



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

SEPTEMBER 2012

MATHEMATICS P3

MARKS: 100

TIME: 2 hours

This question paper consists of 10 pages, 1 formula sheet and 5 diagram sheets.

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. FIVE diagram sheets for answering QUESTION 4.2.1, 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

The *recursive formula* for T_{k+1} of a particular sequence is $T_{k+1} = T_k + 4k - 2$ where $T_1 = 2$ and $k \geq 1$.

1.1 Determine the first FOUR terms of the sequence. (3)

1.2 Hence determine the *explicit formula* for the n^{th} term of the sequence in the form
 $T_n = \dots\dots\dots$ (4)
[7]

QUESTION 2

The circulation of a popular newspaper's monthly sales in the Eastern Cape rose by 12,5% to 36 600 sales for the month of May, partly because of good report writing and profitable advertising.

2.1 If the sales rose to 36 600 in May 2012, how many newspapers were sold the previous month of April 2012? (2)

2.2 If the sales of the newspaper rose to 41 000 in June 2012, what was the percentage increase for the month of June 2012? (2)

2.3 If the shareholders of the newspaper demand 37 000 sales on average per month, would you say that the newspaper sales for the term April to June 2012 meet the demands set by the shareholders? Support your answer with appropriate calculations. (2)
[6]

QUESTION 3

The IQ scores for a general population are normally distributed with a mean of 100 and a standard deviation of 15. If this model is applicable to a population of 48 000 000 people ...

3.1 How many people will have an IQ score above 115? (2)

3.2 How many people will have an IQ score below 130? (2)

3.3 What percentage of the population can be regarded as highly intelligent? (2)

3.4 If a sample of 4,8 million people were tested for IQ scores, are the above results valid and reliable? Support your answer with appropriate calculations. (2)
[8]

QUESTION 4

4.1 Given:

$P(A) = 0,4$

$P(B) = 0,5$

$P(A \cup B) = 0,7$

4.1.1 Represent the data by using a Venn diagram. (3)

4.1.2 Are events A and B mutually exclusive? Support your answer with appropriate calculations. (3)

4.1.3 Are events A and B independent? Support your answer with appropriate calculations. (4)

4.2 A survey is conducted amongst 300 schools in Region X in the Eastern Cape. The ages and qualifications of 3004 teachers are surveyed. The table below shows the results of the survey.

Ages	< 30	30 – 39	40 – 49	≥ 50	TOTALS
Qualifications					
3 year, professional	15	152	102	221	
4 year, professional	43	337	311	166	
Degree, professional	211	578	298	145	
Higher degree, professional	12	121	127	37	
Degree, no professional	13	55	45	15	
TOTALS					

4.2.1 Complete the above table on DIAGRAMSHEET 1. (2)

4.2.2 What is the probability that a teacher is under the age of 40? (2)

4.2.3 What is the probability that a teacher is under the age of 40 and at least has a degree with a professional qualification? (2)

4.2.4 What is the probability that a teacher has no degree? (2)

4.2.5 What is the probability that a teacher is over the age of 40 and has no degree? (2)

4.2.6 Are the ages and the qualifications of the teachers younger than 30 years and having a 4 year professional qualification mutually exclusive? Motivate your answer with appropriate calculations. (3)

[23]

QUESTION 5

- 5.1 A librarian wants to classify 75 000 books in her library. A systems designer is asked to design an inventory system to identify each book. Each number uses one capital letter followed by a series of digits (digits may repeat and the digits from 1 to 9 are allowed). An example of such a book is X 123... How many digits must be used to ensure that each book has a unique number? (4)
- 5.2 A court needs both an Afrikaans and isiXhosa interpreter for each court case.
- 5.2.1 A pair of interpreters is to be selected from a group of eight people consisting of FIVE Afrikaans speakers and THREE isiXhosa speakers. How many different pairs of interpreters can be selected? (1)
- 5.2.2 If all EIGHT people can both speak Afrikaans and isiXhosa, how many pairs of interpreters can be selected? (2)
- [7]

QUESTION 6

After watching a TV commercial on healthy living, TEN teachers of a rural school decided to put themselves under a strict diet and rigorous exercises. The table below show the relationship between their body mass (in kg) and their waist line (in cm) after six weeks.

