NATIONAL SENIOR CERTIFICATE EXAMINATION
SUPPLEMENTARY EXAMINATION – MARCH 2018

MATHEMATICS: PAPER II

EXAMINATION NUMBER												

Time: 3 hours 150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 22 pages and an Information Sheet of 2 pages (i–ii). Please check that your 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 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.

FOR OFFICE USE ONLY: MARKER TO ENTER MARKS

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
10	**15**	**12**	**13**	**20**	**9**	**8**	**7**	**11**	**17**	**5**	**8**	**15**

TOTAL	**/150**

SECTION A

QUESTION 1

The shoulder strength and the number of push-ups done per day by a random sample of twelve eighteen-year-old boys were recorded as shown in the table.

Number of push-ups done per day (x)	27	165	56	156	99	40	70	68	20	105	56	158
Strength of shoulder (y)	0,2	0,98	0,36	0,95	0,72	0,28	0,6	0,6	0,15	0,78	0,4	0,95

(a) (1) Calculate the correlation coefficient. (Round off to three decimal places.)

(2)

(2) Use your answer to describe the relationship between the number of push-ups and the shoulder strength of an eighteen-year-old boy.

(2)

(b) Determine the equation of the regression line and write your answer in the form $y = A + Bx$. (Round off to four decimal places.)

(2)

(c) Use the regression line to predict the strength of an eighteen-year-old boy's shoulder if you know he does 120 push-ups per day.

(2)

(d) An eighteen-year-old boy does 280 push-ups per day. Can your regression line formula predict the strength of his shoulder? (Explain your answer.)

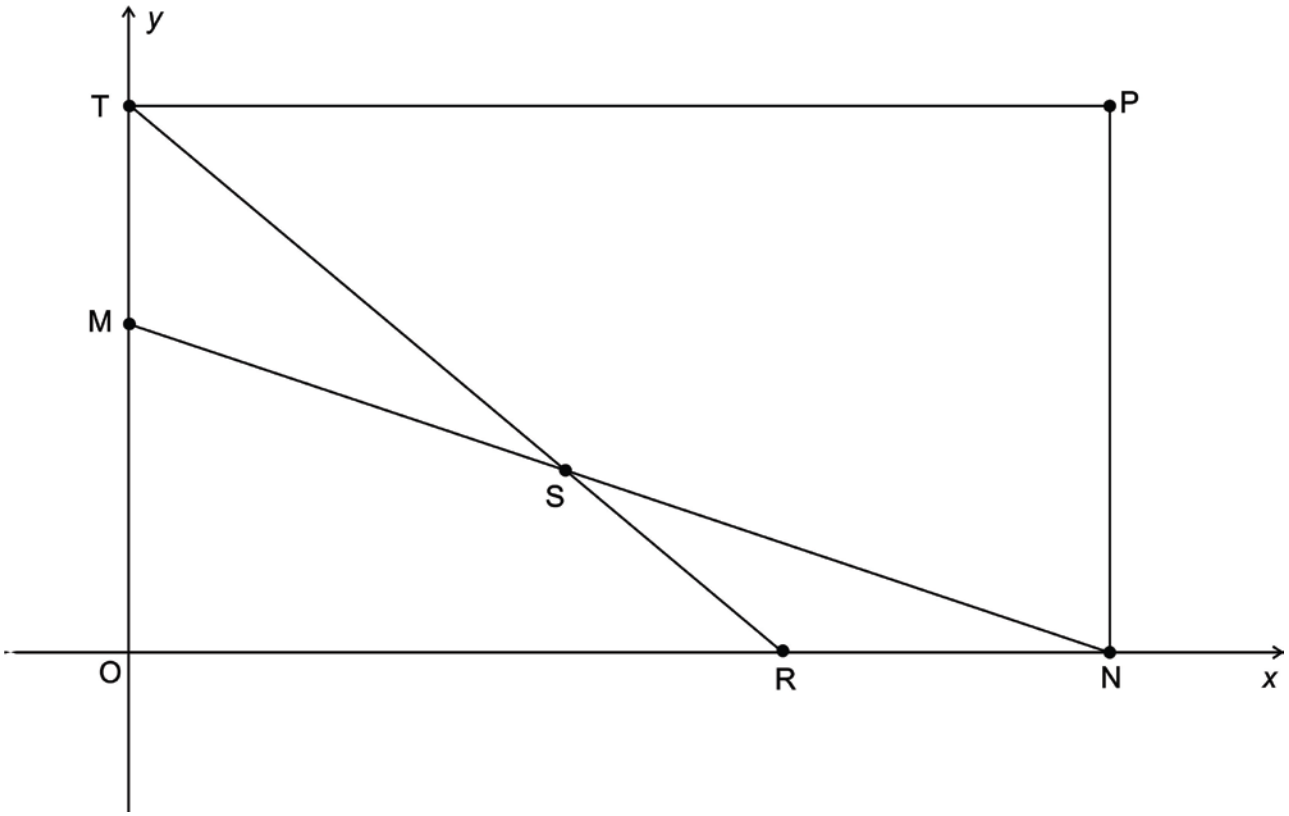
(2)

