2 Consider the identity:

$$\frac{1}{\cos^2 A} - \tan^2 A = 1$$

9.2.1 Prove the identity. (3)

9.2.2 Hence, express $\tan A$ in terms of p if

$\cos A = \dfrac{1}{p}$, $p > 0$ and $90° < A < 360°$. (3)

[17]

QUESTION 10

Given $f(x) = \tan x$ and $g(x) = \sin(x + 45°)$

10.1 Draw the sketch graphs of f and g on the same set of axis for $x \in [-90°; 180°]$. Use DIAGRAM SHEET 4. (6)

10.2 Use your graph to determine the values of x for which:

10.2.1 $g(x) - f(x) = 1$ (2)

10.2.2 $g(x) \geq f(x)$ for $x \in [-90°;90°]$ (2)

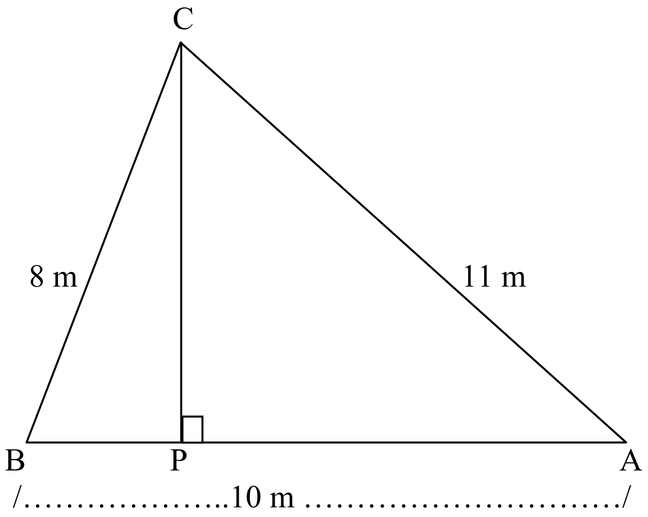
10.2.3 State the period of $y = f(2x)$. (1)

10.3 Write down the equation of h if h is obtained from g by a translation of 30° to the left and 2 units down. (2)

[14]

QUESTION 11

CP is a radio mast. CA and CB are cables used to support the mast. B and A are on the same level as P and ΔCAB is formed. CA = 11 m, CB = 8 m and BA = 10 m.



11.1 Determine $C\hat{A}B$. (4)

11.2 Hence, determine the height of the mast CP. (2)

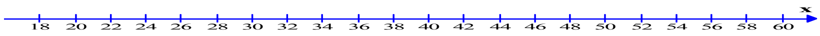
11.3 Determine the area of ΔCAB. (2)
[8]

TOTAL: 150

NAME:

DIAGRAM SHEET 1

QUESTION 1.2



QUESTION 2.1

Interval	Frequency	Cumulative frequency
$10 \leq x < 20$	3	
$20 \leq x < 30$	6	
$30 \leq x < 40$	10	
$40 \leq x < 50$	12	
$50 \leq x < 60$	15	
$60 \leq x < 70$	13	
$70 \leq x < 80$	9	
$80 \leq x < 90$	5	
$90 \leq x < 100$	2	

