basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS P2

NOVEMBER 2018

MARKS: 150

TIME: 3 hours

This question paper consists of 16 pages and a 24-page answer book.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 11 questions.
2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.
3. Clearly show ALL calculations, diagrams, graphs, etc. that you used to determine the answers.
4. Answers only will NOT necessarily be awarded full marks.
5. If necessary, round off answers to TWO decimal places, unless stated otherwise.
6. Diagrams are NOT necessarily drawn to scale.
7. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
8. Write neatly and legibly.

QUESTION 1

A school held a sports day. One of the items on the programme was an obstacle race. Teams of 10 parents and learners participated in this race. The table below shows the time taken, in minutes, by each member of a particular team to complete the race.

4	12	13	16	17	18	20	22	22	25

1.1 How long, in minutes, did it take for the fastest member of this team to complete the race? (1)

1.2 Determine the mean time taken by this team. (2)

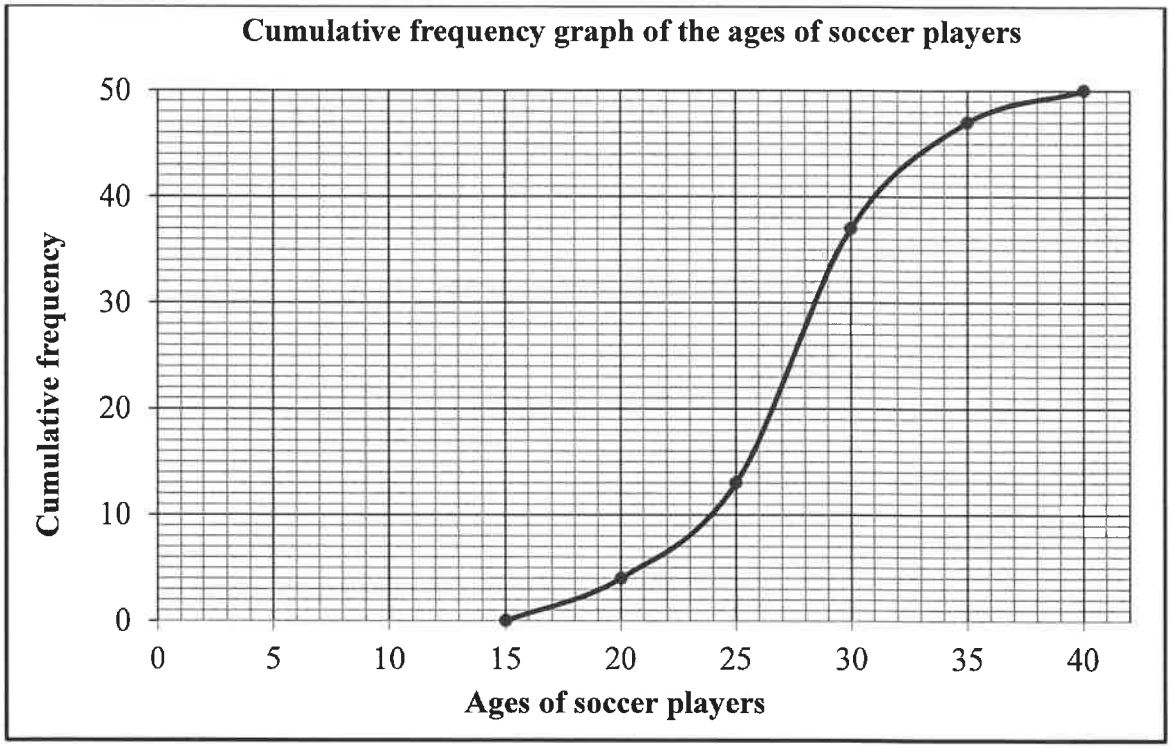
1.3 Calculate the standard deviation for the data. (1)

1.4 How many members of the team completed the obstacle race outside of two standard deviations of the mean? (3)

1.5 It took another team a total time of $x+5$ minutes to complete the race. Calculate the value of x if the overall mean of the two teams combined was 18 minutes. (3)
[10]

QUESTION 2

2.1 A survey was conducted of the ages of players at a soccer tournament. The results are shown in the cumulative frequency graph (ogive) below.



