



Province of the  
**EASTERN CAPE**  
EDUCATION

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**SEPTEMBER 2011**

**MATHEMATICS P3**

**MARKS: 100**

**TIME: 2 hours**



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This question paper consists of 8 pages, 1 information sheet and 2 diagram sheets.

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**INSTRUCTIONS AND INFORMATION**

Read the following instructions carefully before answering the questions.

1. This question paper consists of 10 questions. Answer ALL the questions.
2. Clearly show ALL calculations, diagrams, graphs, et cetera, which you have used in determining your 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. Number the answers correctly according to the numbering system used in this question paper.
6. Diagrams are NOT necessarily drawn to scale.
7. It is in your own interest to write legibly and to present work neatly.
8. TWO diagram sheets for answering QUESTION 6.1 and QUESTIONS 7 to 10 are attached at the end of this question paper. Write your NAME/EXAMINATION NUMBER in the spaces provided and hand them in together with your ANSWER BOOK.

**QUESTION 1**

If  $T_1 = -2$  and  $T_2 = -2$  ;  $T_{n+1} = T_n + T_{n-1}$  for  $n \geq 2$  and  $n \in N$

- 1.1 Write down the first five terms of the sequence. (3)
- 1.2 If the sum of this sequence is  $-1218$ ,
- 1.2.1 How many terms are in the sequence? (1)
- 1.2.2 Write down the  $n^{\text{th}}$  term of this sequence. (1)
- [5]

**QUESTION 2**

In a record voter turnout of more than 50 percent, the Independent Electoral Commission declared the 2011 election on 23 May as free and fair. In a population of 48 million people there are 23 million registered voters in South Africa. The voter turnout for the elections nationally was 57,6 percent of all registered voters. The majority party showed a clear lead of 62,0 percent of the people who did vote and will control 198 municipalities and 7 metropolitan areas. One opposition party managed to get 23,9 percent of the votes and will control only one metropolitan area.

- 2.1 Determine the number of voters that took part in the local government elections. (1)
- 2.2 Is the sample of voters representative of the population? Motivate your answer. (2)
- 2.3 If the majority political party managed to get 62% of the voter turnout for the elections, how many votes were obtained? (1)
- 2.4 There are 234 municipalities available in local government. What percentage of municipalities will the other political parties, excluding the majority political party, share amongst themselves? (2)
- 2.5 A good sample must be unbiased and representative of the population. Name TWO elements that should be part of the composition of voters that will make the sample of voters truly representative. (2)
- [8]

**QUESTION 3**

Members of a health club decided that through correct eating habits and consistent exercise they are able to control their body mass. After seven weeks they measured each others body mass and came to a mean weight of 78 kg and a standard deviation of 5,9 normally distributed among 150 members.

- 3.1 How many members' body mass will fall within ONE standard deviation of the mean? (2)
- 3.2 It is suggested by the dietician of the club that members whose body mass is under 72,1 kg must take additional protein supplements. What percentage of all the members fall into this category? (2)
- 3.3 Calculate the lowest and highest possible body masses of this normal distribution curve. (2)
- [6]

### QUESTION 4

4.1 A survey was conducted amongst 200 learners about the types of movies they watch. The following types were listed: action movies, romantic movies and comedies. The information from the survey is summarised below.

- 90 watched action movies
- 64 watched romantic movies
- 77 watched comedies
- 8 watched all three types of movies
- 18 watched romantic movies and comedies
- 26 did not watch any of the three types of movies
- 27 watched action movies and comedies
- $x$  number of learners watched action movies and romantic movies, but not comedies

4.1.1 Draw a Venn diagram to represent the information. (6)

4.1.2 How many learners prefer action movies only? (3)

4.1.3 What is the probability that, if a learner is randomly selected, s/he would prefer only two types of movies? (2)

4.2 A survey was conducted amongst 1000 Grade 12 learners regarding whether or not they sleep for six hours or more at night and whether or not their concentration levels are good the next day. The results of the survey were as follows:

	Good Concentration	Not Good Concentration	Total
<b>Sleeps for 6 hours or more.</b>	180	$a$	300
<b>Sleeps for less than 6 hours</b>	40	660	$b$
<b>Total</b>	220	780	1000