QUESTION 2.2

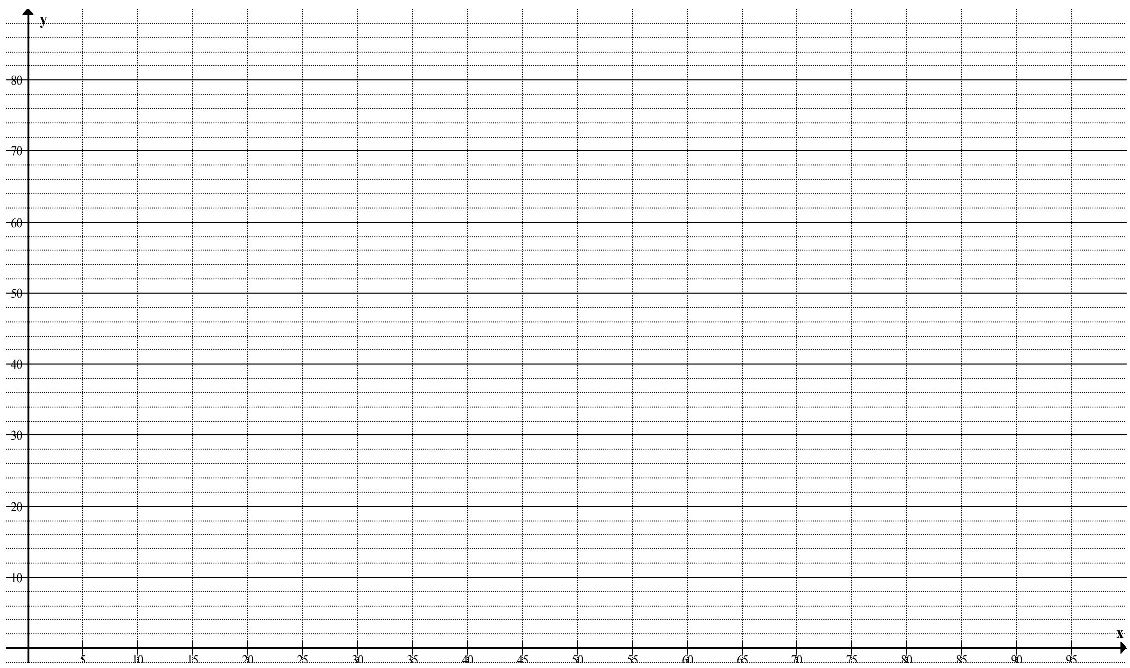


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DIAGRAM SHEET 2

QUESTION 3.1