2.1.1 How many players took part in the soccer tournament? (1)

2.1.2 Determine the number of players between the ages of 24 and 31 years old. (2)

2.1.3 Complete the frequency column of the table below in the ANSWER BOOK.

CLASS INTERVAL	FREQUENCY	CUMULATIVE FREQUENCY
$15 \leq x < 20$		4
$20 \leq x < 25$		13
$25 \leq x < 30$		37
$30 \leq x < 35$		47
$35 \leq x < 40$		50

(3)

2.1.4 Use the grid provided in the ANSWER BOOK to draw a frequency polygon for the data. (4)

2.2 Two Grade 11 Mathematics classes have the same number of learners. The five-number summaries of the marks obtained by these classes for a test are shown below.

CLASS A $(30 ; 48 ; 65 ; 82 ; 90)$

CLASS B $(50 ; 58 ; 65 ; 75 ; 90)$

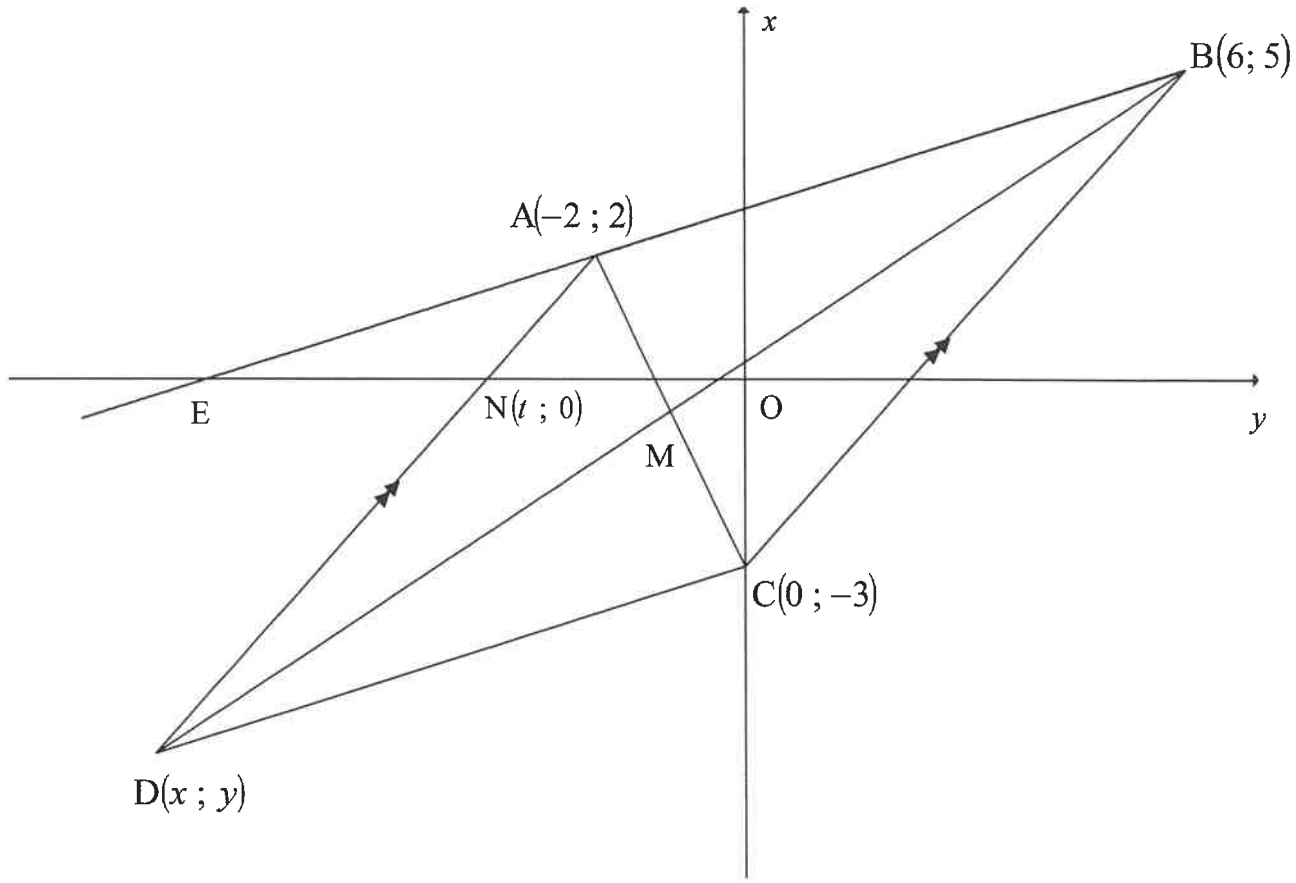
The parents of learners in CLASS A and CLASS B observe that both classes have the same median and the same maximum mark and therefore claim that there is no difference in the performance between these classes.

