



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

SEPTEMBER 2013

MATHEMATICS P2

MARKS: 150

TIME: 3 hours



This question paper consists of 12 pages, including 2 diagram sheets and an information sheet.

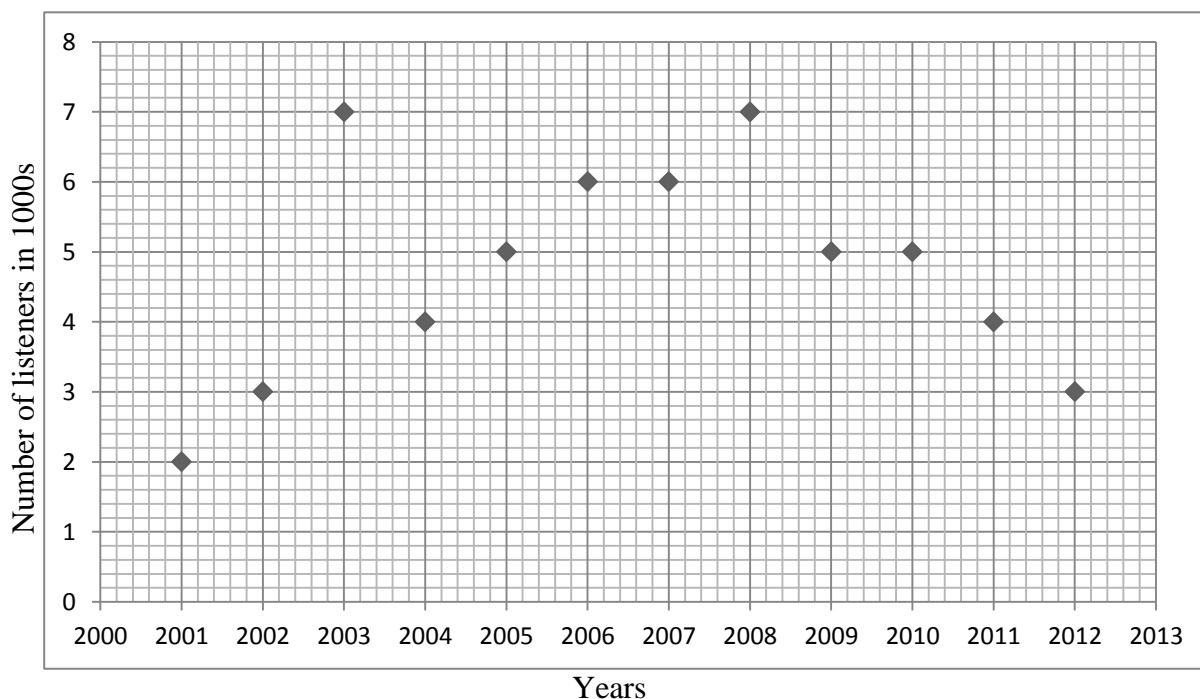
INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 12 questions. Answer ALL the questions.
2. Clearly show ALL calculations, diagrams, graphs, et cetera, which you have used in determining the answers.
3. Answers only will not necessarily be awarded full marks.
4. An approved scientific calculator (non-programmable and non-graphical) may be used, unless stated otherwise.
5. Round off your answers to TWO decimal places if necessary, unless stated otherwise.
6. Diagrams are not necessarily drawn to scale.
7. TWO diagram sheets for answering QUESTION 2.1, QUESTION 4.1, QUESTION 4.2, QUESTION 7.2.1, QUESTION 7.2.2 and QUESTION 11.2 are attached at the end of this question paper. Write your surname and name and insert them in your answer book.
8. Number the answers correctly according to the numbering system used in this question paper.
9. Write legibly and present your work neatly.
10. An information sheet, with formulae, is included at the end of this question paper.

QUESTION 1

The diagram below is a scatter plot for the number of listeners (in thousands) to Perfect Community Radio (PCR) in each year since the opening of the station in 2001.