4.2.1 Determine the values of  $a$  and  $b$ . (1)

4.2.2 Calculate the probability that a Grade 12 learner chosen at random, will sleep at least six hours whose concentration is not good the next day? (2)

4.2.3 Are the events of sleeping for at least six hours and having good concentration the next day independent or not? Motivate your answer with appropriate calculations. (4)

[18]

**QUESTION 5**

- 5.1 A new social networking website allows users to choose their own passwords. The password may have a minimum of 4 and a maximum of 8 characters. They may use all the letters of the alphabet (small caps only), the digits 0 to 9 and the five symbols, #, \$, %, &, \*, when choosing a password.
- 5.1.1 How many six character passwords can be formed if repetition of the characters is allowed? (2)
- 5.1.2 How many six character passwords, starting with a letter of the alphabet and ending with one of the symbols, can be formed? (2)
- 5.1.3 What is the probability that a subscriber chosen at random will have a seven character password with no repetition of characters? (3)
- 5.2 A small police station in a rural village has only 3 police vehicles and 5 parking bays to park the vehicles. In how many ways can these parking bays be occupied? (3)
- [10]**

**QUESTION 6**

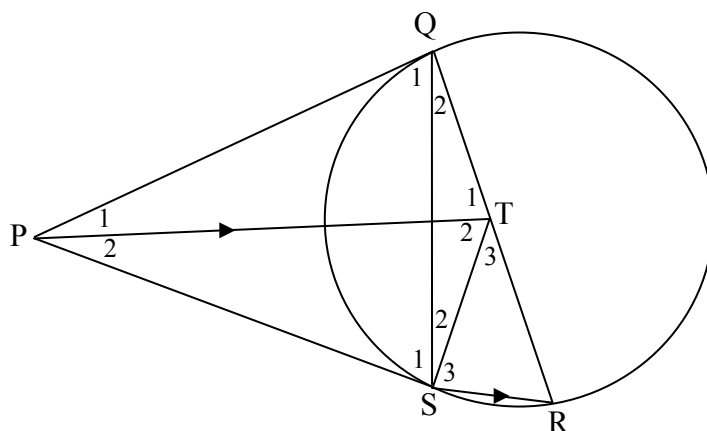
The marks out of a maximum of 100, obtained by 10 learners in Mathematics and Music were recorded as follows:

<b>Mathematics</b>	<b>34</b>	<b>80</b>	<b>50</b>	<b>9</b>	<b>70</b>	<b>58</b>	<b>79</b>	<b>51</b>	<b>90</b>	<b>19</b>
<b>Music</b>	<b>71</b>	<b>19</b>	<b>50</b>	<b>90</b>	<b>39</b>	<b>30</b>	<b>10</b>	<b>38</b>	<b>89</b>	<b>78</b>

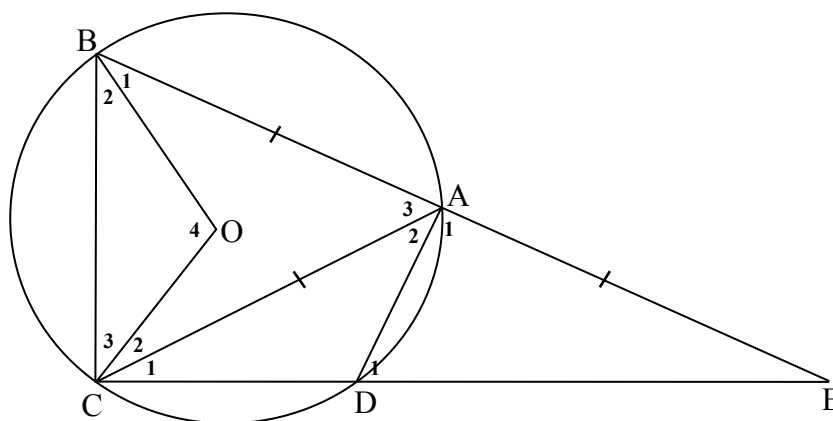
- 6.1 Use DIAGRAM SHEET 1 and draw a scatter plot of the data. (3)
- 6.2 Determine the equation of the regression line. (4)
- 6.3 Determine the correlation coefficient. (2)
- 6.4 What does the correlation coefficient indicate in this case? (1)
- 6.5 Identify the outlier(s) in the set of data. (1)
- 6.6 If the marks of the outlier(s) is/are removed from the data set, what does the new correlation coefficient indicate? (2)
- 6.7 Which ONE of the two correlation coefficients is more accurate, with the outlier included or with the outlier excluded? Motivate your answer. (2)
- [15]**

## QUESTION 7

- 7.1 In the figure, PQ and PS are tangents to the circle through the points Q, S and R.  
 PT // SR with T on QR and  $\hat{S}_1 = 67^\circ$ .