Do you agree with this claim? Use at least TWO different arguments to justify your answer. (3)

[13]

QUESTION 3

In the diagram, A(–2 ; 2), B(6 ; 5), C(0 ; –3) and D(x ; y) are the vertices of a quadrilateral having AD || BC. BA produced has an x-intercept at E. BD and AC intersect at M. N(t ; 0) is a point on AD.



3.1 Calculate the gradient of BC. (2)

3.2 Determine the equation of AD. (3)

3.3 Determine the value of t. (2)

3.4 Calculate the length of AN. (2)

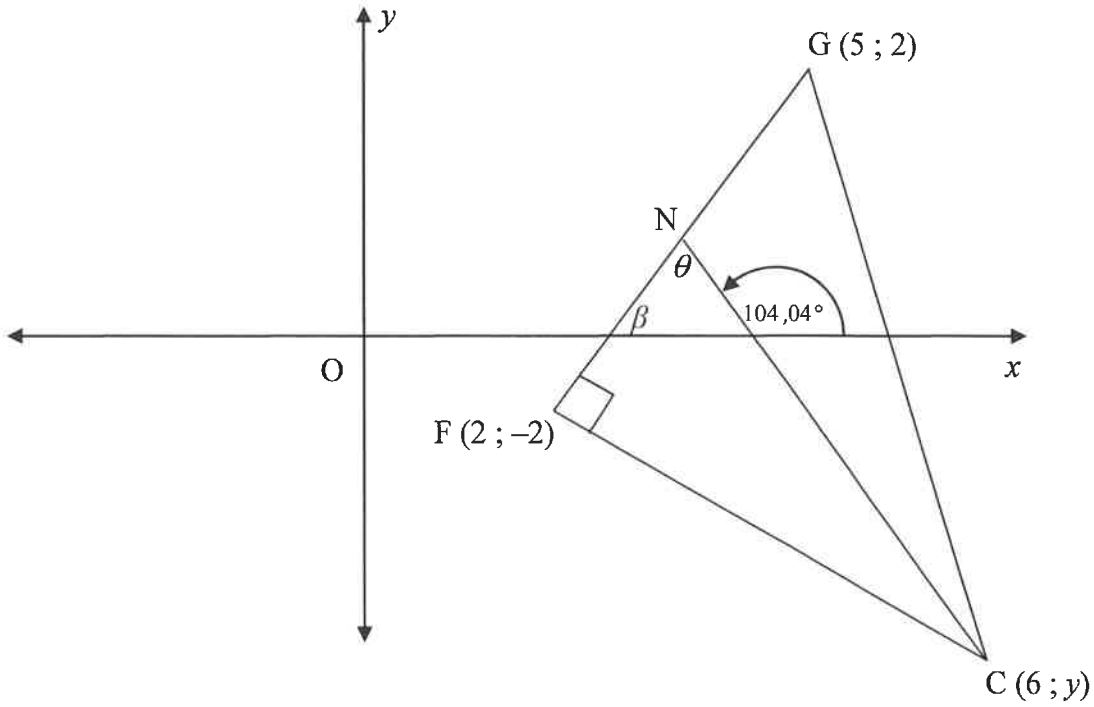
3.5 If DC is defined by $y=\frac{3}{8}x-3$, determine the coordinates of D. (4)

3.6 Prove that ABCD is a parallelogram. (3)

3.7 Calculate the coordinates of M. (3)
[19]

QUESTION 4

In the diagram, F(2 ; –2), G(5 ; 2) and C(6 ; y) are the vertices of ΔFGC. $FG \perp FC$.
N is a point on FG such that the inclination of NC is 104,04°.
The angle of inclination of FG is β and $F\hat{N}C = \theta$.



4.1 Calculate the gradient of FG. (2)

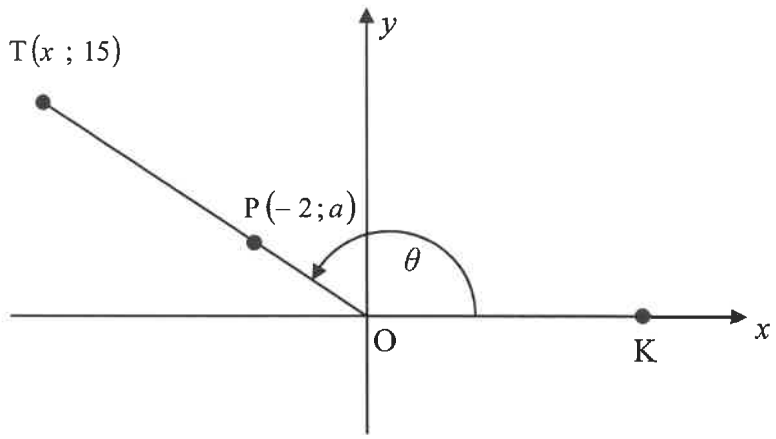
4.2 Calculate the value of y. (3)