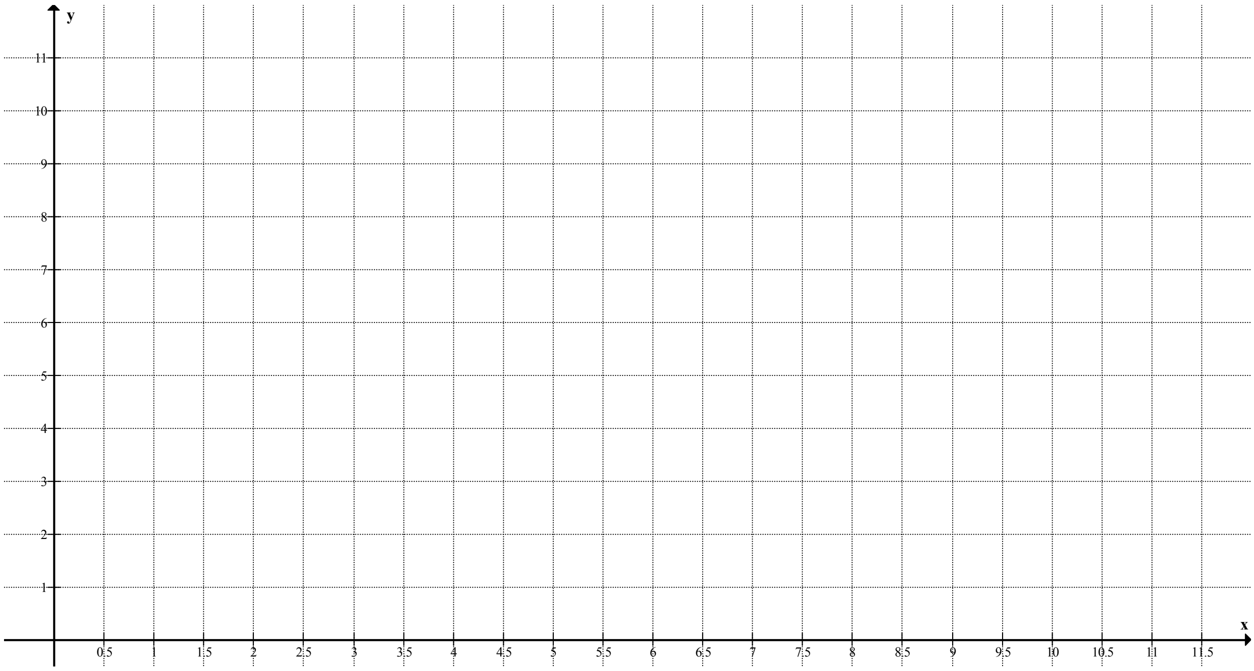

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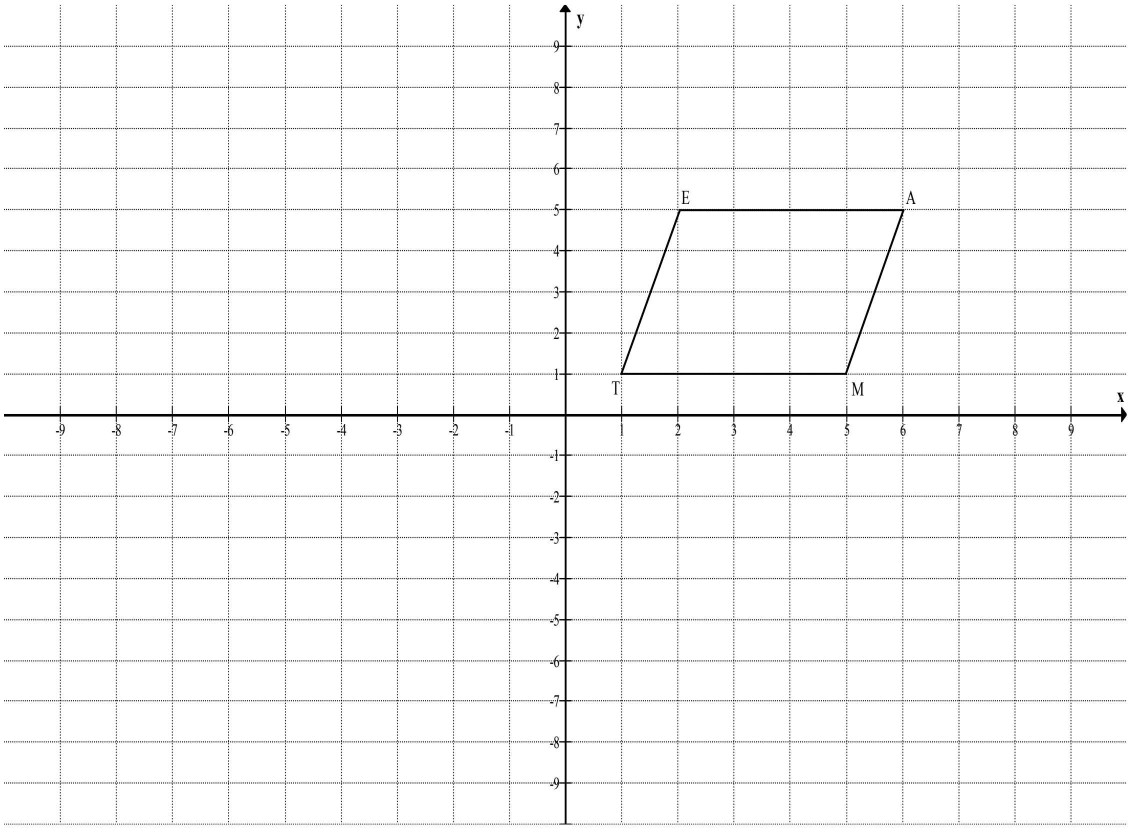
DIAGRAM SHEET 3