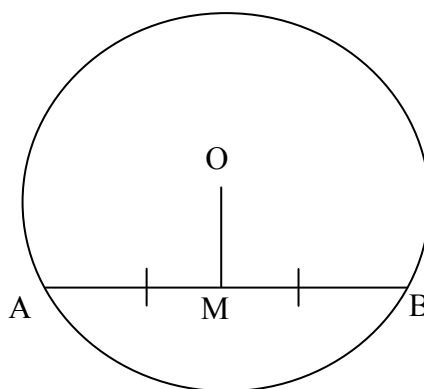
- 7.1.1 Name, with reasons, THREE other angles in the given figure each equal  $67^\circ$ . (3)
- 7.1.2 If T is the centre of the circle, determine the size of  $\hat{T}_2$ . (3)
- 7.1.3 Hence, or otherwise, prove that PQTS is a cyclic quadrilateral. (1)
- 7.2 In the figure below is ABCD a cyclic quadrilateral of the circle with centre O and  $BA = CA$ . BA and CD produced intersect in E,  $BA = AE$  and  $\hat{O}_4 = 4x$ .



- 7.2.1 Determine, with reasons, the size of  $\hat{E}$  in terms of  $x$ . (3)
- 7.2.2 Hence, prove that ED is a diameter of circle AED. (4)

**QUESTION 8**

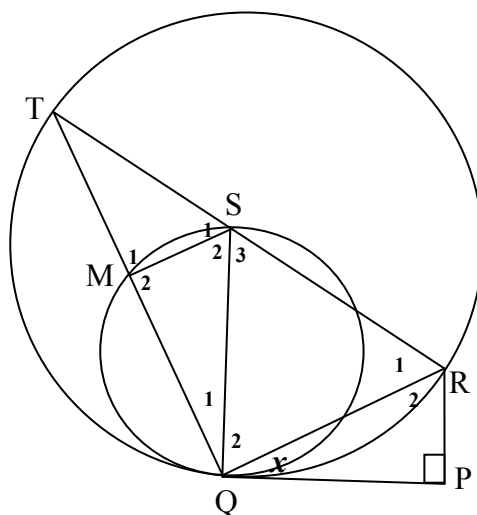
In the diagram below, AB is a chord of the circle with centre O. M is the midpoint of AB. Prove the theorem that states that  $OM \perp AB$ .



[5]

**QUESTION 9**

PQ is a common tangent to the two circles. S is the centre of the larger circle and QS is a diameter of the smaller circle. T and R are points on the larger circle and TSR is a straight line. TQ cuts the smaller circle at M and  $RP \perp QP$ .



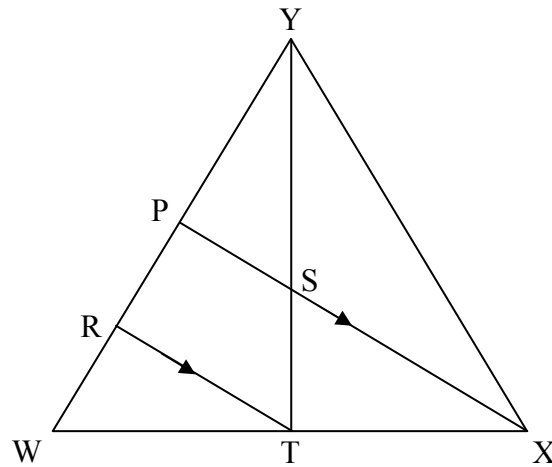
Prove, giving reasons, that:

- 9.1  $TM = MQ$  (2)
- 9.2 QR bisects  $\widehat{PRS}$  (3)
- 9.3  $\triangle PQR \sim \triangle QTR$  (3)
- 9.4  $RQ^2 = 2 SQ \cdot RP$  (3)

[11]

**QUESTION 10**

In the diagram, XP is the perpendicular bisector of side WY of  $\triangle WXY$ . T is a point on WX such that  $WT : WX = 3:5$ , XP and YT intersect at S and TR is drawn parallel to XP.