4.3 Calculate the size of θ. (3)

4.4 Calculate the length of NC. (4)
[12]

QUESTION 5

5.1 In the diagram below, $T(x\,;15)$ is a point in the Cartesian plane such that $OT = 17$ units. $P(-2\,;a)$ lies on OT. K is a point on the positive x-axis and $T\hat{O}K = \theta$.



Determine, with the aid of the diagram, the following:

5.1.1 The value of x (2)

5.1.2 $\tan\theta$ (1)

5.1.3 $\cos(180° - \theta)$ (2)

5.1.4 $\sin^2\theta$ (2)

5.1.5 The value of a (3)

5.2 Simplify WITHOUT using a calculator:

$$\frac{\sin 120°.\cos 210°.\tan 315°.\cos 27°}{\sin 63°.\cos 540°}$$ (7)

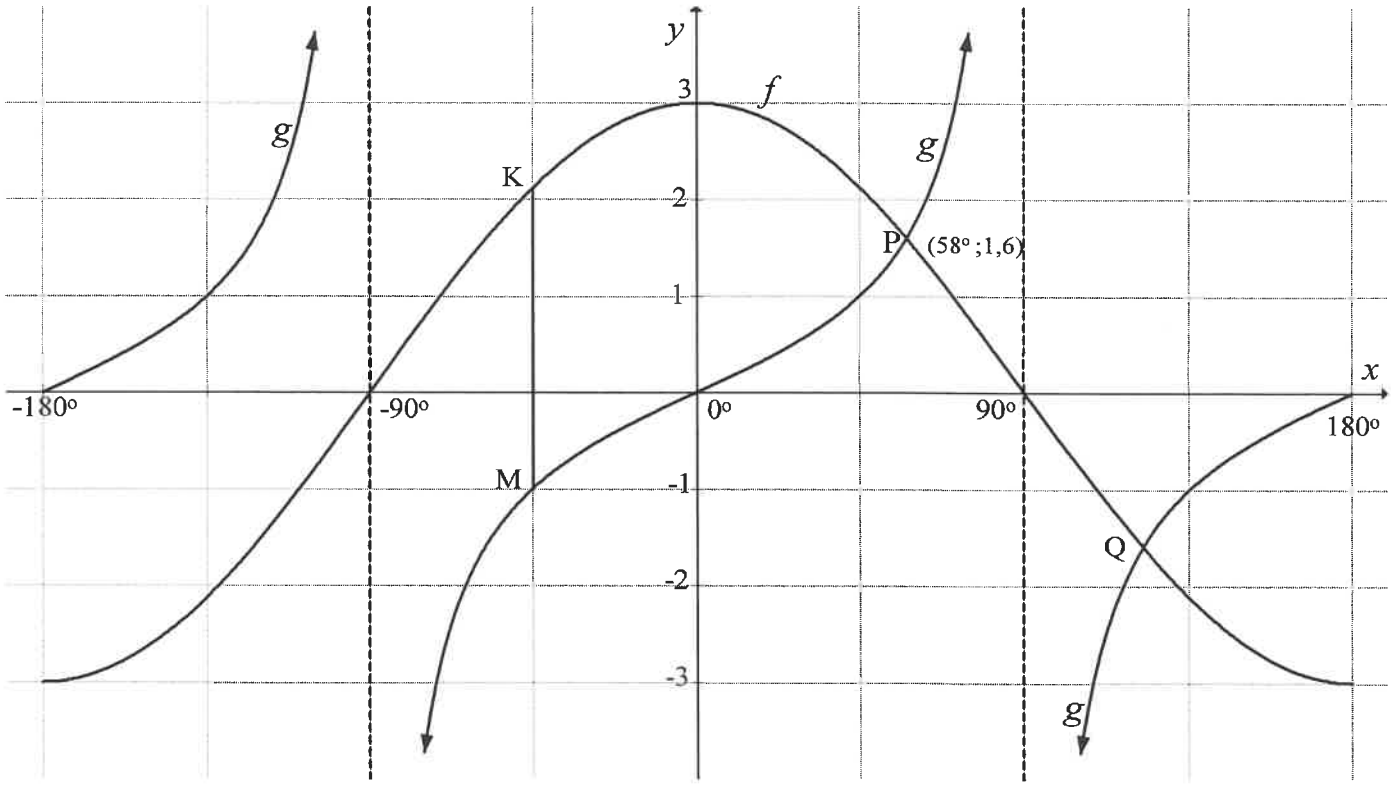
5.3 Prove the identity:

$$\frac{1}{\cos\theta} - \frac{\cos\theta}{1+\sin\theta} = \tan\theta$$ (5)