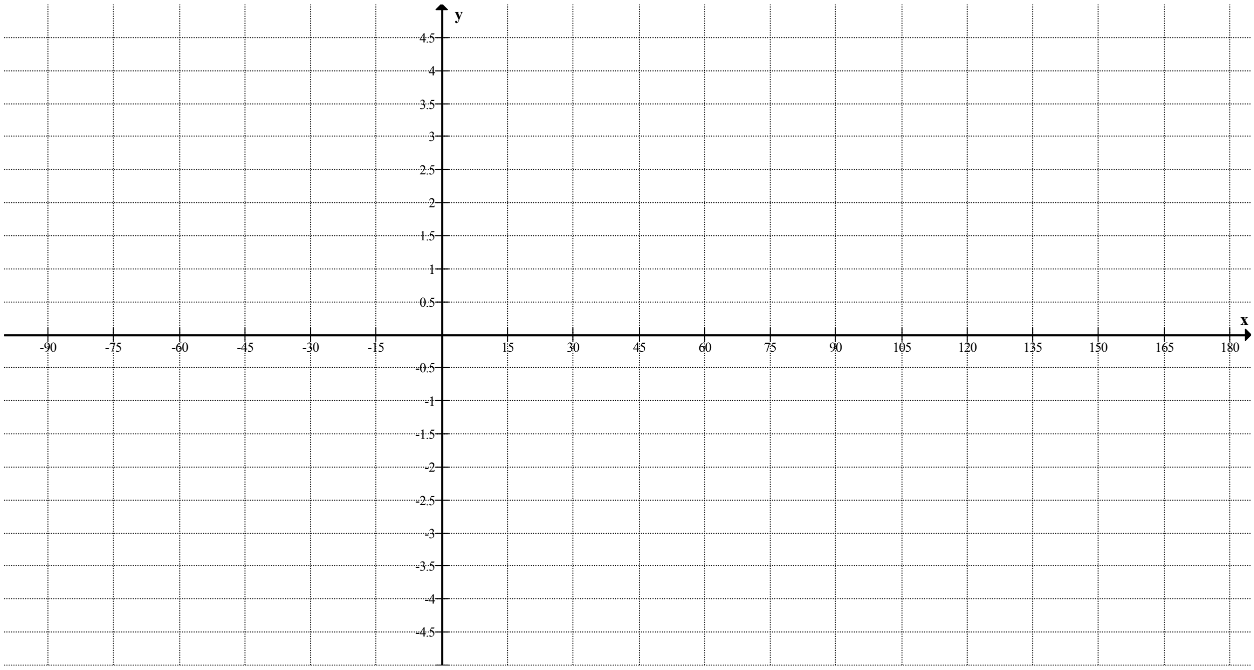
QUESTION 6.1



NAME:

DIAGRAM SHEET 4

QUESTION 10.1



INFORMATION SHEET: MATHEMATICS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$A = P(1+ni)$ $\quad$ $A = P(1-ni)$ $\quad$ $A = P(1-i)^n$ $\quad$ $A = P(1+i)^n$

$\sum_{i=1}^{n} 1 = n$ $\quad$ $\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$ $\quad$ $T_n = a + (n-1)d$ $\quad$ $S_n = \frac{n}{2}\left(2a + (n-1)d\right)$

$T_n = ar^{n-1}$ $\quad$ $S_n = \frac{a\left(r^n - 1\right)}{r-1}$; $\quad r \neq 1$ $\quad$ $S_\infty = \frac{a}{1-r}$; $-1 < r < 1$

$F = \frac{x\left[(1+i)^n - 1\right]}{i}$ $\quad$ $P = \frac{x[1-(1+i)^{-n}]}{i}$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $\quad$ $\mathrm{M}\left(\frac{x_1 + x_2}{2} ; \frac{y_1 + y_2}{2}\right)$

$y = mx + c$ $\quad$ $y - y_1 = m(x - x_1)$ $\quad$ $m = \frac{y_2 - y_1}{x_2 - x_1}$ $\quad$ $m = \tan\theta$

$$(x-a)^2 + (y-b)^2 = r^2$$

In ΔABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $\quad$ $a^2 = b^2 + c^2 - 2bc.\cos A$ $\quad$ $area\ \Delta ABC = \frac{1}{2}ab.\sin C$

$\sin(\alpha + \beta) = \sin\alpha.\cos\beta + \cos\alpha.\sin\beta$ $\quad$ $\sin(\alpha - \beta) = \sin\alpha.\cos\beta - \cos\alpha.\sin\beta$

$\cos(\alpha + \beta) = \cos\alpha.\cos\beta - \sin\alpha.\sin\beta$ $\quad$ $\cos(\alpha - \beta) = \cos\alpha.\cos\beta + \sin\alpha.\sin\beta$

$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases}$ $\quad$ $\sin 2\alpha = 2\sin\alpha.\cos\alpha$

$(x ; y) \to (x\cos\theta + y\sin\theta ; y\cos\theta - x\sin\theta)$ $\quad$ $(x ; y) \to (x\cos\theta - y\sin\theta ; y\cos\theta + x\sin\theta)$

$\bar{x} = \frac{\sum fx}{n}$ $\quad$ $\sigma^2 = \frac{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}{n}$

$P(A) = \frac{n(A)}{n(S)}$ $\quad$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$