[10]

QUESTION 2

In the Cartesian plane below:

- The line MN intersects TR at S.
- M, N, R and T are points on the axes.
- The equation of line TR is $6y + 5x = 30$.
- The area of the rectangle OTPN is 45 units^2.



(a) Calculate the coordinates of point T.

(2)

(b) Determine the coordinates of point N.

(2)

(c) If MT = 2 units, then determine the equation of line MN.

(3)

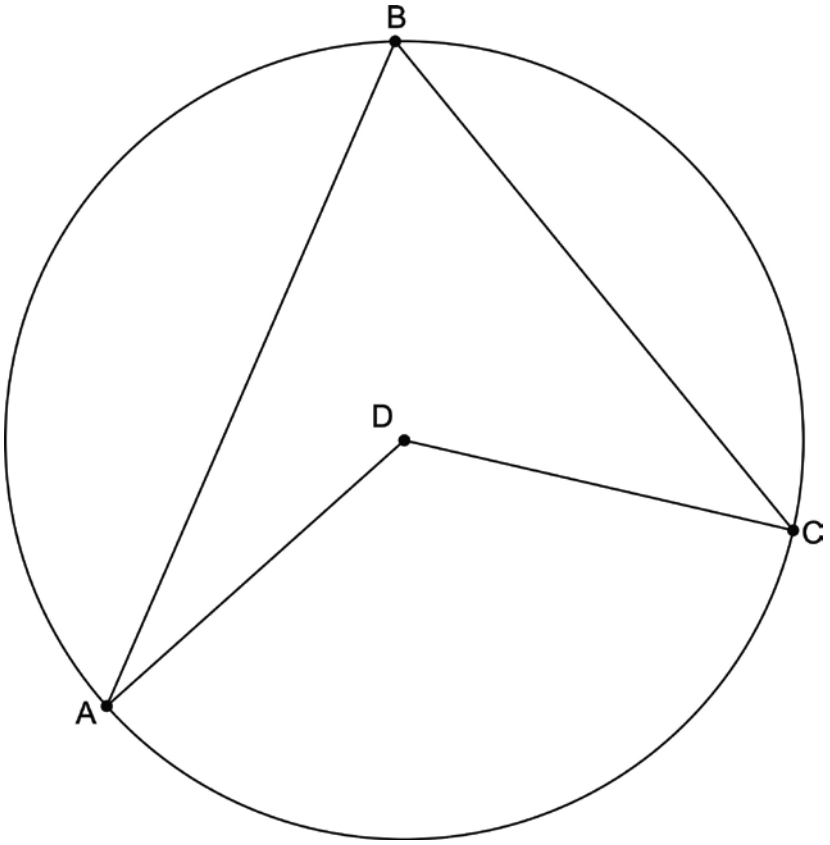
(d) Determine the coordinates of S and hence calculate the area of ΔRSN.

(8)

[15]

QUESTION 3

(a) Use the diagram below to prove that the angle subtended at the centre of a circle is equal to twice the angle subtended at the circumference of the circle.



Given: D is the centre of the circle.
A, B and C are points on the circle.