5.4 Determine the general solution of $3\sin x = 2\tan x$ (6)
[28]

QUESTION 6

The graphs of the functions $f(x) = a\cos b\theta$ and $g(x) = c\tan\theta$ for $x \in [-180° ; 180°]$ are sketched below. The graphs intersect at P(58° ; 1,6) and Q.



6.1 Write down the range of f. (2)

6.2 If M(–45° ; –1) lies on g, determine the value of c. (1)

6.3 Write down the values of a and b. (2)

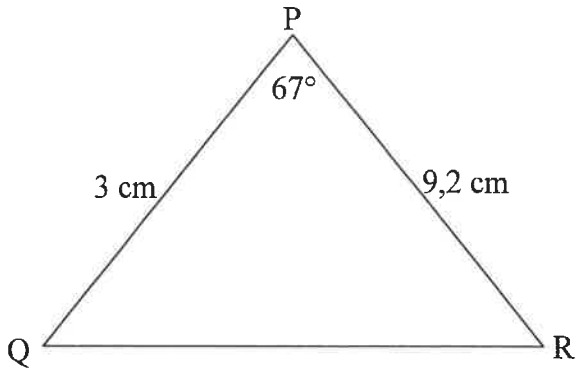
6.4 Determine the coordinates of Q. (2)

6.5 K lies on f such that KM is parallel to the y-axis.
Calculate the length of KM . (2)

6.6 If the system of axes is shifted 45° to the left and the graphs remain fixed, write down the equation that is now represented by graph f. (2)
[11]

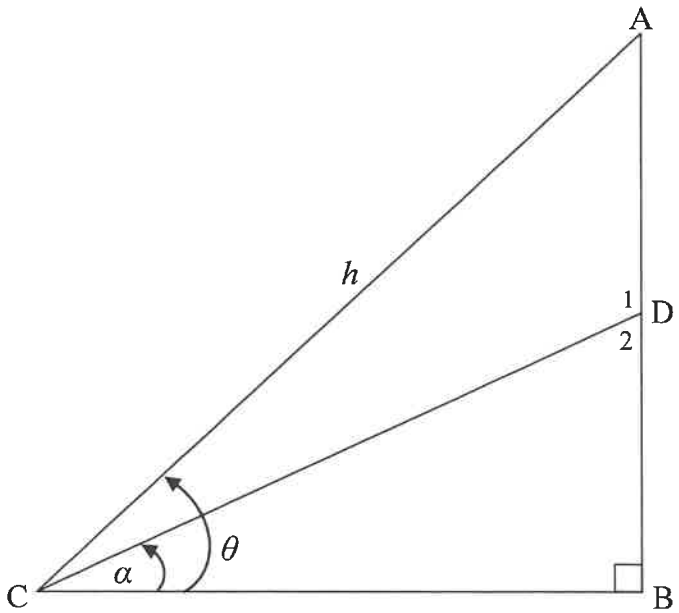
QUESTION 7

7.1 In the diagram, $\hat{P} = 67°$, PQ = 3 cm and PR = 9,2 cm.
Determine the length of QR.



(3)

7.2 In the diagram below, $D\hat{C}B = \alpha$, AC = h units and $A\hat{C}B = \theta$.



7.2.1 Determine size of $A\hat{C}D$ in terms of θ and α. (1)

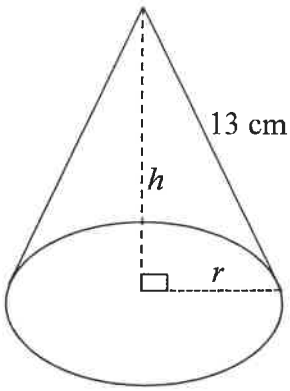
7.2.2 Prove that $AD = \dfrac{h\sin(\theta - \alpha)}{\cos\alpha}$ (4)

7.2.3 Determine the length of AD if $h = 17$ units, $\theta = 58°$ and $\alpha = 23°$. (2)

7.2.4 Calculate the area of ΔADC. (3)
[13]

QUESTION 8

The diagram below shows a cone with a perpendicular height of h cm, a radius of r cm and a slant height of 13 cm.



