



NATIONAL SENIOR CERTIFICATE EXAMINATION  
SUPPLEMENTARY EXAMINATION – MARCH 2019

**MATHEMATICS: PAPER II**

**EXAMINATION NUMBER**

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Time: 3 hours

150 marks

**PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY**

1. This question paper consists of 27 pages and an Information Sheet of 2 pages (i–ii). Please check that your question paper is complete.
2. Read the questions carefully.
3. **Answer ALL the questions on the question paper and hand this in at the end of the examination. Remember to write your examination number on the space provided.**
4. Diagrams are not necessarily drawn to scale.
5. You may use an approved non-programmable and non-graphical calculator, unless otherwise stated.
6. Ensure that your calculator is in **DEGREE** mode.
7. All the necessary working details must be clearly shown. Answers only will not necessarily be awarded full marks.
8. It is in your own interest to write legibly and to present your work neatly.
9. Round off to two decimal places unless otherwise stated.
10. There are four blank pages at the end of this paper. In case you run out of space when answering a question, use these pages. Clearly indicate the number of the question you are working on.

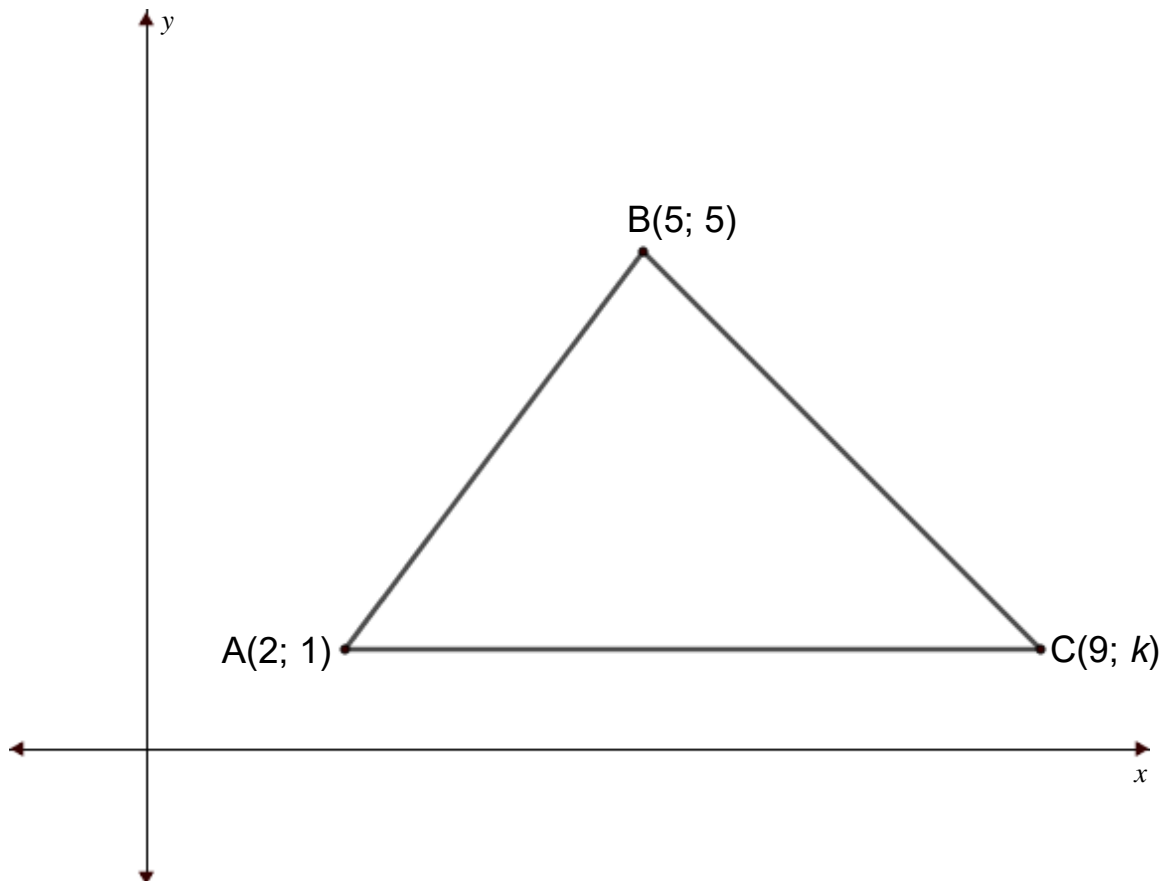
**FOR OFFICE USE ONLY: MARKER TO ENTER MARKS**

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	TOTAL
16	10	11	20	17	7	16	10	13	6	16	8	/150

**SECTION A****QUESTION 1**

In the diagram below,  $\triangle ABC$  has vertices  $A(2; 1)$ ;  $B(5; 5)$  and  $C(9; k)$ .

