



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

SEPTEMBER 2010

MATHEMATICS – SECOND PAPER

MARKS: 150

TIME: 3 hours



This question paper consists of 9 pages, a formula sheet and 2 diagram sheets.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 11 questions. Answer ALL questions.
2. Clearly show ALL calculations, diagrams, graphs, et cetera that 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. TWO diagram sheets for answering QUESTION 1.1, QUESTION 1.2 and QUESTION 10.1 are attached at the end of this question paper. Write your centre number and examination number on these sheets in the space provided and place it in your ANSWER BOOK.
6. Diagrams are NOT necessarily drawn to scale.
7. Number the answers correctly according to the numbering system used in this question paper.
8. It is in your own interest to write legibly and to present your work neatly.

QUESTION 1

The table below shows the number of goals conceded and the number of transgressions for 11 teams in the local football league.

Team	A	B	C	D	E	F	G	H	I	J	K
Number of goals conceded	40	51	32	65	60	48	50	35	41	43	62
Number of Transgressions	7	13	12	28	21	14	20	8	14	13	24

- 1.1 Use the diagram sheet to draw a scatter plot to represent the given data. (4)
- 1.2 Draw the line of best fit. (2)
- 1.3 Use your line to estimate how many transgressions Team L got if they conceded 48 goals. (2)
- [8]**

QUESTION 2

The test results of 39 grade 12 learners are given as follows:

- The lowest mark is 27 and the range for the marks is 60
- The upper quartile is 72
- The 10th learner scored 35 and the 20th learner scored 50
- Marks are out of 100

- 2.1 Determine the highest mark obtained by these learners. (2)
- 2.2 Write down the 5 number summary for these marks (3)
- 2.3 Draw the box and whisker diagram for the data (3)
- 2.4 With reference to 2.3, comment on the skewness of the data (2)
- 2.5 How many learners scored more than 72% (2)
- [12]**

QUESTION 3

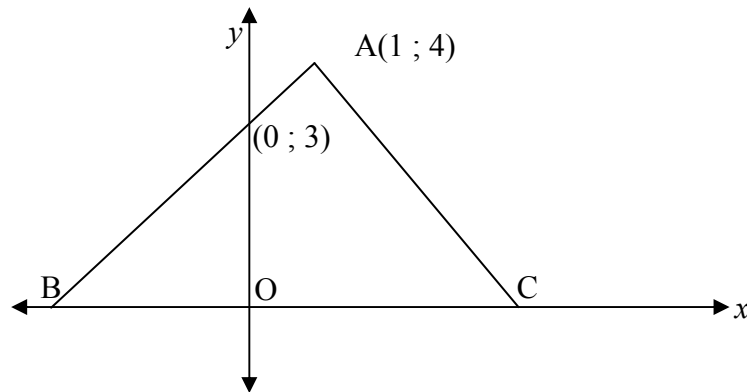
The following data represents the number of goals scored by 8 provincial soccer players:

12 ; 14 ; 10 ; 9 ; 8 ; 9 ; 11 ; 15

- 3.1 Determine the mean number of goals scored by these players. (2)
- 3.2 Calculate the standard deviation for the data. (3)
- 3.3 How many players scored goals within one standard deviation of the mean? (2)
- [7]**

QUESTION 4

ABC is a triangle with A(1 ; 4) and B and C on the x-axis. The y-intercept of AB is (0 ; 3). $AB \perp AC$.



- 4.1 Calculate the gradient of AB. (2)
- 4.2 Determine the equation of AC. (4)
- 4.3 Prove that $\triangle ABC$ is isosceles. (3)
- 4.4 Show that the x-intercept of AB is -3. (2)
- 4.5 Write down the coordinates of C. (2)
- 4.6 Determine the area of $\triangle ABC$. (4)