Volume of cone $= \frac{1}{3}\pi r^2 h$

Total surface area of the cone
$= \pi r^2 + \pi r s$

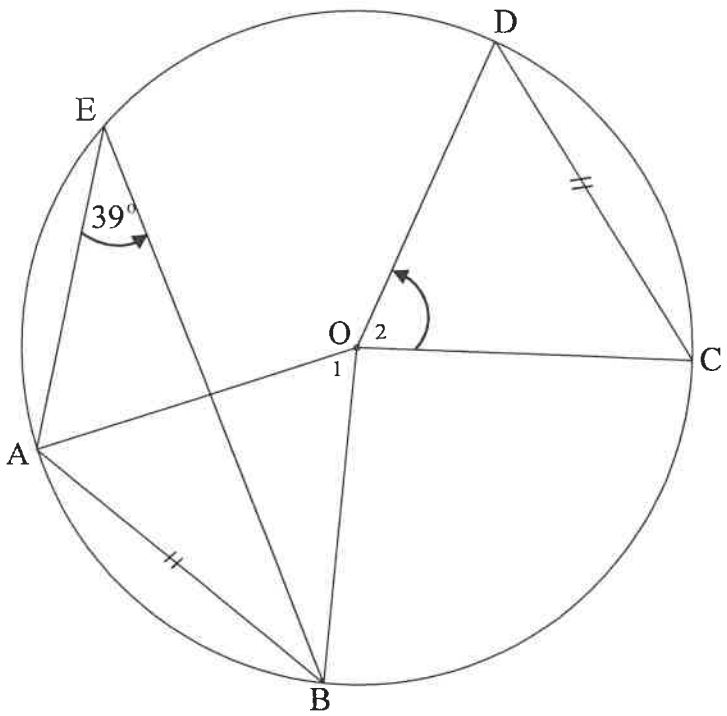
8.1 Show that the volume of the cone is given by $V = \frac{169\pi h - \pi h^3}{3}$ (4)

8.2 If $h = 12$ cm, determine the total surface area of the cone. (3)
[7]

Give reasons for your statements and calculations in QUESTIONS 9, 10 and 11.

QUESTION 9

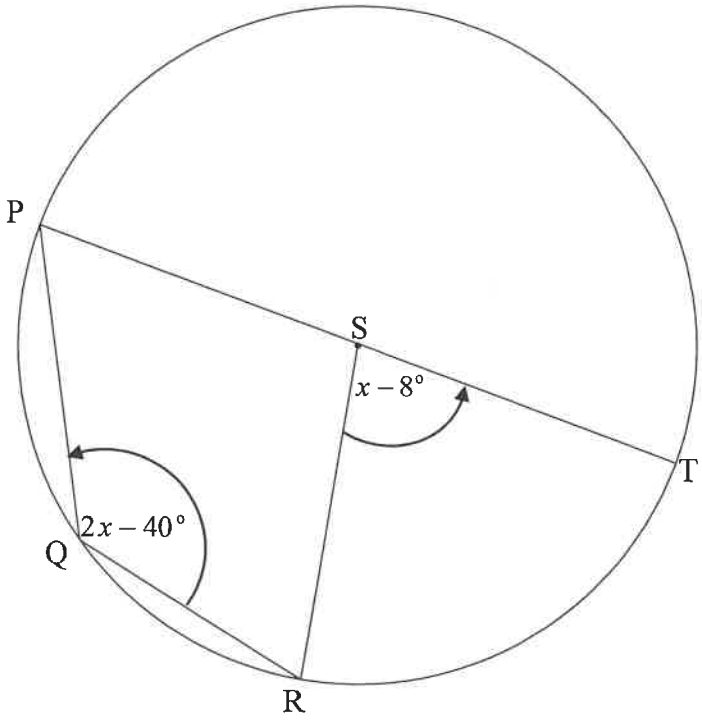
9.1 In the figure, O is the centre of the circle. A, B, C, D and E lie on the circle such that chord AB and chord DC are equal in length and $A\hat{E}B = 39°$.