- 1.1 Will a straight line, a quadratic curve or an exponential curve best fit the data? (1)
- 1.2 Write down the year in which there was an outlier. (1)
- 1.3 Which years recorded the highest number of listeners? (1)
- 1.4 Determine the range of the number of listeners per year. (1)
- 1.5 Estimate to the nearest 1 000 the number of listeners for the year 2013. (1)
- 1.6 The radio station made major changes to their shows after 2008. Did these changes make a positive or negative impact? Justify your answer. (2)

[7]**QUESTION 2**

The number of goals scored by two netball players in each of the ten matches are:

Player A: 4; 7; 2; 10; 13; 10; 15; 8; 6; 14

Player B: 6; 12; 7; 3; 16; 7; 8; 9; 4; 2

- 2.1 Draw box and whisker diagrams for Players A and B using DIAGRAM SHEET 1. (6)
- 2.2 One of these players must receive the award for the best player. Should it be Player A or Player B? Justify your answer by referring to the information depicted in the box and whisker diagrams. (2)

[8]

QUESTION 3

The following are the salaries per month (in rands) for 10 workers at Supper Private School:
6 000; 4 200; 3 000; 5 000; 8 000; 7 500; 2 600; 1 400; 10 500; 4 000

- 3.1 Determine the mean salary of the workers. (2)
- 3.2 Determine the standard deviation of the data. (2)
- 3.3 How many workers earn a salary which differs from the mean by less than one standard deviation and is below the mean? (2)
- [6]**

QUESTION 4

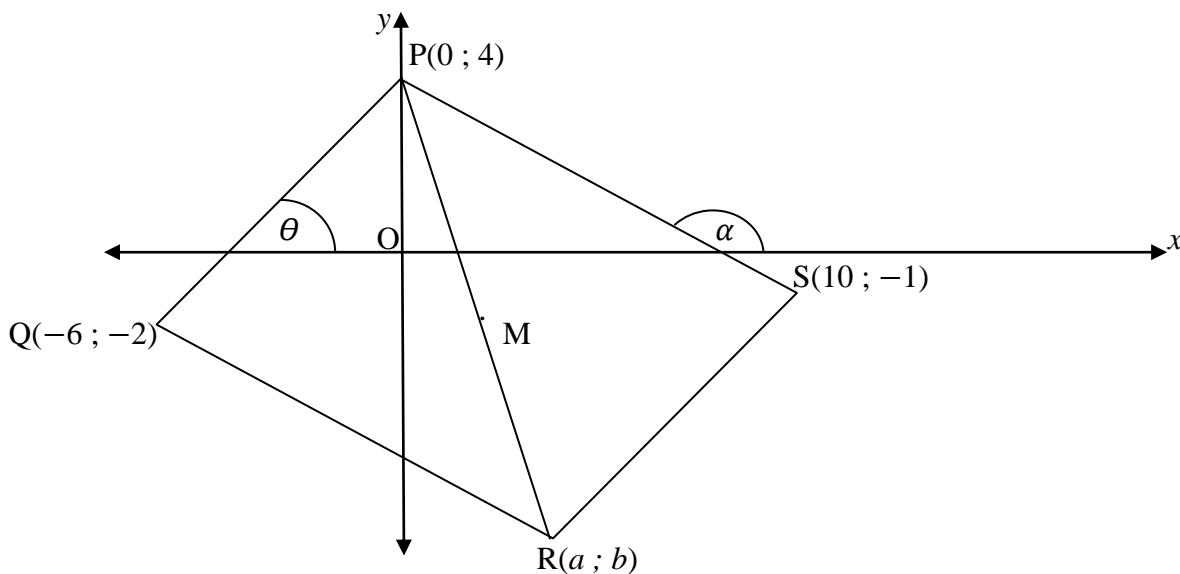
The percentages achieved by 95 Grade 12 learners in June Mathematics examinations are shown in the following table.

Interval	Frequency	Cumulative frequency
$10 < x \leq 20$	8	
$20 < x \leq 30$	14	
$30 < x \leq 40$	20	
$40 < x \leq 50$	23	
$50 < x \leq 60$	17	
$60 < x \leq 70$	9	
$70 < x \leq 80$	4	

- 4.1 Complete the cumulative frequency column on DIAGRAM SHEET 1. (2)
- 4.2 Draw the ogive (cumulative frequency curve) on DIAGRAM SHEET 1. (3)
- 4.3 The Mathematics teacher believes that the median percentage achieved by the grade will increase by 10% in the September examinations. What must the median percentage in September be to achieve this increase? (2)
- [7]**

QUESTION 5

PQRS is a parallelogram with $P(0 ; 4)$, $S(10 ; -1)$, $R(a ; b)$ and $Q(-6 ; -2)$ as shown below.