Construction: _____ (1)

Required to prove: _____ (1)

Proof: _____

_____

_____

_____

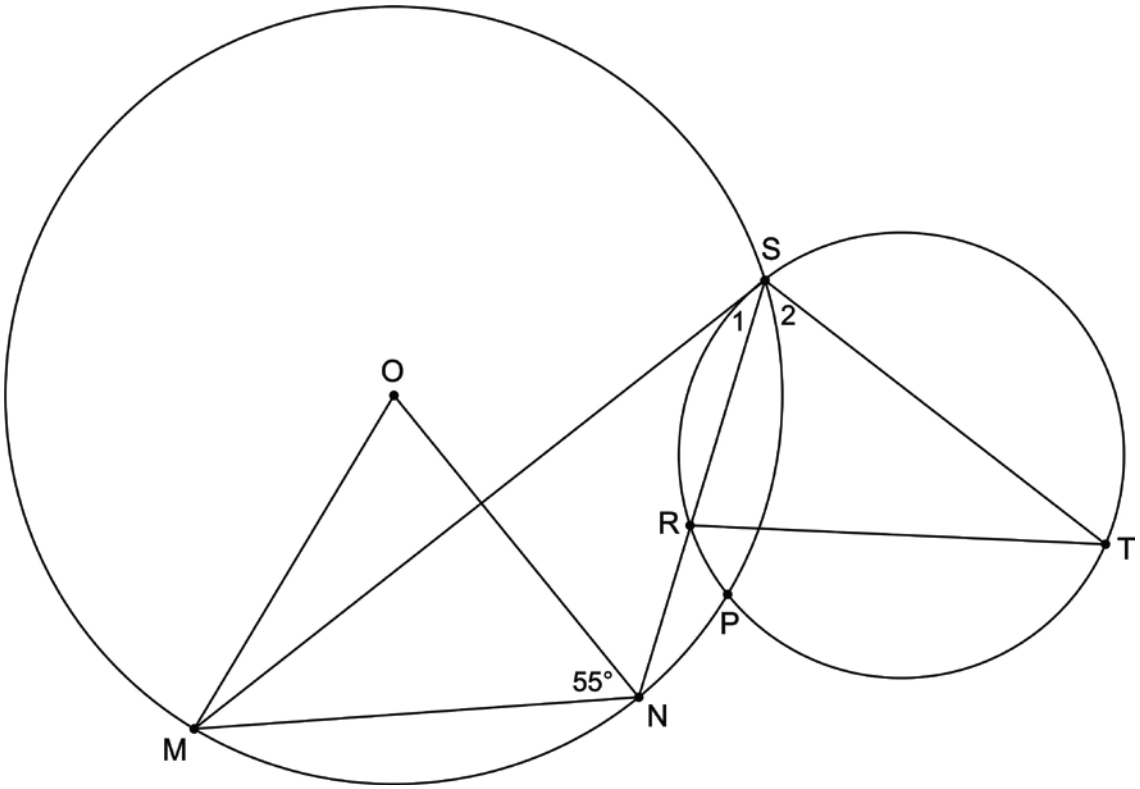
_____

_____

_____ (4)

(b) In the diagram below, two circles intersect at S and P:

- O is the centre of the large circle.
- MS is a tangent to the smaller circle at point S.
- $M\hat{N}O = 55°$.
- M and N are points on the larger circle.
- R and T are points on the smaller circle.
- SRN is a straight line.