- $AC$  is parallel to the  $x$ -axis.



- (a) Write down the value of  $k$ .

(1)

- (b) Calculate the length of  $AB$ .

(2)

- (c) Determine the equation of a line that goes through the midpoint of line AC and point B.

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(4)

- (d) Determine the size of angle  $\hat{CAB}$ .

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(3)

- (e) Calculate the area of  $\triangle ABC$ .

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(3)

- (f) Write down the equation of a circle that has a centre at point B and a radius of 5 units.

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(1)

- (g) Would the circle above go through point A? Explain your answer.

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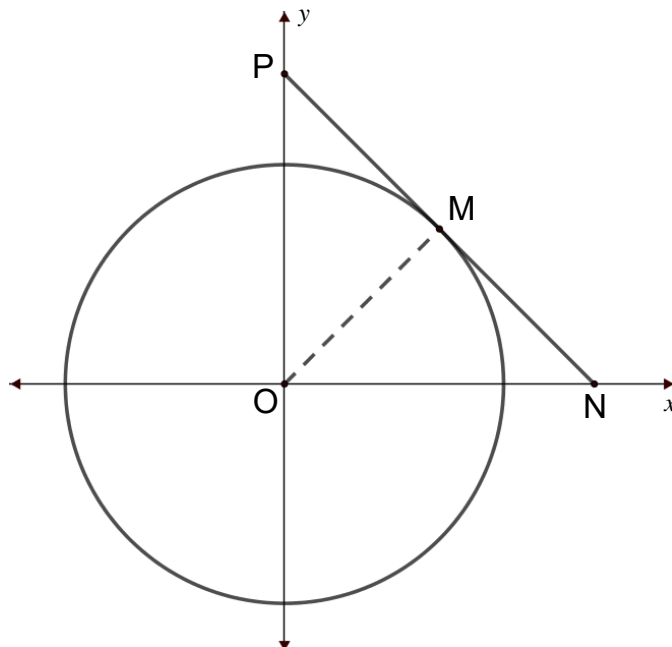
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(2)  
**[16]**

**QUESTION 2**

In the diagram below, circle centre O and equation  $x^2 + y^2 = 9$  is drawn.

- Line OM has equation  $y = x$ .
- Line PN is a tangent to the circle at M with P and N on the y-axis and x-axis respectively.



- (a) Write down the length of OM.

\_\_\_\_\_ (1)

- (b) Determine the coordinates of point M.

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\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (4)

- (c) Determine the equation of line PN.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (3)

(d) Calculate the area of  $\triangle OPN$ .

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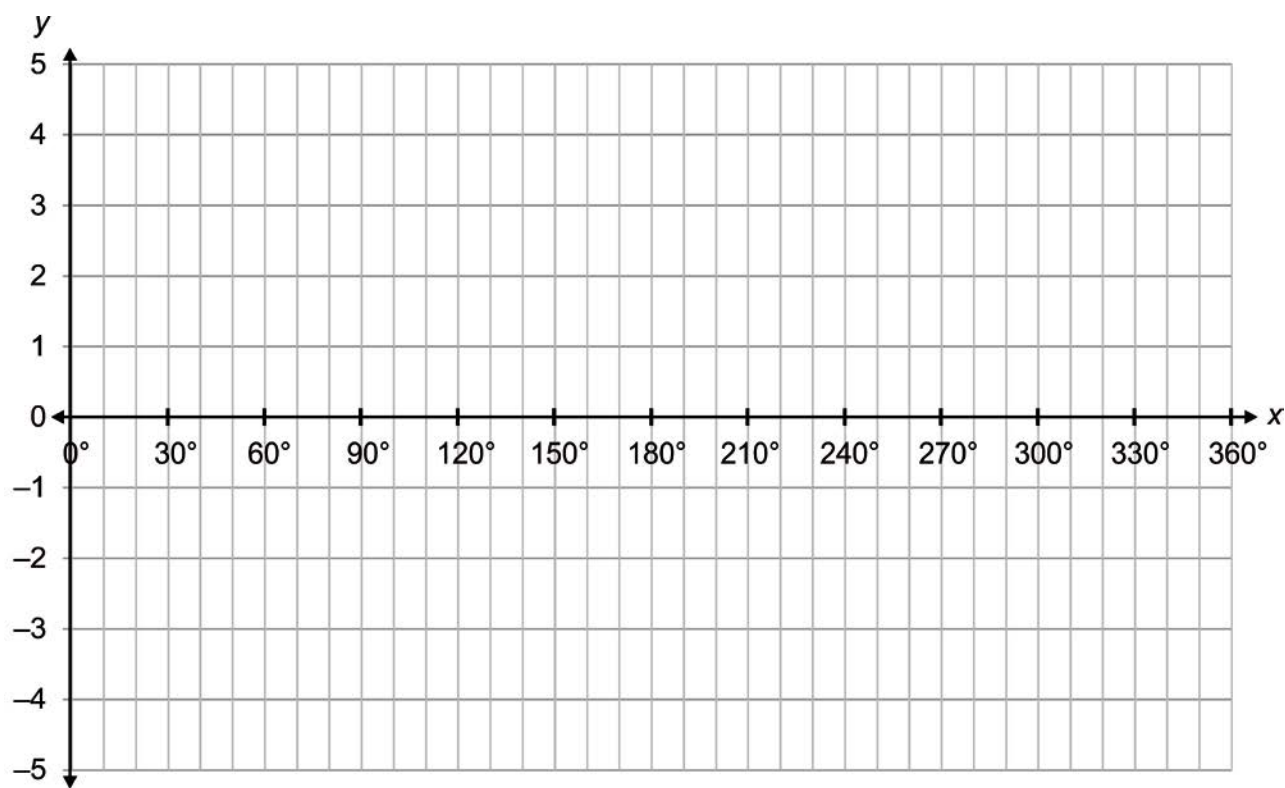
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(2)  
**[10]**