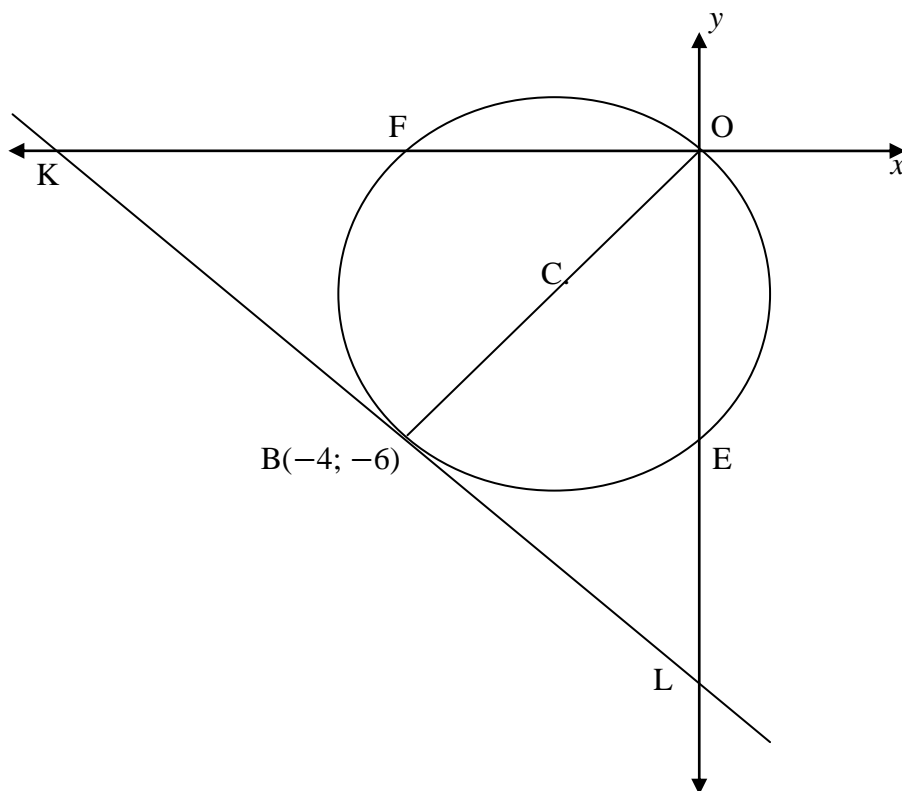


- 5.1 Calculate the length of PS. (2)
- 5.2 Determine the gradient of PQ. (2)
- 5.3 Determine the equation of SR. (3)
- 5.4 Determine the co-ordinates of M, the midpoint of PR. (3)
- 5.5 Hence or otherwise, determine the values of a and b . (3)
- 5.6 Determine the size of \widehat{QRS} , correct to ONE decimal digit. (7)

[20]

QUESTION 6

A circle with centre at C passes through the origin, O, and also intersects the x -axis at F and the y -axis at E. The tangent to the circle at B(-4 ; -6) intersects the x -axis at K and the y -axis at L.



- 6.1 Calculate the length of the radius of the circle. (3)
- 6.2 Determine the equation of the circle in the form $(x - a)^2 + (y - b)^2 = r^2$. (4)
- 6.3 Why is $\triangle OBL$ a right angled triangle? (1)
- 6.4 Determine the equation of the tangent KL. (4)
- 6.5 Determine the co-ordinates of E. (2)
- 6.6 Determine whether EF is a diameter of the circle. Show all working. (5)

[19]