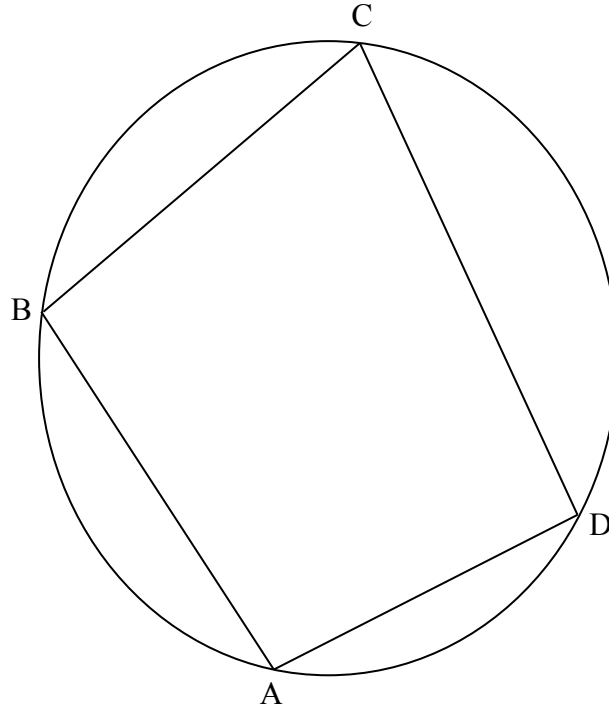
Body mass in kg	132	150	72	135	111	84	87	54	138	135
Waistline in cm	132	106	99	104	98	105	96	89	142	104

- 6.1 Use DIAGRAM SHEET 1 and draw a scatter plot of the data. (2)
- 6.2 State the relationship that you observe from your scatter plot between the body mass and the waistline. (1)
- 6.3 Determine the correlation coefficient correct to THREE decimal places. (2)
- 6.4 Use your calculator to calculate the least squares regression line, $y = a + bx$ correct to ONE decimal place. (3)
- 6.5 Use the line of best fit to predict the waist line of a teacher who weighs 60 kg after six weeks. (2)
- 6.6 Use the equation of the least squares regression line to predict the waistline of a teacher whose body mass is 200 kg after six weeks. (2)

[12]

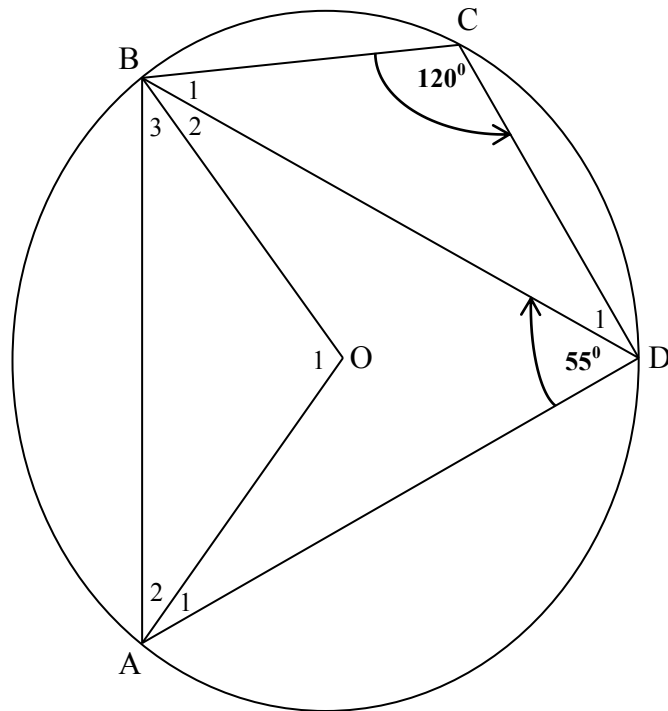
QUESTION 7

- 7.1 In the figure below ABCD is a cyclic quadrilateral. Prove the THEOREM that states that the opposite angles of a cyclic quadrilateral are supplementary ($\hat{A} + \hat{C} = 180^\circ$).