**QUESTION 3**

- (a) On the set of axis provided below sketch the graph of  $f(x) = 3\cos 2x$  if  $x \in [0^\circ; 360^\circ]$



(4)

- (b) If  $g(x) = 2$ , determine, correct to one decimal place, the values for  $x$  where  $f(x) = g(x)$  if  $x \in [0^\circ; 360^\circ]$ .

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(6)

- (c) Write down the maximum value of  $g(x) - f(x)$ .

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(1)  
[11]

### QUESTION 4

(a) (1) Prove that  $\frac{\sin \theta}{\cos \theta - \sin \theta} + \frac{\sin \theta}{\cos \theta + \sin \theta} = \tan 2\theta$ .

[illegible]

(5)

- (2) Hence, determine, correct to one decimal place, the general solution for  $\theta$  if

$$\frac{\sin \theta}{\cos \theta - \sin \theta} + \frac{\sin \theta}{\cos \theta + \sin \theta} = -5$$

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(4)

- (b) If  $\sin 27^\circ = m$ , determine, without the use of a calculator, the value of the following in terms of  $m$ .

- (1)  $\cos 27^\circ$

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(2)

- (2)  $\sin^2 63^\circ$

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(2)

- (3)  $\sin 72^\circ$

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(3)



(4)  $\tan 243^\circ$

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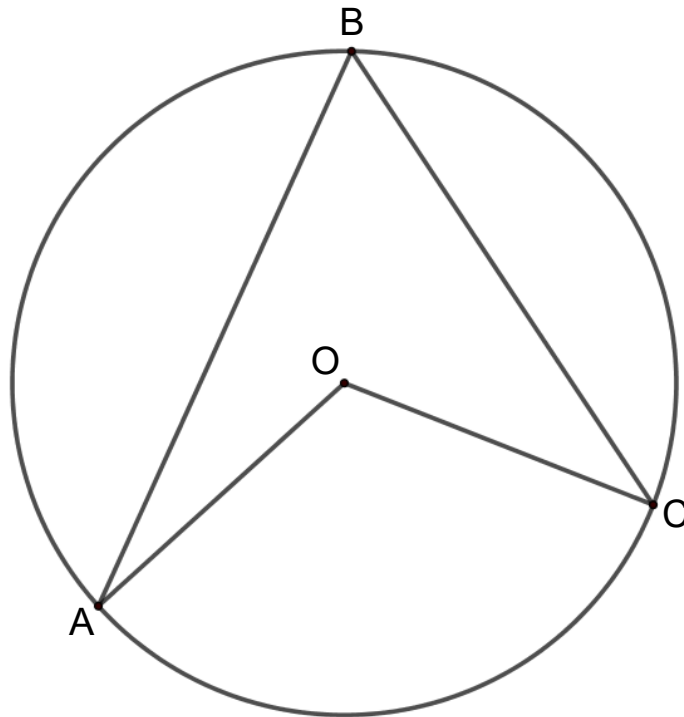
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(4)  
[20]

**QUESTION 5**

- (a) Prove the theorem that states, "The angle subtended by a chord at the centre of a circle is twice the size of the angle subtended at the circumference".