QUESTION 7

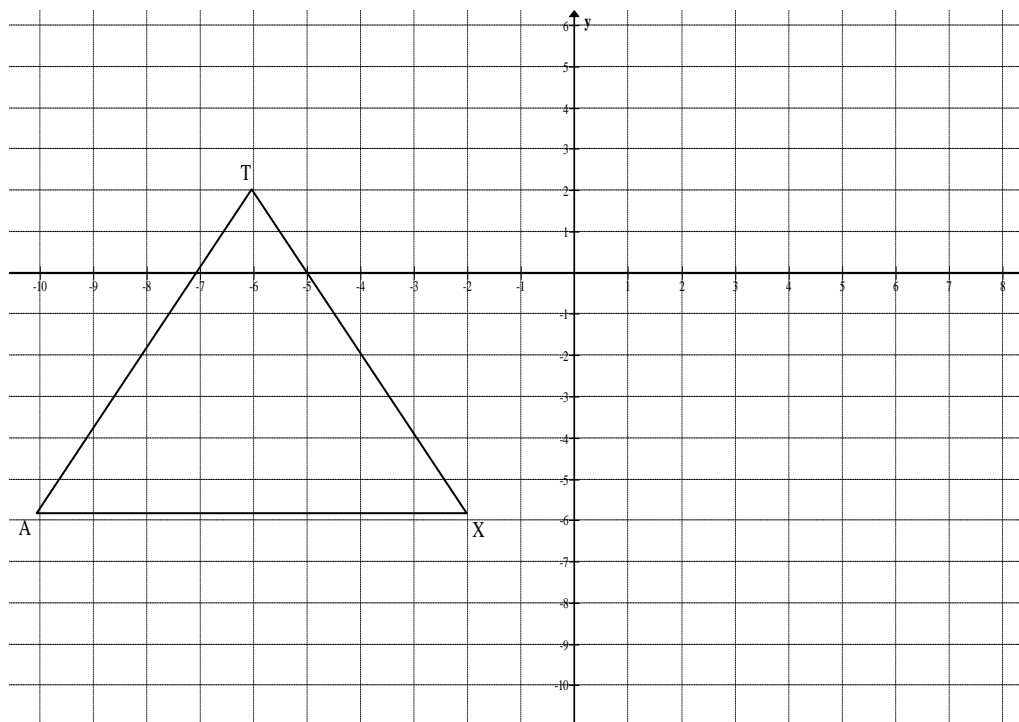
7.1 $K(5 ; -8)$ and $L(-1 ; 2)$ are points on the Cartesian plane. Fully describe, in words:

7.1.1 the translation of point K to point L. (2)

7.1.2 the transformation of K to $K'(8 ; 5)$. (2)

7.1.3 the transformation of L to $L'(-2 ; 1)$. (2)

7.2 $\triangle TAX$ with vertices $T(-6 ; 2)$, $A(-10 ; -6)$ and $X(-2 ; -6)$ is given below:



7.2.1 $\triangle TAX$ is reduced to $\triangle T'A'X'$ by a scale factor of $\frac{1}{2}$. Draw $\triangle T'A'X'$ on DIAGRAM SHEET 2. (2)

7.2.2 $\triangle T'A'X'$ is then translated 6 units to the right and 5 units up to $\triangle T''A''X''$. Draw $\triangle T''A''X''$ on the same set of axes on DIAGRAM SHEET 2. (2)

7.2.3 Is the transformation of $\triangle T'A'X'$ to $\triangle T''A''X''$ rigid or not? Justify your answer. (2)

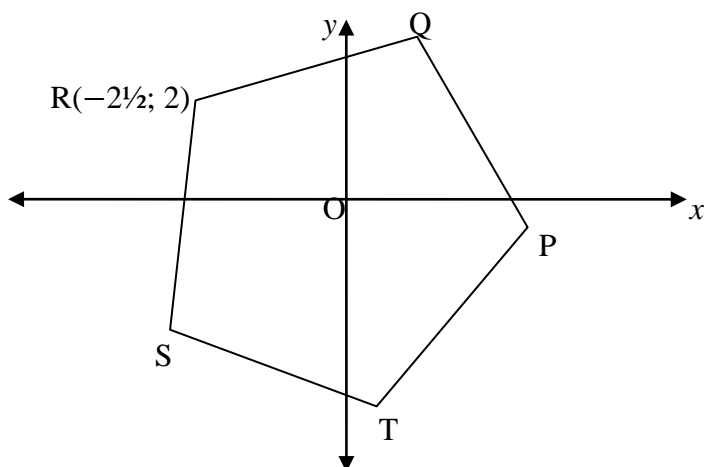
7.2.4 Hence or otherwise, write down a single rule for the transformation of $\triangle TAX$ to $\triangle T''A''X''$ in the form $(x; y) \rightarrow (\dots; \dots) \rightarrow (\dots; \dots)$. (4)

7.2.5 Write down the ratio Area of $\triangle TAX$: Area of $\triangle T''A''X''$. (1)

[17]

QUESTION 8

In the diagram below, $R(-2\frac{1}{2}; 2)$ is one of the vertices of a regular pentagon PQRST. The vertices are all equal distances from O.