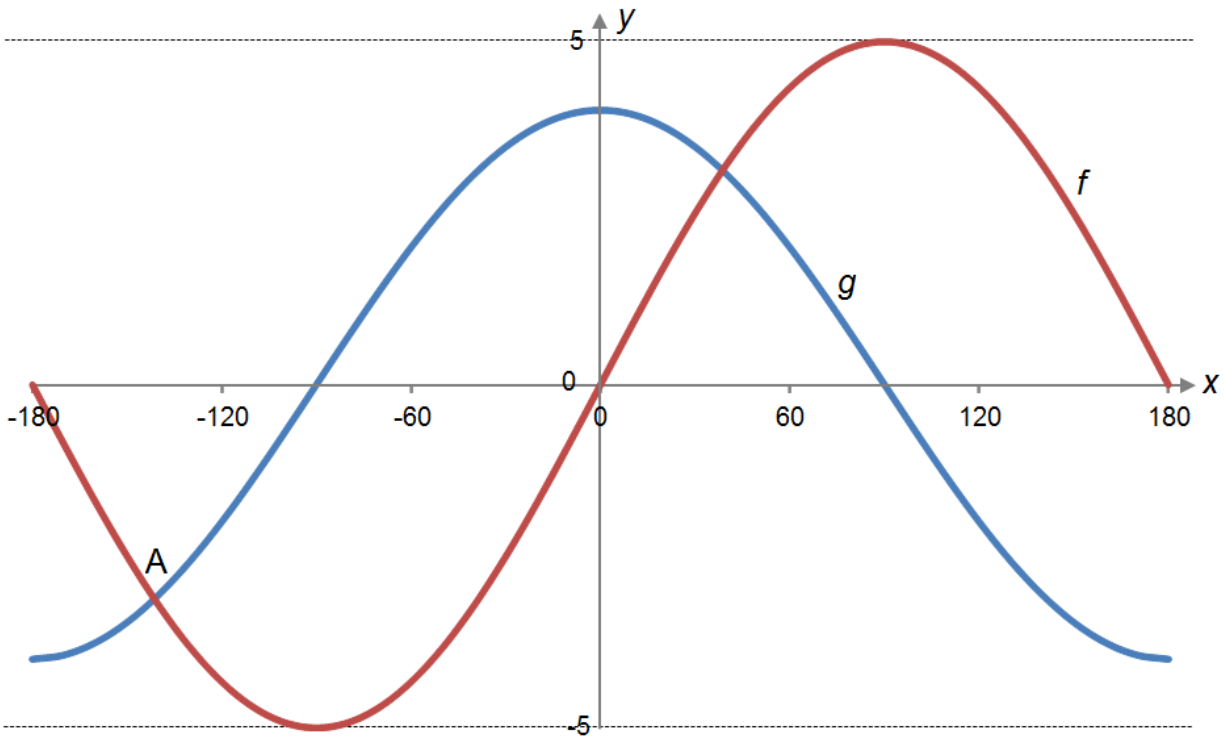
Determine the size of angle $S\hat{T}R$.

(6)
[12]

QUESTION 4

In the diagram below:

- $f(x) = a\sin x \quad x \in [-180°; 180°]$
- $g(x) = 4\cos bx \quad x \in [-180°; 180°]$
- The graph of f passes through $(90°; 5)$ and the graph of g passes through $(90°; 0)$.



(a) Determine the values of a and b.

(2)

(b) Write down the new equation for $f(x)$ if it was shifted $30°$ to the right and two units vertically down.

(2)

(c) Calculate the minimum value of $\frac{8}{g(x)}$ if $x \in [-60°; 60°]$.

(2)

(d) For what values of k will $f(x) = k$ have no real solutions?

(2)

(e) Calculate the coordinates of point A. Give answers correct to one decimal place.

(5)
[13]

QUESTION 5

(a) Determine the general solution for θ if $\sin 2\theta + \cos\theta = 0$.

(8)

(b) If $\cos 73° \cos 31° + \sin 73° \sin 31° = p$ then determine the value of the following in terms of p:

(1) $\cos^2 21 - \sin^2 21 + 7$

(3)

(2) $\sin 42°$

(3)

(c) Prove that

$$\frac{\sin\theta}{1+\sin(90+\theta)} - \frac{\sin(-\theta)}{1-\cos(-\theta)} = \frac{2}{\sin\theta}$$

(6)
[20]