Required to Prove: \_\_\_\_\_ (1)

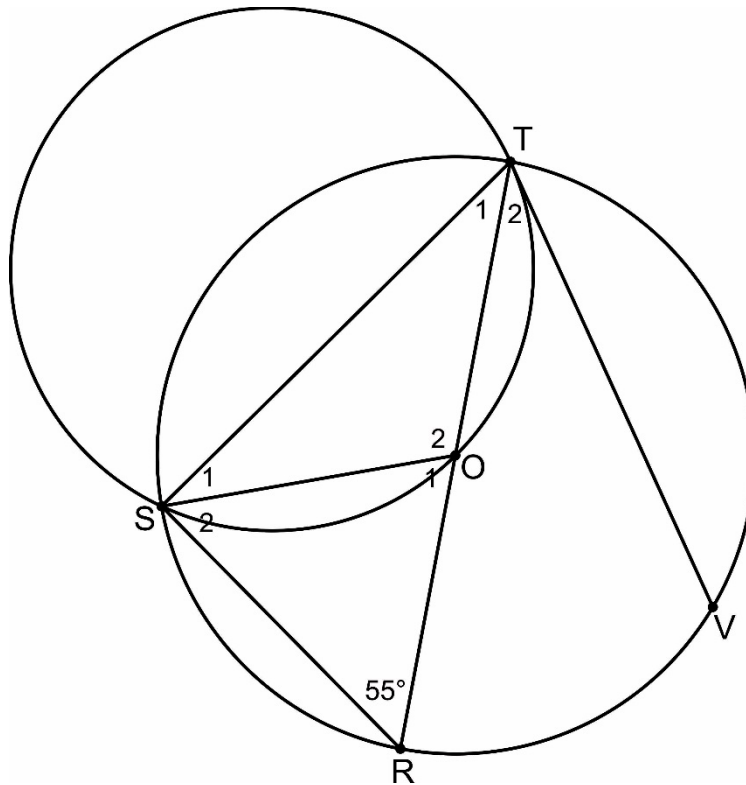
Construction: \_\_\_\_\_ (1)

Proof: \_\_\_\_\_

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\_\_\_\_\_  
\_\_\_\_\_ (4)

(b) In the diagram below, ST is a common chord to the two circles.

- R and V are points on the larger circle.
- RT passes through O, the centre of the larger circle.
- O is also a point on the smaller circle.
- VT is a tangent to the smaller circle at T.
- $\hat{ORS} = 55^\circ$ .



Calculate the size of angle  $\hat{T}_2$ .

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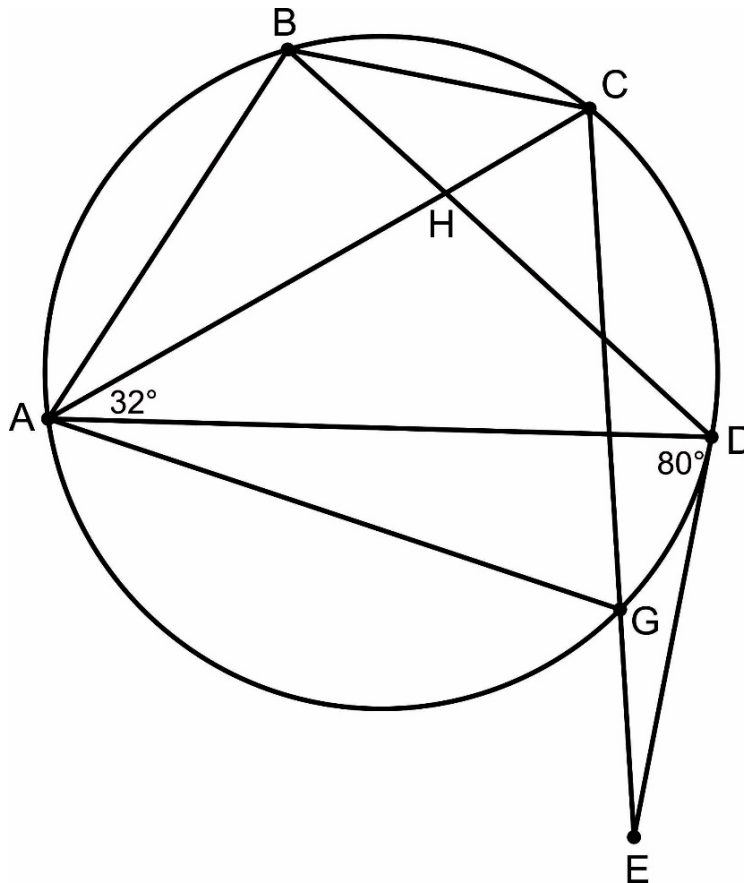
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(5)

(c) In the diagram below, the circle passes through A, B, C, D and G.