Determine the co-ordinates of P.

(6)

[6]**QUESTION 9**

9.1 If $\tan 58^\circ = m$, determine the following in terms of m without using a calculator.

9.1.1 $\sin 58^\circ$ (2)

9.1.2 $\sin 296^\circ$ (3)

9.1.3 $\cos 2^\circ$ (3)

9.2 Given the following identity:

$$\frac{\cos x - \sin x \sin 2x}{\cos 2x} = \cos x \quad (4)$$

9.2.1 Prove the identity.

9.2.2 For which values of x is the identity undefined? Give your answer in general form.

(4)

[16]**QUESTION 10**

10.1 Simplify, without using a calculator, to ONE trigonometric ratio:

$$\frac{2 \cos(90^\circ + x) \sin 216^\circ \cos 396^\circ}{\sin 72^\circ} \quad (5)$$

10.2 Solve for x if $x \in [-90^\circ; 180^\circ]$:

$$2 \tan x + \cos x = \frac{1}{\cos x} \quad (7)$$

[12]

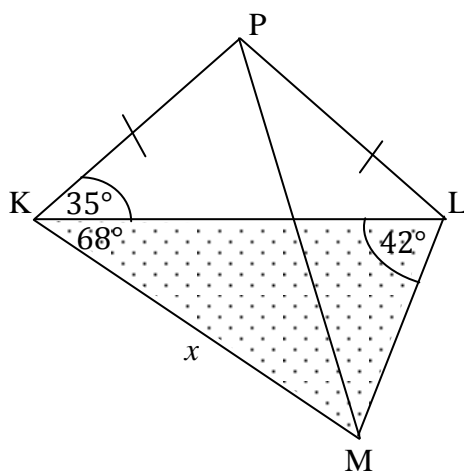
QUESTION 11

Given $f(x) = \cos 2x$ and $g(x) = -\sin x$, for $x \in [-180^\circ; 180^\circ]$

- 11.1 Calculate the values of x for which $f(x) = g(x)$ for $x \in [-180^\circ; 180^\circ]$. (8)
- 11.2 Sketch, on the same set of axes, the graphs of f and g showing all intercepts with the axes as well as the turning points for $x \in [-180^\circ; 180^\circ]$. (6)
- 11.3 Write down the period of f . (1)
- 11.4 Determine the values of x for which $f(x) - g(x) \leq 0$ for $x \in [-180^\circ; 180^\circ]$. (3)
- 11.5 Hence, determine the minimum value of $\cos 2x + \sin x$ on the interval $[-180^\circ; 180^\circ]$. (2)
- 11.6 $g(x)$ is reflected about the x -axis and then shifted 1 unit down to $h(x)$. Write down the equation of $h(x)$. (2)

[22]**QUESTION 12**

In the accompanying figure, P is a balloon held in position by three stay wires PK, PL and PM. $PK = PL$. $\angle KPM = 68^\circ$, $\angle KLM = 42^\circ$, $\angle PKL = 35^\circ$ and $KM = x$.



- 12.1 Show that $KP = \frac{x \sin 35^\circ}{\sin 42^\circ}$ (6)
- 12.2 Hence, calculate the area of $\triangle PKL$ if $x = 70$ m. (4)

[10]**TOTAL: 150**

DIAGRAM SHEET 1 SURNAME: NAME:

QUESTION 2.1



QUESTION 4.1

Interval	Frequency	Cumulative Frequency
$10 < x \leq 20$	8	
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QUESTION 4.2