9.1.1 Determine the size of $\hat{O}_1$. (2)

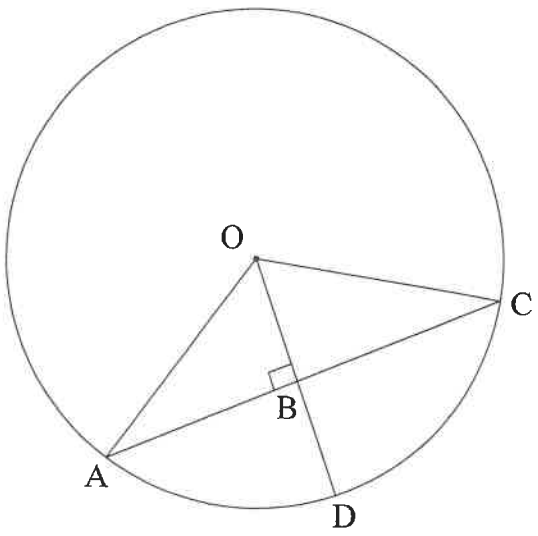
9.1.2 Determine the size of $\hat{O}_2$. (2)

9.2 In the diagram, S is the centre of circle PQRT. PT is a diameter. $R\hat{S}T = x - 8°$ and $P\hat{Q}R = 2x - 40°$.



Determine the value of x. (4)

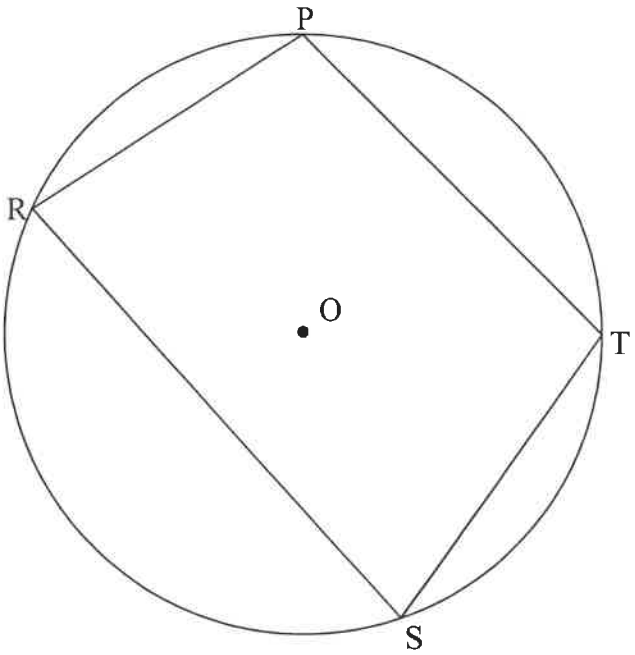
9.3 In the diagram, O is the centre of the circle. Chord AC is perpendicular to radius OD at B. OB = $2x$ units and AC = $8x$ units.



Show that the length of BD is $2x\left(\sqrt{5}-1\right)$ units. (5)
[13]

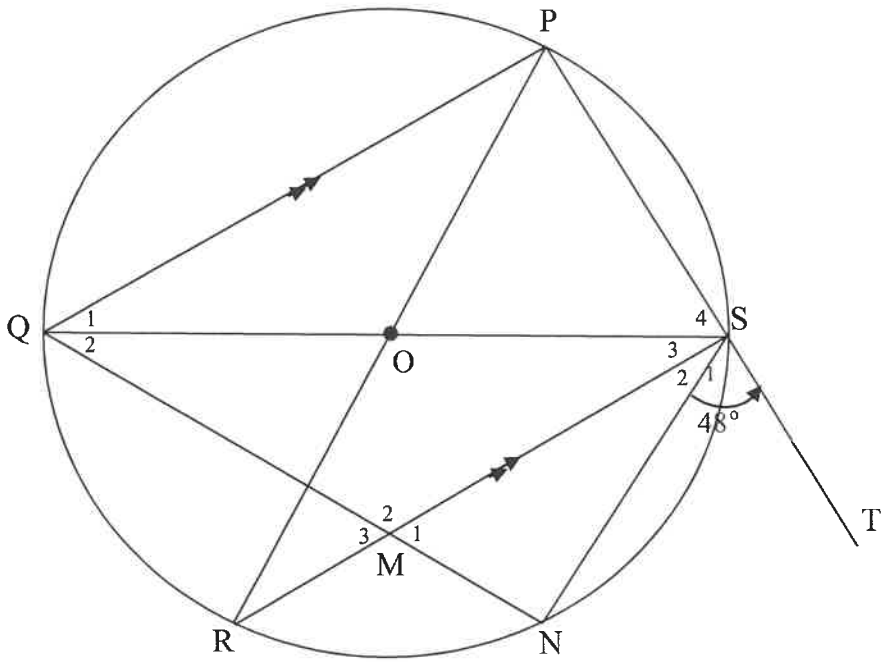
QUESTION 10

10.1 In the diagram below, O is the centre of the circle and PTSR is a cyclic quadrilateral.



Prove the theorem that states that $\hat{P} + \hat{S} = 180°$. (5)