- BD and AC intersect at H.
- The tangent to circle at point D meets CG produced to E.
- $\hat{CAD} = 32^\circ$ .
- $\hat{ADE} = 80^\circ$ .



Find the size of  $\hat{AGE}$ .

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(6)  
[17]

**QUESTION 6**

Refer to the statements below and answer the questions that follow:

- A line of best fit has an equation of  $y = 57 - 3x$ .
- There is one outlier that has been identified as (9; 4).
- The correlation coefficient is very strong.

- (a) If the outlier was removed, would the correlation coefficient be stronger? (Explain your answer.)

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(1)

- (b) Is the correlation coefficient closer to one or negative one? (Explain your answer.)

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(2)

- (c) If you were to make a prediction using the line of best fit, would it be perfectly accurate? (Explain your answer.)

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(2)

- (d) An individual makes a prediction that if  $x$  has a value of 30,  $y$  will have a value of  $-33$ . His friend points out that he is extrapolating and that his result is not accurate. Explain what his friend is referring to.

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(2)  
[7]**81 marks**

**SECTION B****QUESTION 7**

The table below summarises the amount of water consumed by individuals.

Number of litres used	Frequency	Midpoint	Cumulative Frequency
$0 < x \leq 40$	2 000	20	2 000
$40 < x \leq 80$	3 000	60	5 000
$80 < x \leq 120$	7 000	100	12 000
$120 < x \leq 160$	13 000	140	25 000
$160 < x \leq 200$	6 500	180	31 500
$200 < x \leq 240$	2 500	220	34 000
$240 < x \leq 280$	1 000	260	35 000

- (a) Determine the estimated mean number of litres used by an individual.

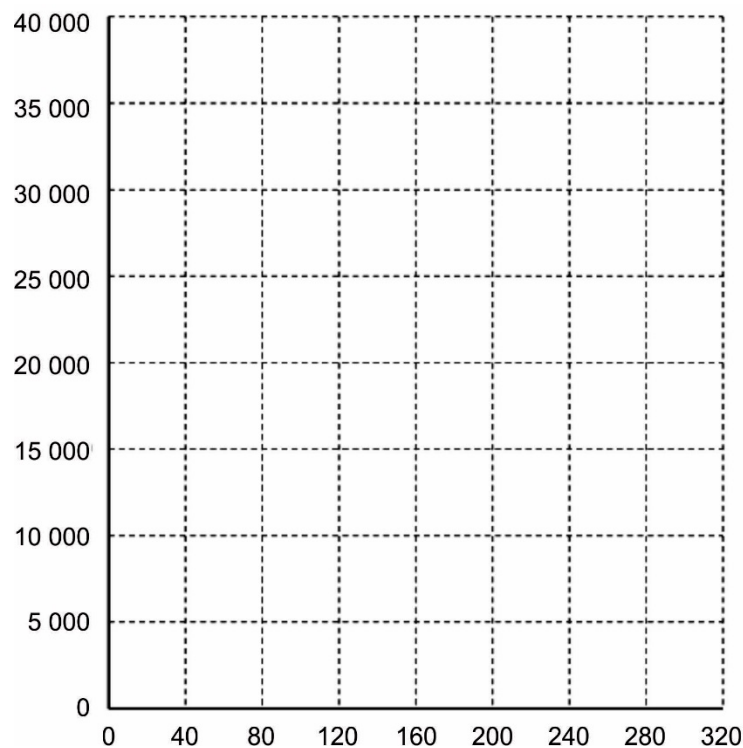
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(2)

- (b) Draw a cumulative frequency graph that represents the information in the table above.



(4)

- (c) Determine the median number of litres used by an individual. Show on your graph where you would read this value.

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(2)

- (d) How many individuals use more than 220 litres of water? Show on your graph where you would read this value.

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(2)

- (e) At the time of the survey the maximum number of litres permitted per individual was 280 litres. If this restriction was reduced to 240 litres per individual, what would happen to:

- (1) the median? (Give a reason for your answer.)

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(2)

- (2) the standard deviation? (Give a reason for your answer.)

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(2)

- (3) the skewness of the data? (Give a reason for your answer.)