Determine:

10.1  $\frac{YP}{YR}$  (3)

10.2  $\frac{TR}{SP}$  (2)

10.3  $\frac{\text{Area } \triangle SPY}{\text{Area } \triangle TRY}$  (3)

**[8]**

**TOTAL: 100**



**INFORMATION SHEET: MATHEMATICS**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$y = mx + c$$

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

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

$$m = \tan \theta$$

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

In  $\triangle ABC$ :

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

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

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

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

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

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

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

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

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

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

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

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

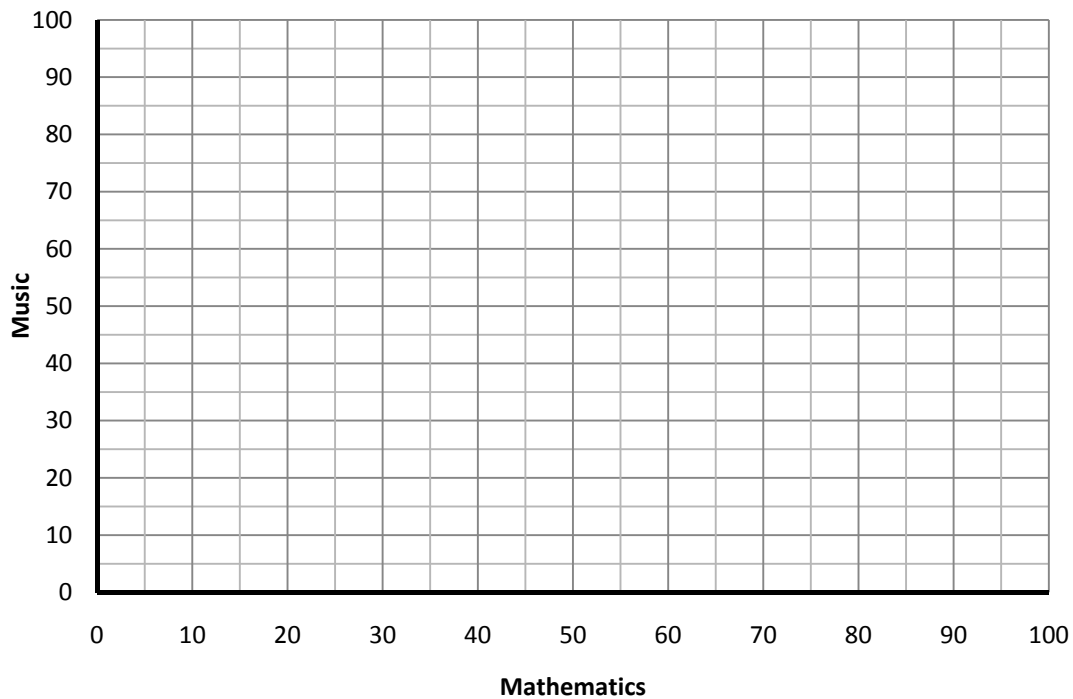
$$\hat{y} = a + bx$$

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

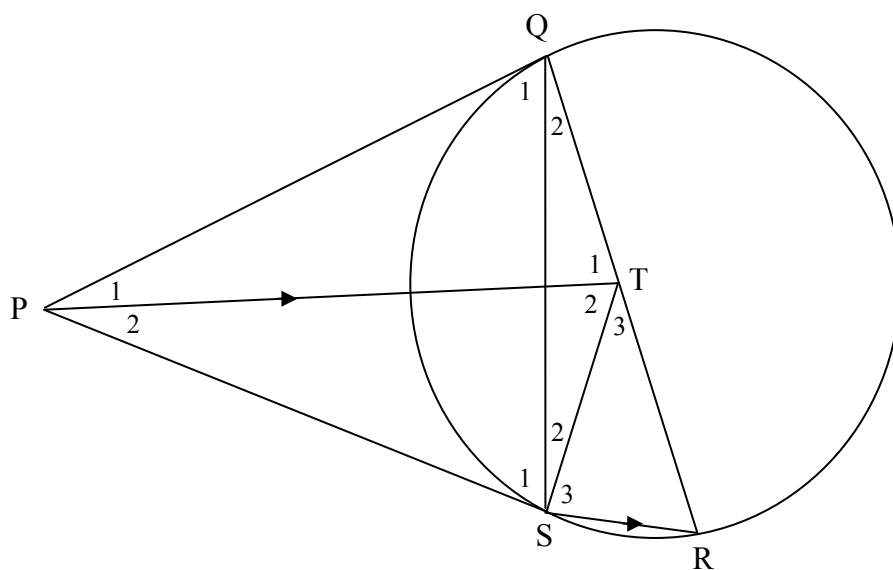
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**DIAGRAM SHEET 1****QUESTION 6**