**[5]**

QUESTION 8

8.1 In the figure below O is the centre of the circle, $\hat{C} = 120^\circ$ and $\hat{A}DB = 55^\circ$.

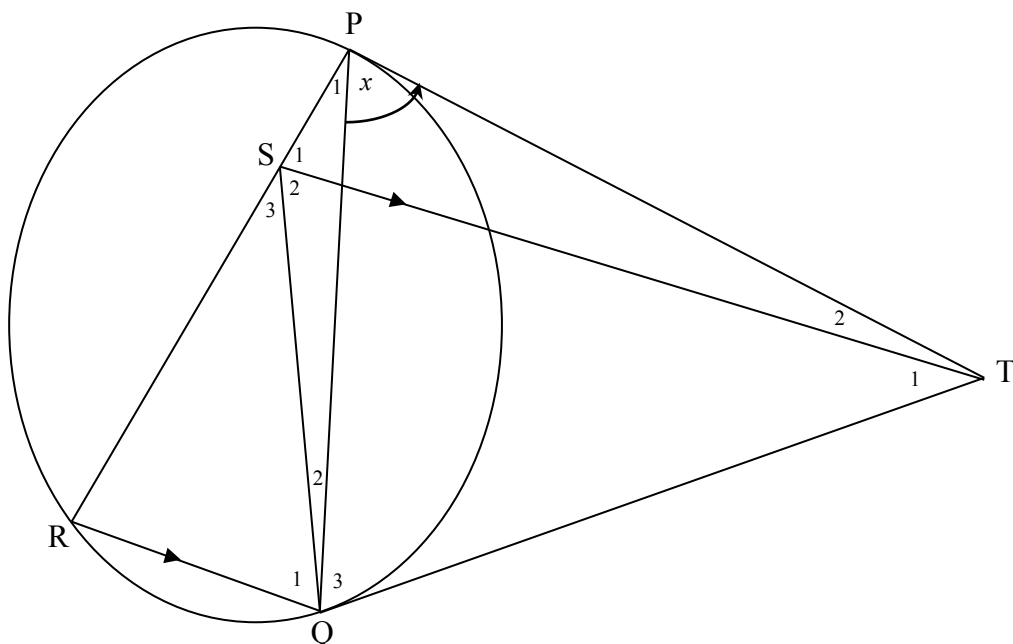


Determine with reasons:

8.1.1 $\hat{O}_1$ (2)

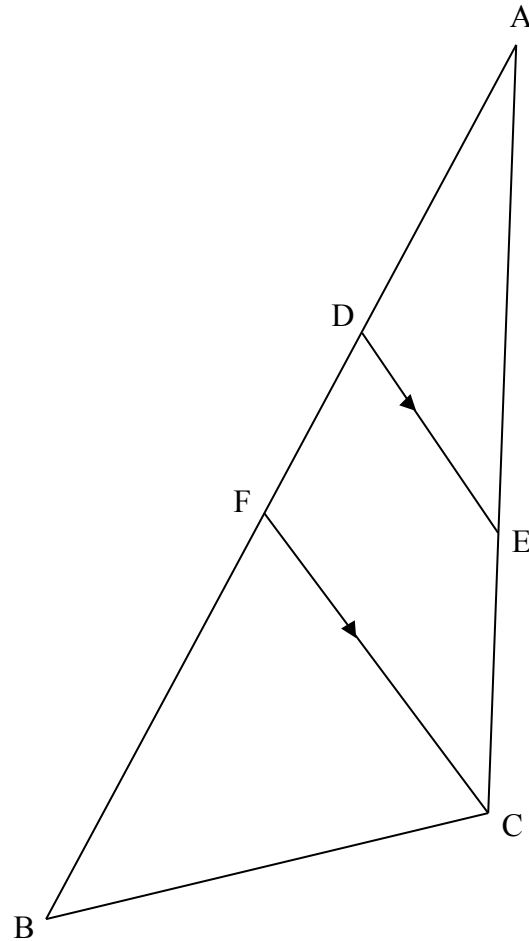
8.1.2 $\hat{O}AD$ (4)

8.2 The figure below shows that TP and TQ are tangents to the circle PQR, $\hat{P}Q = x$ and $RQ \parallel ST$.



QUESTION 10

In the figure below $EA = 2EC$, $AB = 3AD$, $DE \parallel FC$.