10.2 In the figure, QS and PR are diameters of the circle with centre O such that PQ || SR. PS is produced to T. N is a point on the circle such that $\hat{Q}_1 = \hat{Q}_2$. SN is drawn.
RS intersects QN at M. $\hat{S}_1 = 48^\circ$



10.2.1 Determine, with reasons, the size of:

(a) $\hat{Q}_1$ (3)

(b) $\hat{R}$ (2)

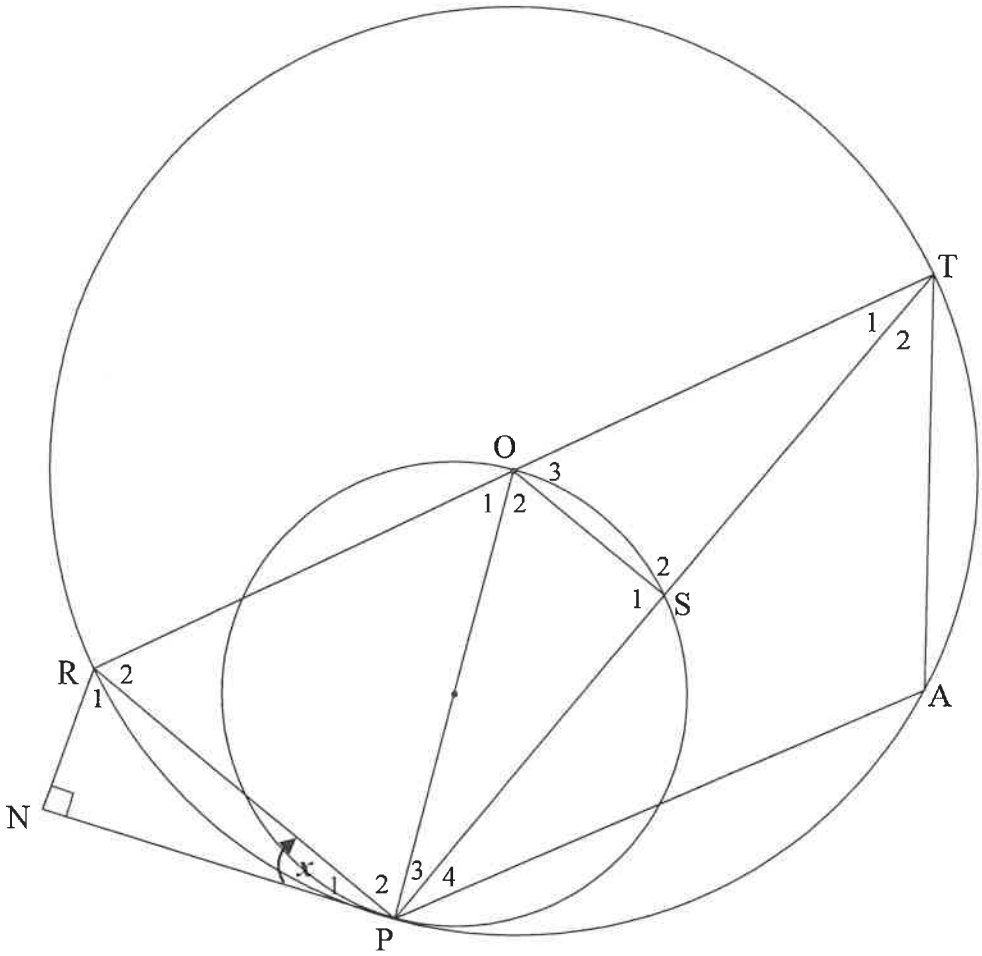
(c) $\hat{M}_1$ (2)

10.2.2 Prove that ST is a tangent to the circle passing through M, N and S. (2)
[14]

QUESTION 11

O is the centre of the larger circle RTAP. OP is the diameter of the smaller circle PSO. NP is a tangent to both circles at P. RN ⊥ NP.

Let $\hat{P}_1 = x$.



11.1 Prove that PR bisects $O\hat{R}N$. (5)

11.2 Prove that $R\hat{O}S = P\hat{A}T$. (5)

[10]

TOTAL: 150