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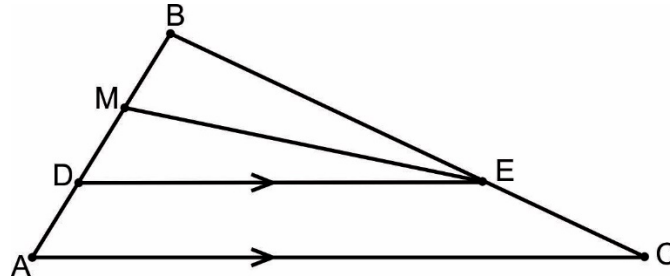
(2)

**[16]**

**QUESTION 8**

In the diagram below,  $\triangle ABC$  is drawn with D and E points on AB and CB respectively.

- M is a point on DB.
- $DE \parallel AC$ .
- $AD = DM = MB$ .



- (a) Calculate  $\frac{EC}{BE}$ .

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(2)

- (b) Calculate  $\frac{\text{Area of } \triangle BME}{\text{Area of } \triangle BAC}$ .

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(4)



(c) If the length of  $DE = 17$  units, find the length of  $AC$ .

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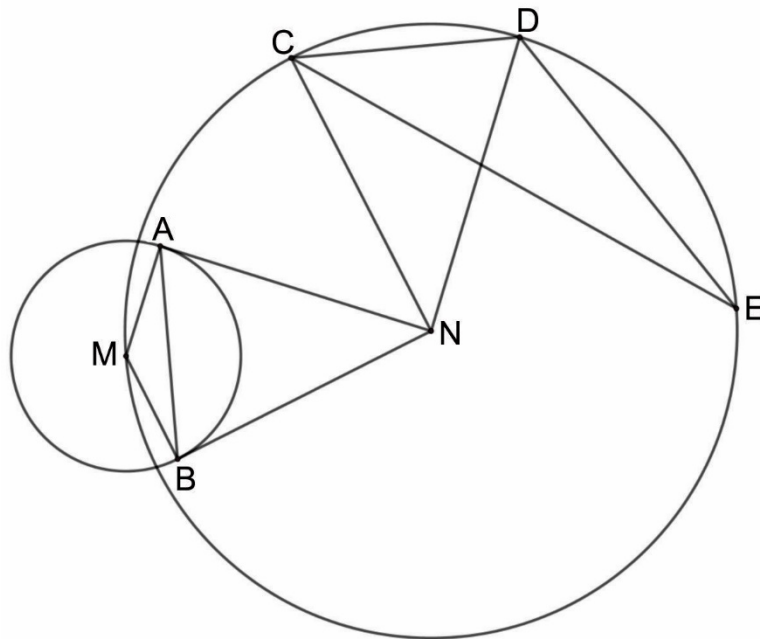
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(4)  
**[10]**

**QUESTION 9**

In the diagram below, N is the centre of the larger circle and M is the centre of the smaller circle.

- C, D, E and M are points on the larger circle.
- AB is a chord of the smaller circle.
- $\hat{AMB} = 136^\circ$ .
- $\hat{DEC} = 22^\circ$ .
- CE = 9 units.
- DE = 6,2 units.
- AN and NB are tangents to circle M.



(a) Prove that  $\triangle ANB \parallel \triangle CND$ .

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(8)

- (b) If  $\frac{DN}{AN} = \frac{27}{25}$ ; calculate the length of AB.