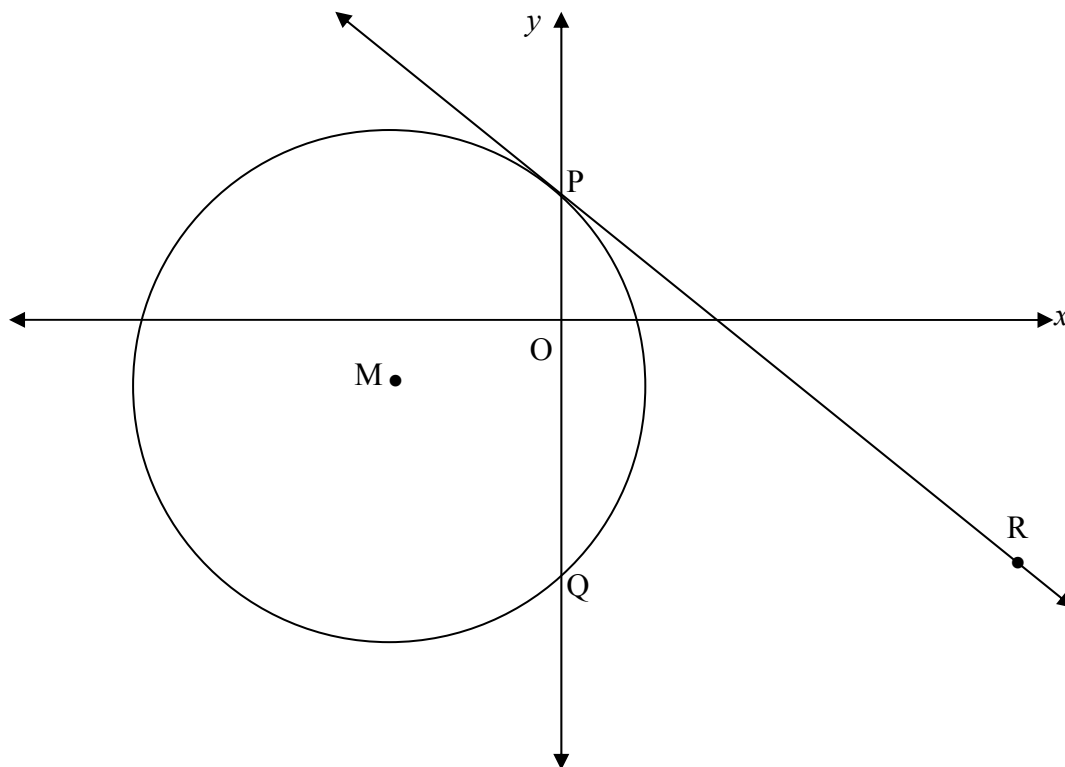
[17]

QUESTION 5

The diagram below shows a circle with equation

$$x^2 + 6x + y^2 + 4y - 12 = 0.$$

The circle cuts the y – axis at P and Q. PR is a tangent to the circle at P. M is the centre of the circle.



5.1 Determine:

5.1.1 The coordinates of M (4)

5.1.2 The coordinates of P (4)

5.1.3 The equation of the tangent at P (3)

5.1.4 The size of $\angle RPO$. (4)

5.2 Determine the coordinates of R if $MR = \sqrt{125}$ (8)

[23]

QUESTION 6

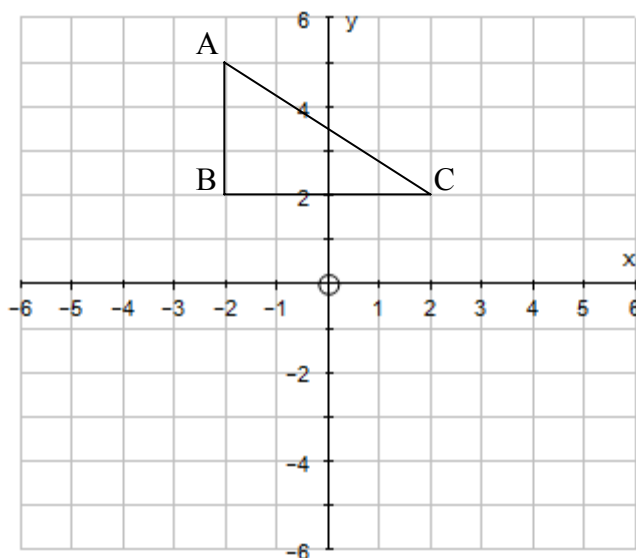
6.1 The point $P(4 ; -2)$ is given.