Determine with reasons:

10.1 $\frac{AE}{CE}$ (1)

10.2 $\frac{AD}{DF}$ (1)

10.3 $\frac{AD}{BD}$ if $AD = 2x$ (3)

10.4 $\frac{\text{Area } \triangle CFB}{\text{Area } \triangle CFA}$ (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 $\triangle ABC$:

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

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

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

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

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

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

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

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

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

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

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

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

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

$$P(A \text{ of } B) = P(A) + P(B) - P(A \text{ en } B)$$

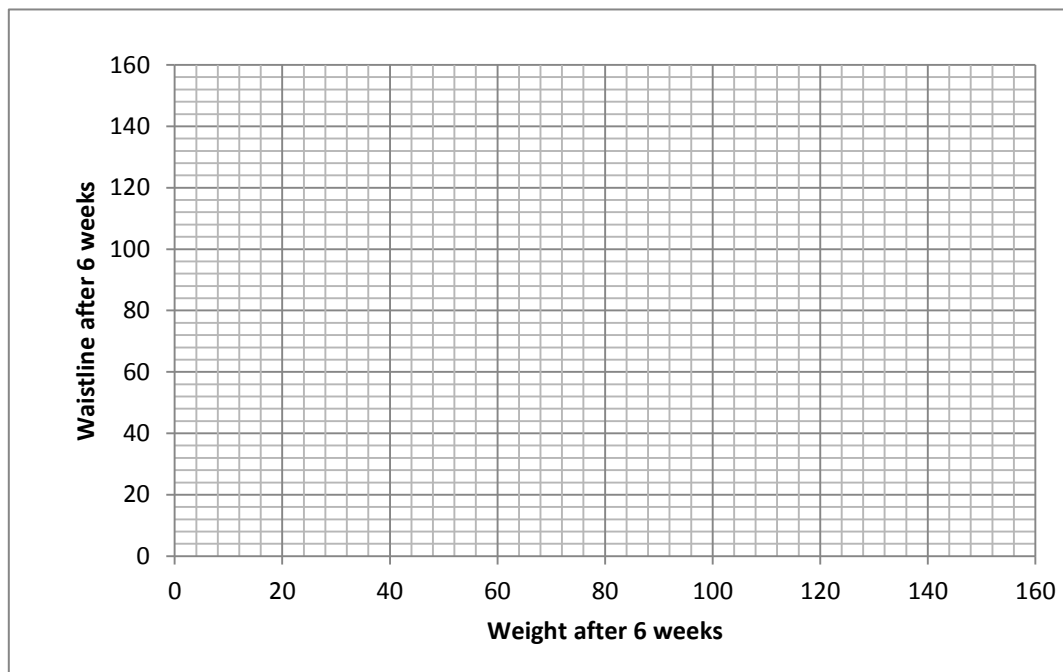
$$\hat{y} = a + bx$$

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

NAME/EXAMINATION NUMBER:

DIAGRAM SHEET 1**QUESTION 4.2.1**

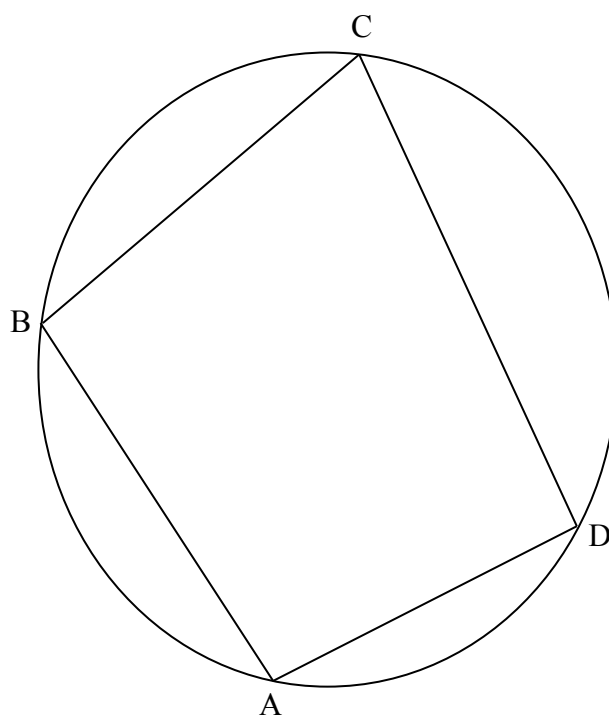
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Higher degree professional	12	121	127	37	
Degree, no professional	13	55	45	15	
TOTALS					