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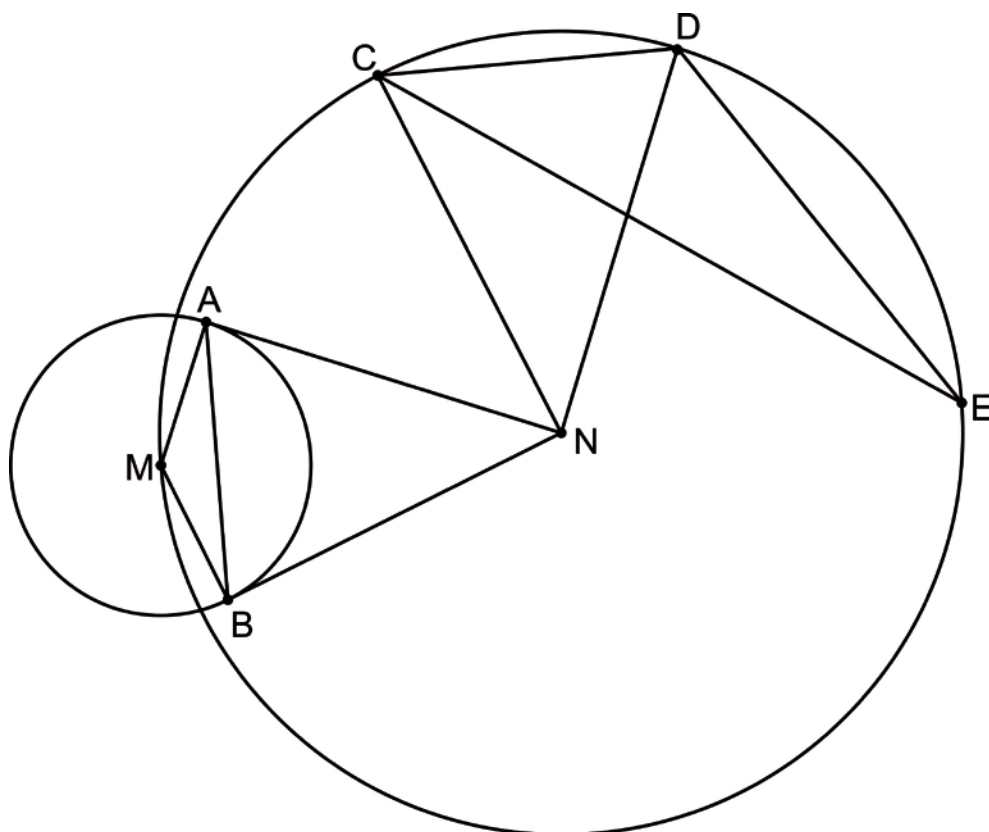
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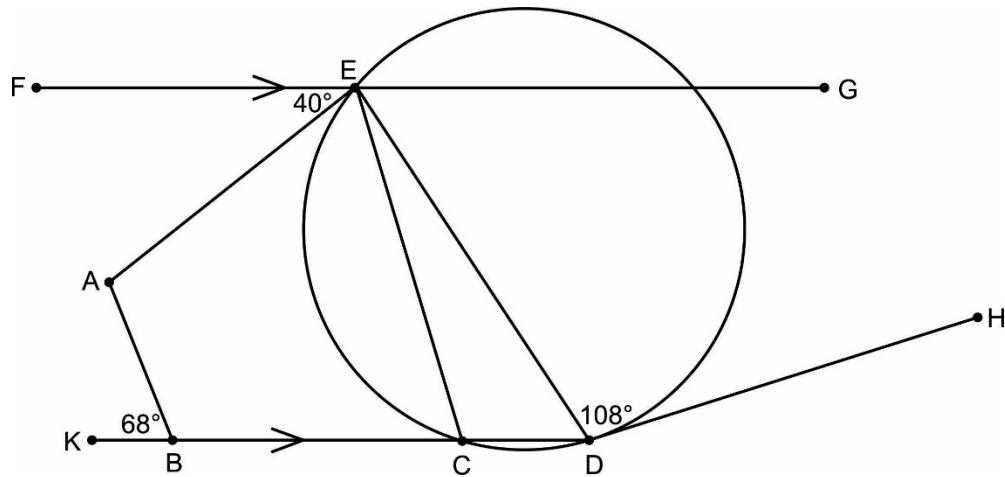
(5)  
[13]



### QUESTION 10

In the diagram below, E, C and D are points on the circle.

- DH is a tangent to the circle at point D with  $\hat{HDE}=108^\circ$ .
- DC is produced and DCBK // GEF
- A is a point between the parallel lines with  $\hat{FEA}=40^\circ$  and  $\hat{ABK}=68^\circ$ .



Prove that AECB is a cyclic quadrilateral.