6.1.1 Write down the coordinates of P' which is the image of P under the transformation: $(x ; y) \rightarrow (x - 2 ; -y)$ (2)

6.1.2 Describe the transformation which will map P onto the point $(-4 ; 2)$. (2)

6.1.3 Write down the rule for the transformation in QUESTION 6.1.2 (2)

6.2 Triangle ABC is given with vertices $A(-2 ; 5)$, $B(-2 ; 2)$ and $C(2 ; 2)$



6.2.1 Write down the coordinates of $\triangle A'B'C'$ which is the reflection of $\triangle ABC$ in the line $y = -x$. (3)

6.2.2 What is the ratio of the perimeter of $\triangle ABC$ with respect to $\triangle A''B''C''$ after an enlargement with scale factor 3. (3)

6.2.3 If the area of $\triangle ABC$ is x^2 units, write down in terms of x the area of $\triangle A''B''C''$ (2)

[14]

QUESTION 7

The point $T(-3 ; 5)$ is rotated around the origin through 90° in a clockwise direction to $T'(x + 2 ; y - 2)$.

7.1 Write down the numerical values of x and y . (4)

7.2 Use the values of x and y to find the image of T'' which is the image of T' after a rotation of 120° anti-clockwise around the origin. Leave your answer in surd form. (6)
[10]

QUESTION 8

(No calculator may be used in this question)

8.1 In $\triangle ABC$ $\hat{A} + \hat{B} = 90^\circ$.

Determine the value of $\sin A \cos B + \cos A \sin B$. (3)

8.2 Use compound angles to show that $\cos 2x = 2\cos^2 x - 1$ (2)

8.3 Use your answer in QUESTION 8.2 to prove that

$$\cos 22,5^\circ = \frac{\sqrt{2 + \sqrt{2}}}{2} \quad (4)$$

8.4 Find the general solution for:

$$\tan^2 \alpha = \cos 2\alpha + 2\sin^2 \alpha \quad (6)$$

[15]

QUESTION 9

9.1 Simplify the following:

$$\frac{\cos(x - 540^\circ) \cdot \tan(x + 180^\circ)}{\cos(90^\circ - x)} \quad (5)$$

9.2 The following identity is given:

$$\frac{1 - \cos 2x}{\sin 2x} = \tan x$$

9.2.1 Prove the identity. (4)

9.2.2 Use the identity to find the value of $\tan 15^\circ$ in its simplest surd form.
(No calculator may be used.) (4)

9.3 Find the value of

$$(\sin 75^\circ + \cos 75^\circ)^2 \text{ without the use of a calculator.} \quad (5)$$

[18]

QUESTION 10

Given: $f(x) = \sin(45^\circ - x)$ and $g(x) = \tan x$

10.1 Sketch the graphs of f and g on the same set of axes for $x \in [-135^\circ; 180^\circ]$. Use the diagram sheet provided. (5)

10.2 Use your graphs to answer the following questions:

10.2.1 For which value of x is $\sin(45^\circ - x) = \tan x$, $x > 0$? (1)

10.2.2 Write down an interval for x such that $\sin(45^\circ - x) \cdot \tan x > 0$ (2)

10.3 Write down the equation of f after a horizontal shift of 45° to the left and a vertical shift of 2 units. (2)

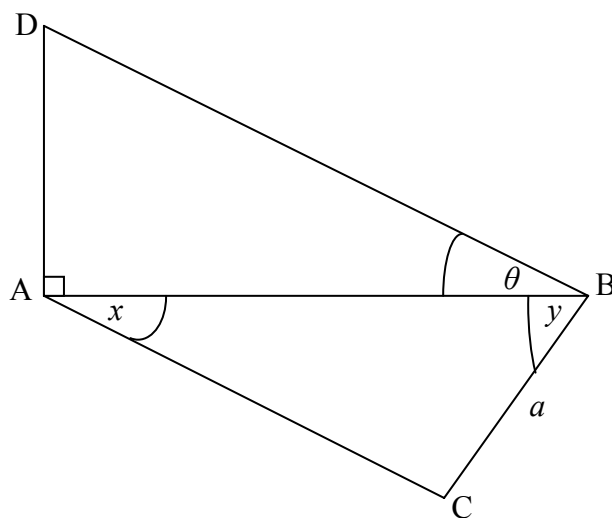
10.4 Write down the period of the new graph in QUESTION 10.3 (1)

[11]

QUESTION 11

A, B and C are three points on a horizontal plane and $AC = 2BC$.