QUESTION 6.1

NAME/EXAMINATION NUMBER:

DIAGRAM SHEET 2

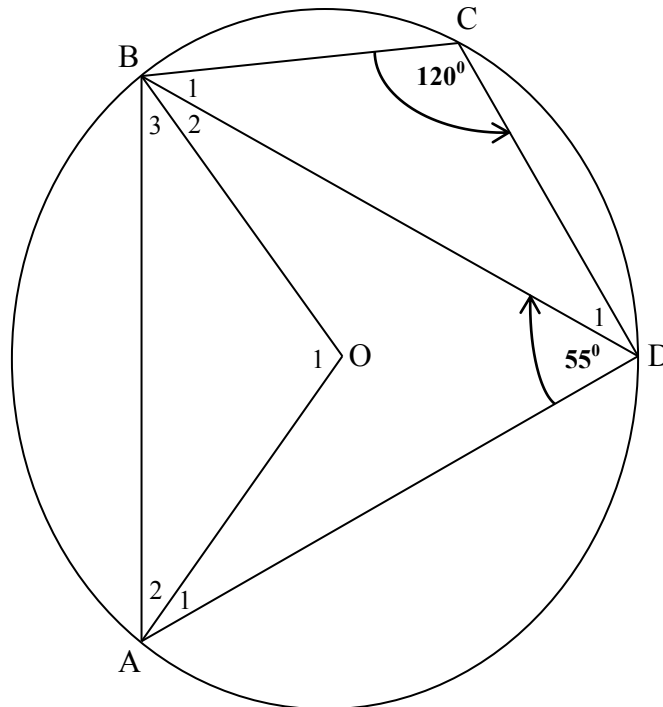
QUESTION 7



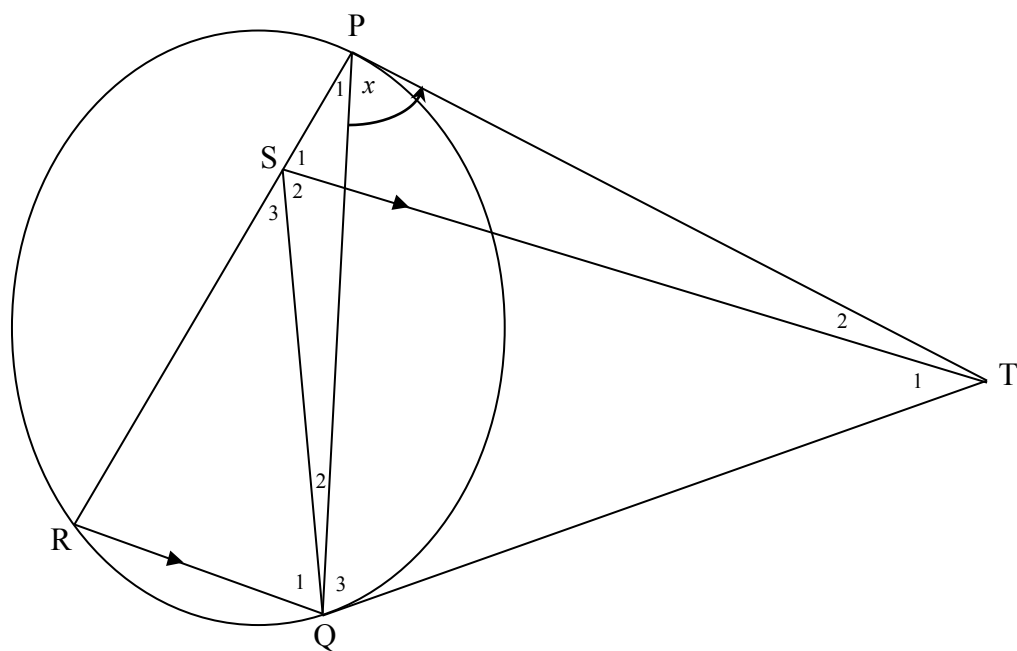
NAME/EXAMINATION NUMBER:

DIAGRAM SHEET 3

QUESTION 8.1



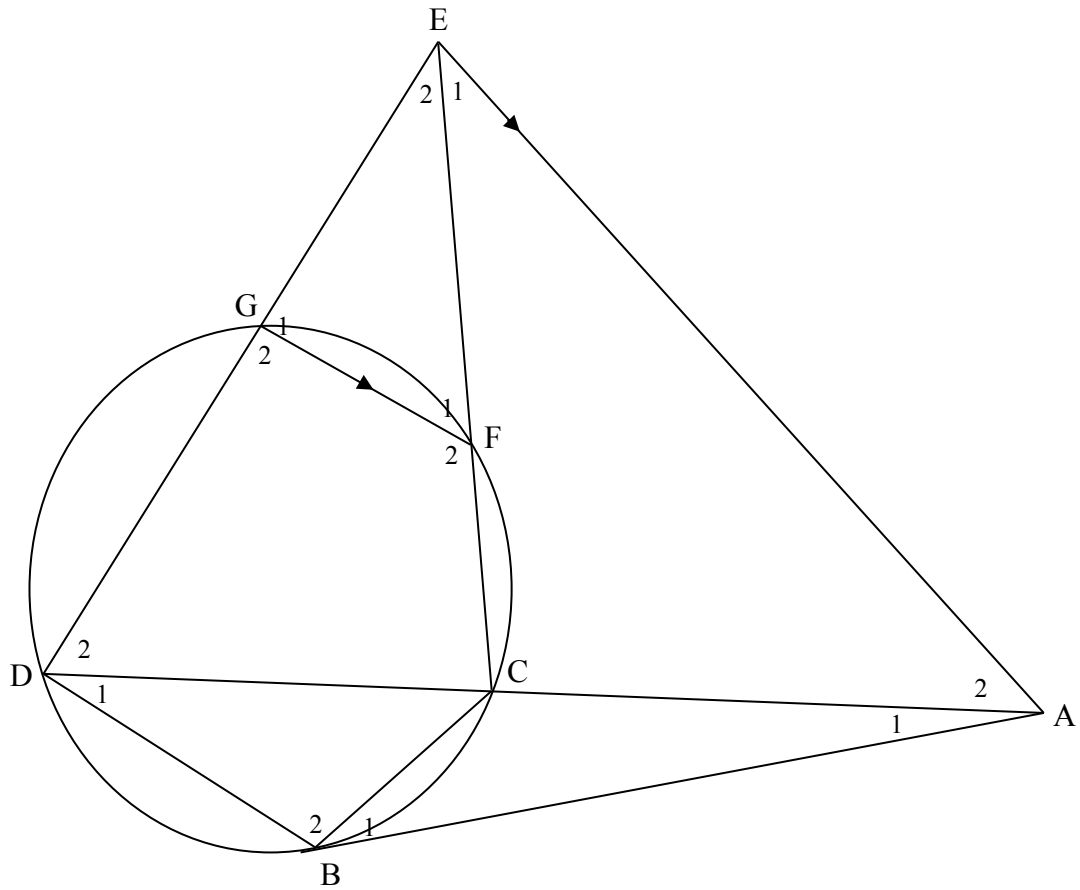
QUESTION 8.2



NAME/EXAMINATION NUMBER:

DIAGRAM SHEET 4

QUESTION 9



NAME/EXAMINATION NUMBER:

DIAGRAM SHEET 5

QUESTION 10