QUESTION 6

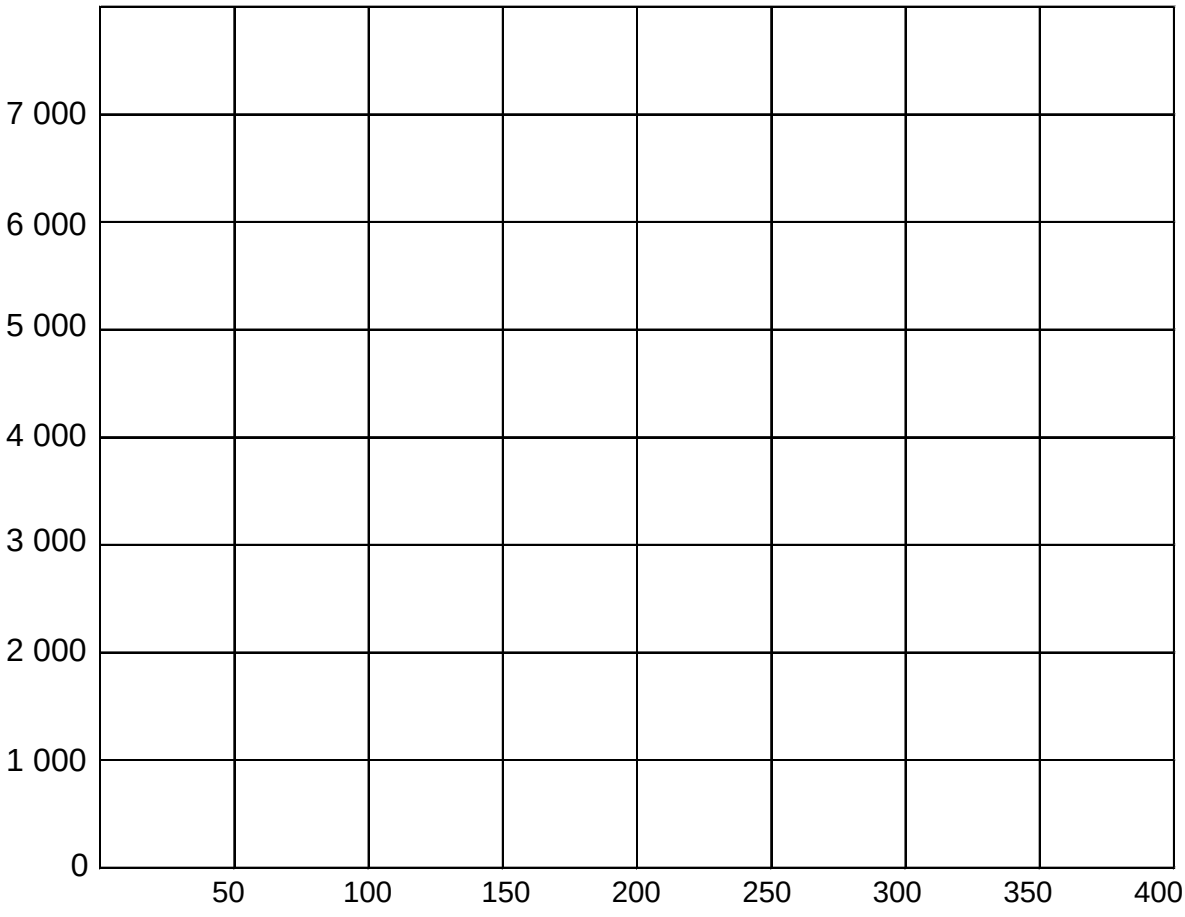
A group of 7 000 grade 12 learners were asked how many minutes they spend in front of a screen each day. The results are summarised in the table below. Use this table to answer the questions that follow.

Minutes spent in front of a screen per day	Frequency
$50 \leq x < 100$	500
$100 \leq x < 150$	900
$150 \leq x < 200$	1 500
$200 \leq x < 250$	1 600
$250 \leq x < 300$	1 400
$300 \leq x < 350$	700
$350 \leq x < 400$	400

(a) Calculate an estimate for the mean number of minutes spent in front of a screen per day.

(2)

(b) Sketch a cumulative frequency curve to represent the data above.



(3)

(c) Experts are concerned about learners who spend more than 125 minutes in front of a screen each day. Use your diagram to determine what percentage of learners this represents.

(2)

(d) You realise that 400 of the 500 learners who spend between 50 and 100 minutes in front of a screen each day should actually be in the class interval between 100 and 150 minutes. How would this affect the standard deviation? Explain.
(Do not calculate the standard deviation.)