$\hat{CAB} = x$, $\hat{ABC} = y$ and $BC = a$. DA is a vertical tower on the plane ABC and the angle of elevation of D from B is θ .



11.1 Show that $\sin y = 2\sin x$. (2)

11.2 Prove that $DA = a \tan \theta \sqrt{5 + 4\cos(x + y)}$ (8)

11.3 Hence, determine the height of the tower, rounded off to two decimal digits, if

$$a = 27,3 \text{ meters, } x = 29^\circ \text{ and } \theta = 36,4^\circ. \quad (5)$$

[15]

TOTAL: 150

INFORMATION SHEET/INLIGTINGSBLAD: MATHEMATICS/WISKUNDE

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad A = P(1 + ni) \quad A = P(1 - ni) \quad A = P(1 - i)^n \quad A = P(1 + i)^n$$

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

$$\sum_{i=1}^n ar^{i-1} = \frac{a(r^n - 1)}{r - 1} ; \quad r \neq 1 \quad \sum_{i=1}^{\infty} ar^{i-1} = \frac{a}{1 - r} ; \quad -1 < r < 1$$

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

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

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

$$y = mx + c$$

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

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

$$m = \tan \theta \quad (x - a)^2 + (y - b)^2 = r^2$$

In $\triangle ABC$:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \quad a^2 = b^2 + c^2 - 2bc \cdot \cos A \quad \text{area } \triangle ABC = \frac{1}{2} ab \cdot \sin C$$

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

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

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

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

$$\bar{x} = \frac{\sum fx}{n} \quad \sigma^2 = \frac{\sum (x_i - \bar{x})^2}{n}$$

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

$$\hat{y} = a + bx \quad b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

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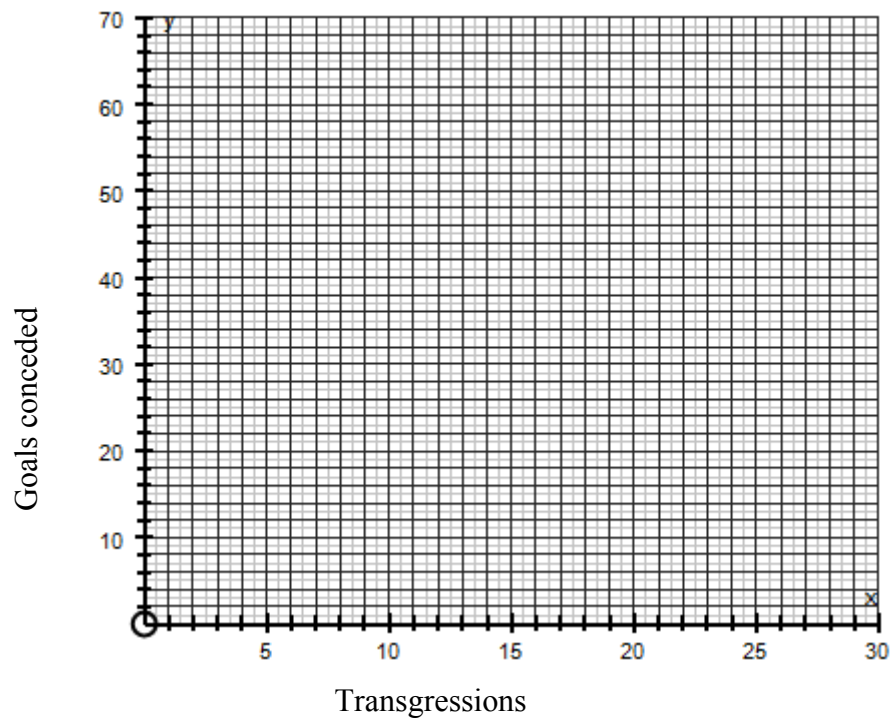
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DIAGRAM SHEET 1

QUESTION 1.1 & 1.2



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DIAGRAM SHEET 2

QUESTION 10.1