6.1

**MARKS****QUESTION 7**

7.1

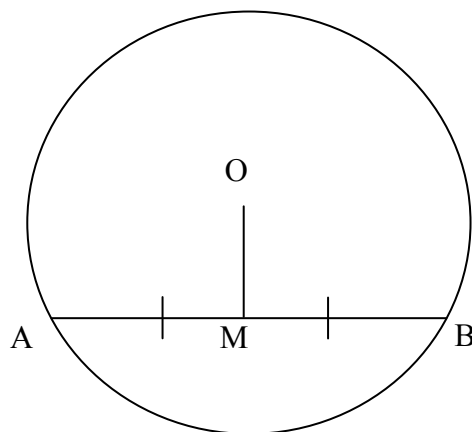
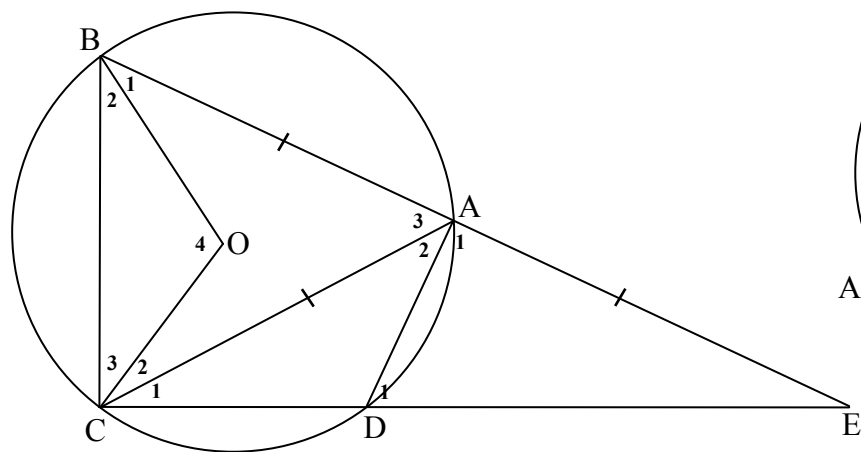


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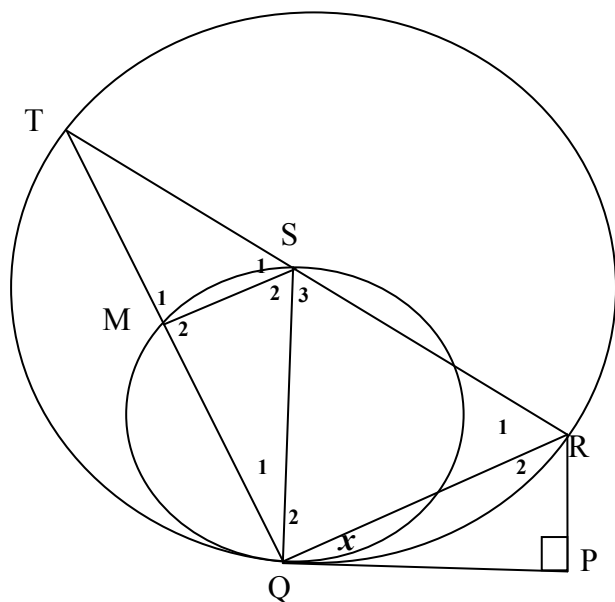
## DIAGRAM SHEET 2

7.2

## QUESTION 8



## QUESTION 9



## QUESTION 10