(2)
[9]

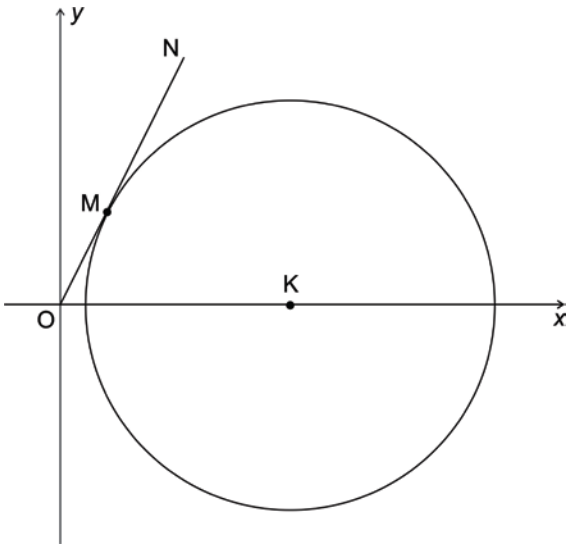
79 marks

SECTION B

QUESTION 7

In the Cartesian plane below:

- Line ON is a tangent to the circle at M.
- The equation of line ON is $y = 2x$.
- The equation of the circle is $x^2 + y^2 - 20x + p = 0,$ where p is a constant.
- K is the centre of the circle.



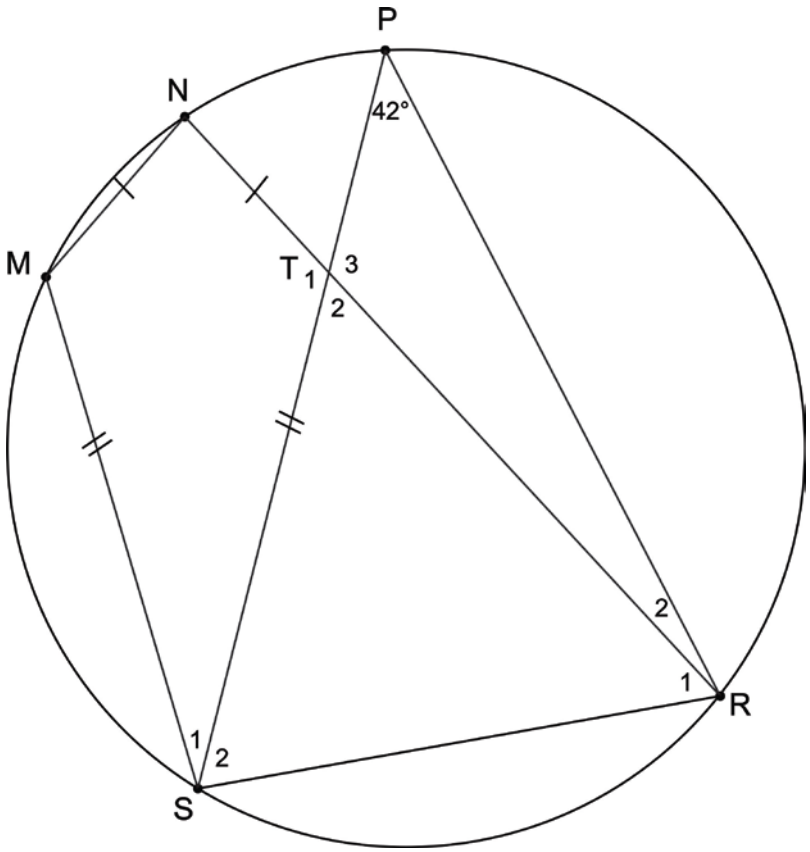
Determine the coordinates of point M.

[8]

QUESTION 8

In the diagram below:

- M, N, P, R and S are points on a circle.
- MS = ST and MN = NT.
- $T\hat{P}R = 42°$.
- Lines NR and SP intersect at point T.



(a) True or False: Both diagonals of a kite bisect the interior angles. Explain.

(2)

(b) Calculate the size of angle $M\hat{N}T$.