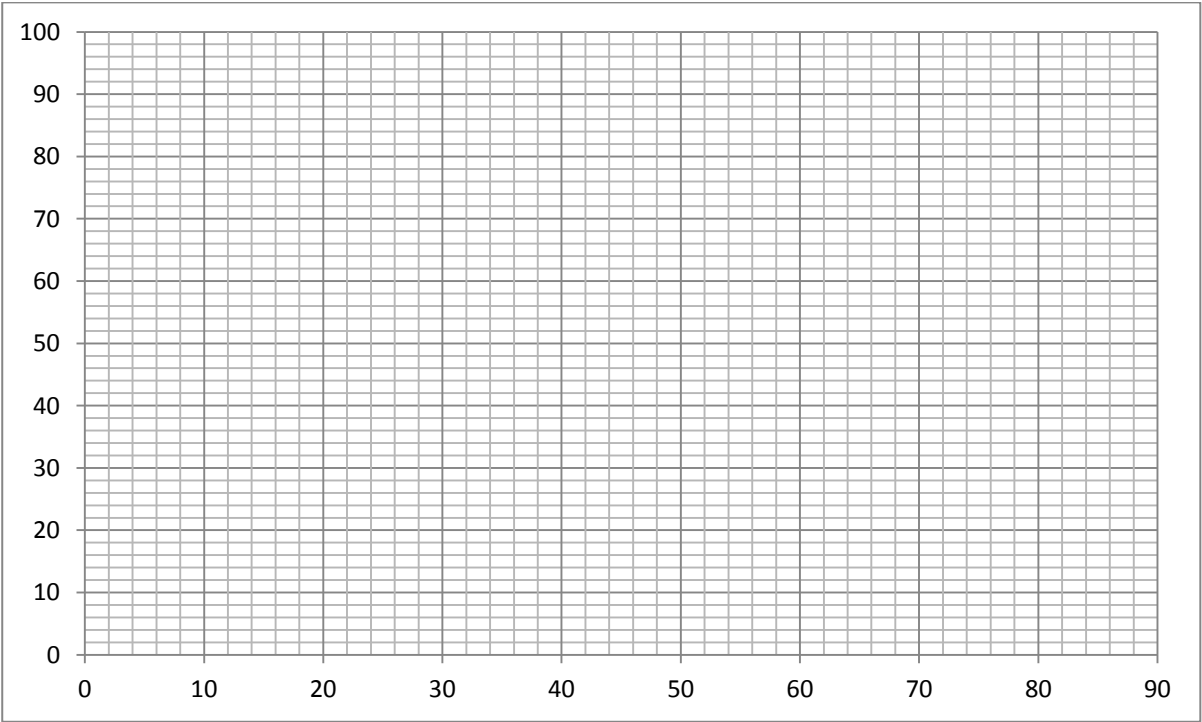
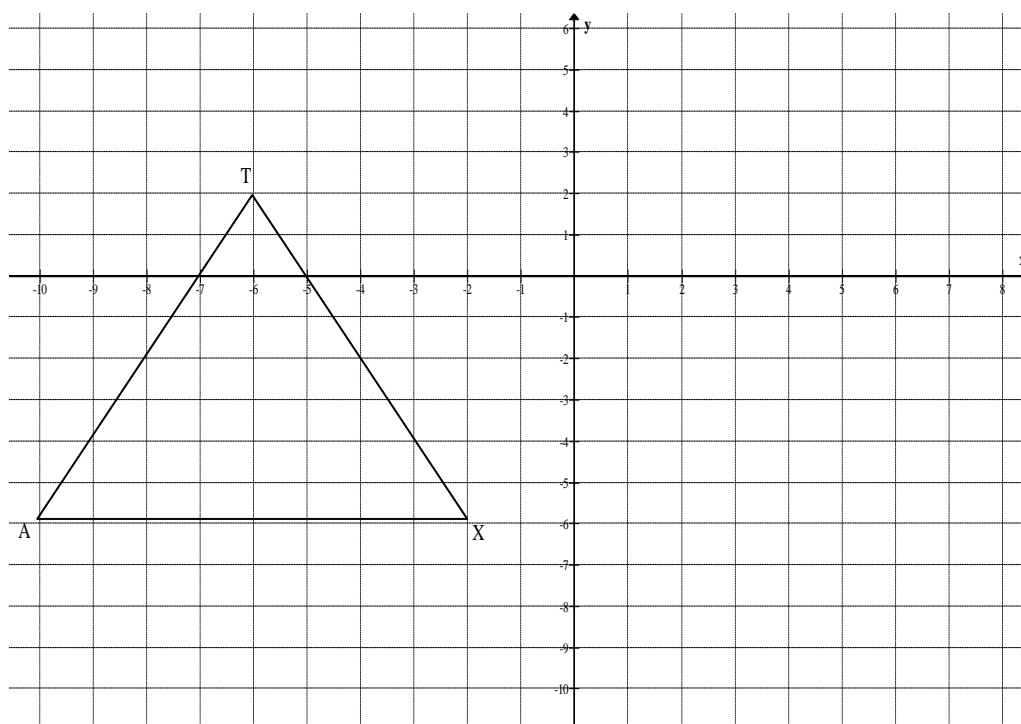