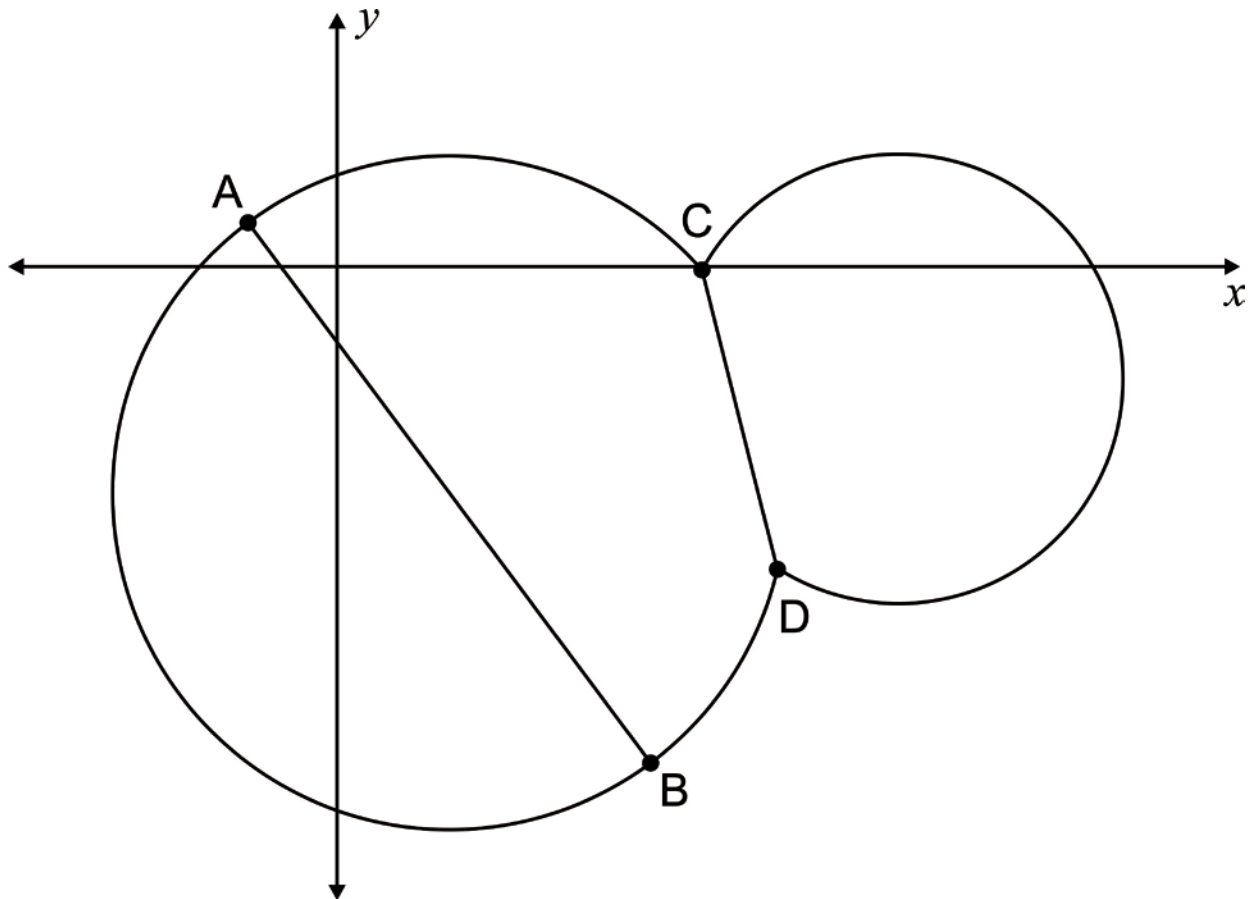
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**[6]**

**QUESTION 11**

In the diagram below, the two circles intersect in C and D.

- AB is a diameter of the larger circle and has equation  $4x + 3y = -2$ .
- CD has equation  $4x + y = 13$ .
- The smaller circle has equation of  $x^2 + y^2 - 10x + 2y = -22$ .



- (a) Determine the coordinates of the centre and the radius of the smaller circle.

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(4)

- (b) Show that point C does not lie on the x-axis.

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(4)

- (c) Find the midpoint of line AB.

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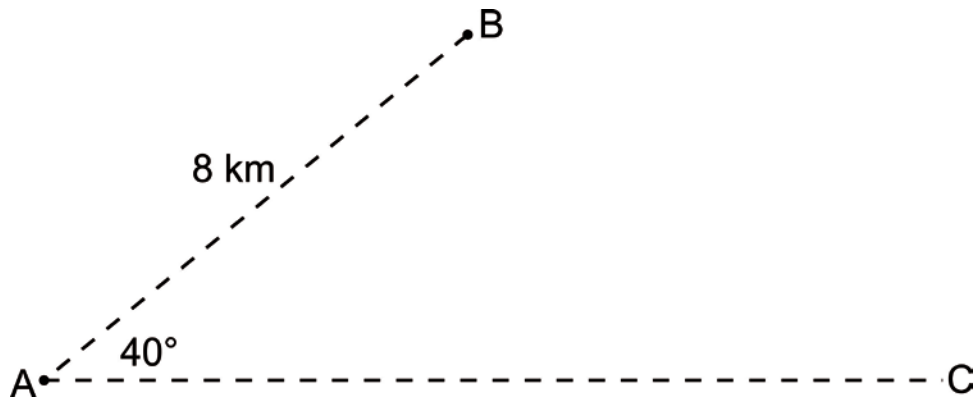
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(8)  
[16]

### QUESTION 12

- Points A and B are 8 km apart and on the same horizontal plane as point C.
- The base of a vertical building is at a point on AC. The vertical building is 7 km from point B and  $\angle B\hat{A}C = 40^\circ$ .



If the vertical building is 160 metres in height, calculate the greatest possible angle of elevation from point A to the top of the building.

[illegible]

**[8]**

**69 marks**

**Total: 150 marks**

## Extra pages

[illegible]



[illegible]

[illegible]

[illegible]