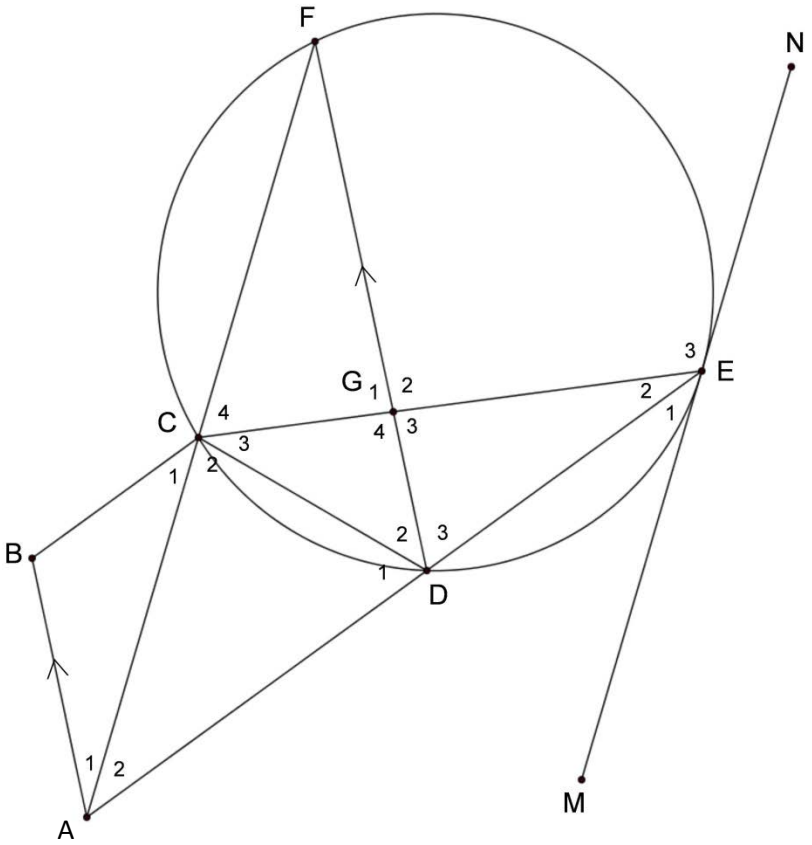
(5)

[7]

QUESTION 9

In the diagram below:

- C, D, E and F are points on a circle.
- Line MN is a tangent to the circle at E.
- Line AF intersects the circle at C.
- AB//DF.
- $\hat{C}_1 = \hat{C}_3$.



(a) Prove that $\Delta CBA \,|||\, \Delta CDE$.

(4)

(b) Prove that ABCD is a cyclic quad.

(3)

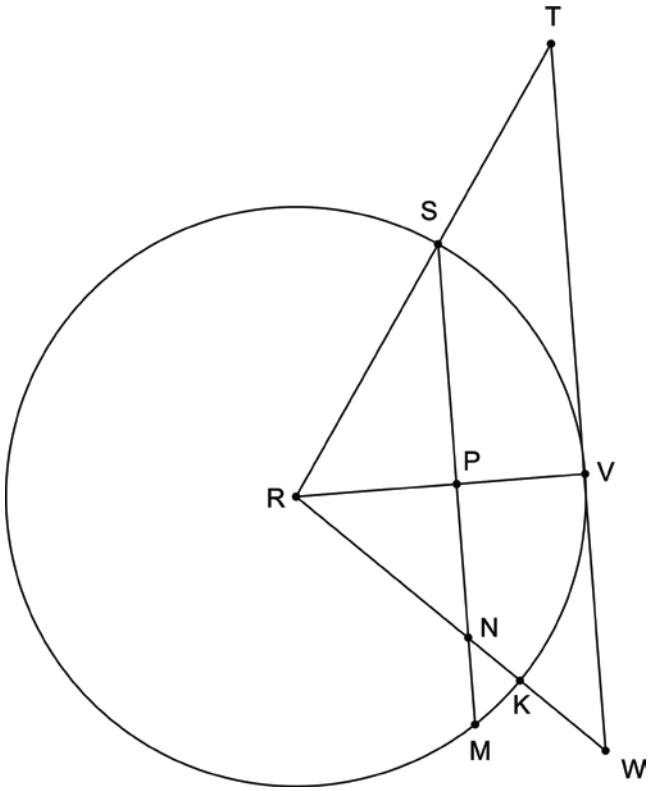
(c) Prove that $\hat{E}_3 = \hat{A}_2 + \hat{C}_2$.

(4)
[11]

QUESTION 10

In the diagram below:

- TW is a tangent to circle centre R at point V.
- Radius RV intersects chord SM at P and MP = PS.
- The circle has a radius of 10 units.
- RST and RKW are straight lines.
- RW intersects the circle at K and chord SM at N.
- ST = 7 and NW = 6 units.