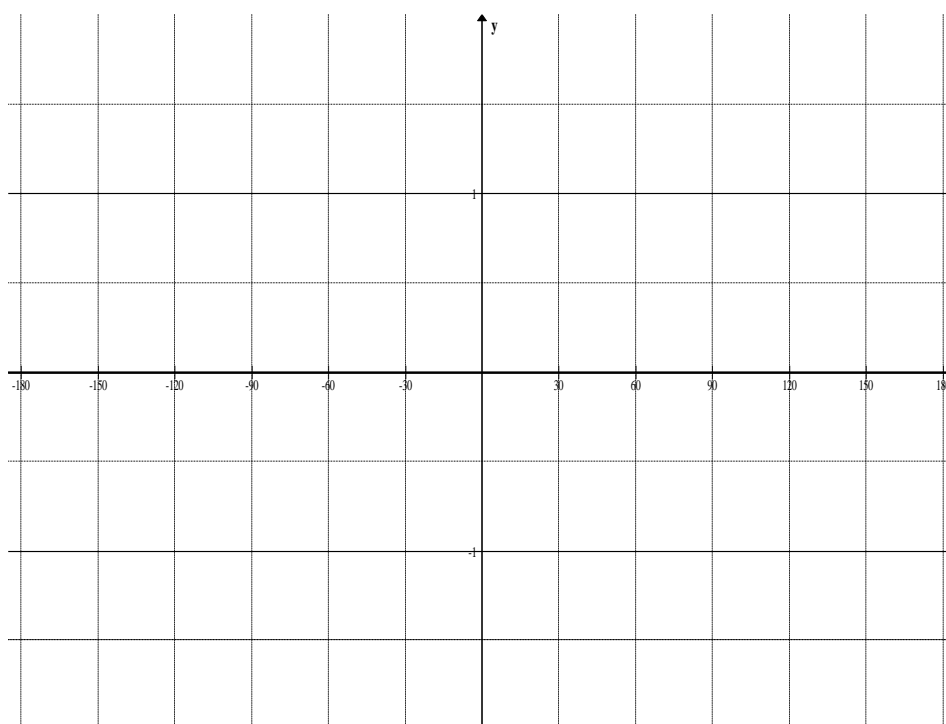
DIAGRAM SHEET 2

SURNAME: NAME:

QUESTION 7.2.1 and 7.2.2



QUESTION 11.2



INFORMATION SHEET: MATHEMATICS

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

$$A = P(1 + ni)$$

$$A = P(1 - ni)$$

$$A = P(1 - i)^n$$

$$A = P(1 + i)^n$$

$$\sum_{i=1}^n 1 = n$$

$$\sum_{i=1}^n i = \frac{n(n+1)}{2}$$

$$T_n = a + (n-1)d$$

$$S_n = \frac{n}{2}(2a + (n-1)d)$$

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r - 1} ; \quad r \neq 1$$

$$S_\infty = \frac{a}{1 - r} ; \quad -1 < r < 1$$

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

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

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

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c$$

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

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan \theta$$

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

$$\text{In } \triangle ABC: \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

$$\text{area } \triangle ABC = \frac{1}{2} ab \cdot \sin C$$

$$\sin(\alpha + \beta) = \sin \alpha \cdot \cos \beta + \cos \alpha \cdot \sin \beta$$

$$\sin(\alpha - \beta) = \sin \alpha \cdot \cos \beta - \cos \alpha \cdot \sin \beta$$

$$\cos(\alpha + \beta) = \cos \alpha \cdot \cos \beta - \sin \alpha \cdot \sin \beta$$

$$\cos(\alpha - \beta) = \cos \alpha \cdot \cos \beta + \sin \alpha \cdot \sin \beta$$

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

$$\sin 2\alpha = 2\sin \alpha \cdot \cos \alpha$$

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

$$\bar{x} = \frac{\sum fx}{n}$$

$$\sigma^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}$$

$$P(A) = \frac{n(A)}{n(S)}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