(a) Prove that TW//SN.

(4)

(b) Determine the length of NK.

(5)

(c) Calculate the length of PN.

(8)
[17]

QUESTION 11

Two circles are given:
Circle A: $(x - 3)^2 + (y - 2)^2 = 9$
Circle B: $(x - 9)^2 + (y + 1)^2 = 9$

Show that the circles do not intersect.

[5]

QUESTION 12

Two different circles pass through the point T(–2 ; 4) and both circles touch the *x*-axis and the *y*-axis.

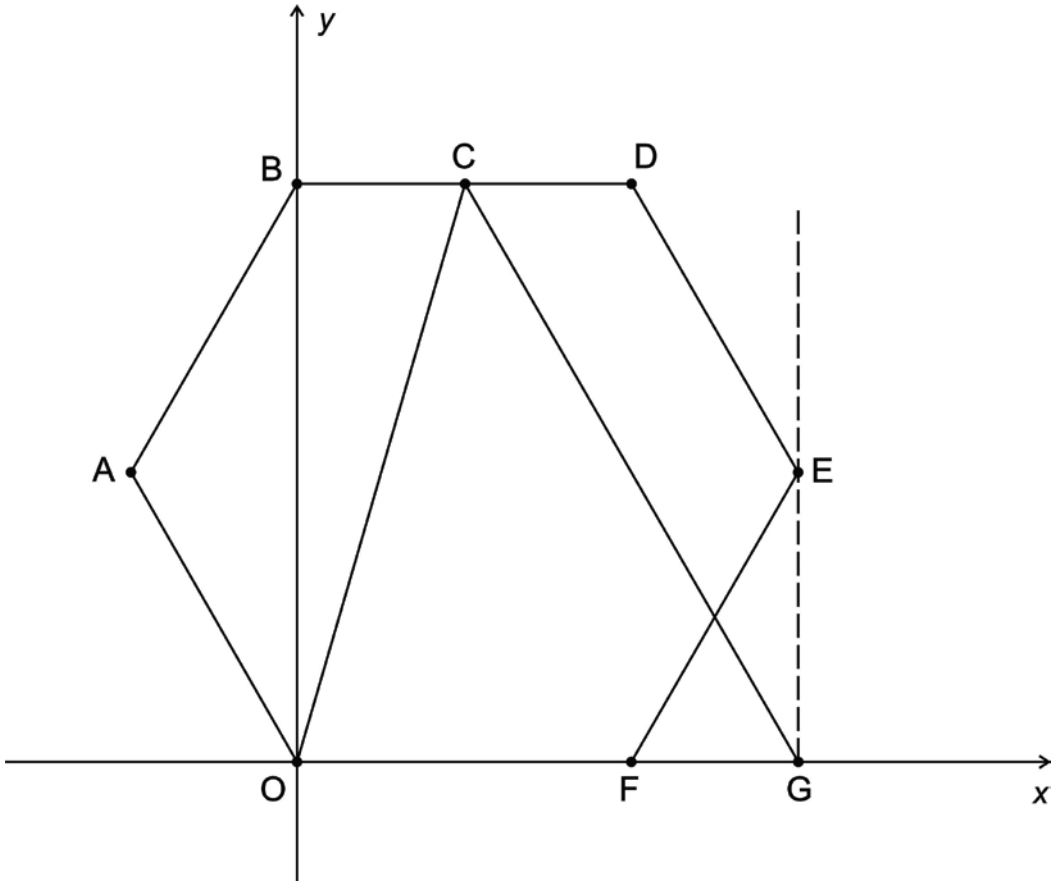
Determine the equations of the two circles.

[8]

QUESTION 13

In the Cartesian plane below:

- The regular hexagon ABDEFO has side lengths of 4 units.
- EG is perpendicular to the x–axis.
- C is the midpoint of line BD.
- O is the origin and B, F and G are points on the axes.



(a) Determine the coordinates of point C. Leave your answers in surd form.

(5)

(b) Determine the area of ΔOCG. Leave your answers in surd form.

(5)

(c) Determine the size of $O\hat{C}G$. Give your answer correct to one decimal place.

(5)
[15]

71 marks

Total: 150 marks