



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

MATHEMATICS P2

NOVEMBER 2016

MARKS: 150

TIME: 3 hours

This question paper consists of 13 pages and a 22-page answer book.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 12 questions.
2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.
3. Clearly show ALL calculations, diagrams, graphs et cetera 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

The table below shows the number of cans of food collected by 9 classes during a charity drive.

5	8	15	20	25	27	31	36	75
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- 1.1 Calculate the range of the data. (1)
- 1.2 Calculate the standard deviation of the data. (2)
- 1.3 Determine the median of the data. (1)
- 1.4 Determine the interquartile range of the data. (3)
- 1.5 Use the number line provided in the ANSWER BOOK to draw a box and whisker diagram for the data above. (3)
- 1.6 Describe the skewness of the data. (1)
- 1.7 Identify outliers, if any exist, for the above data. (1)
- [12]**

QUESTION 2

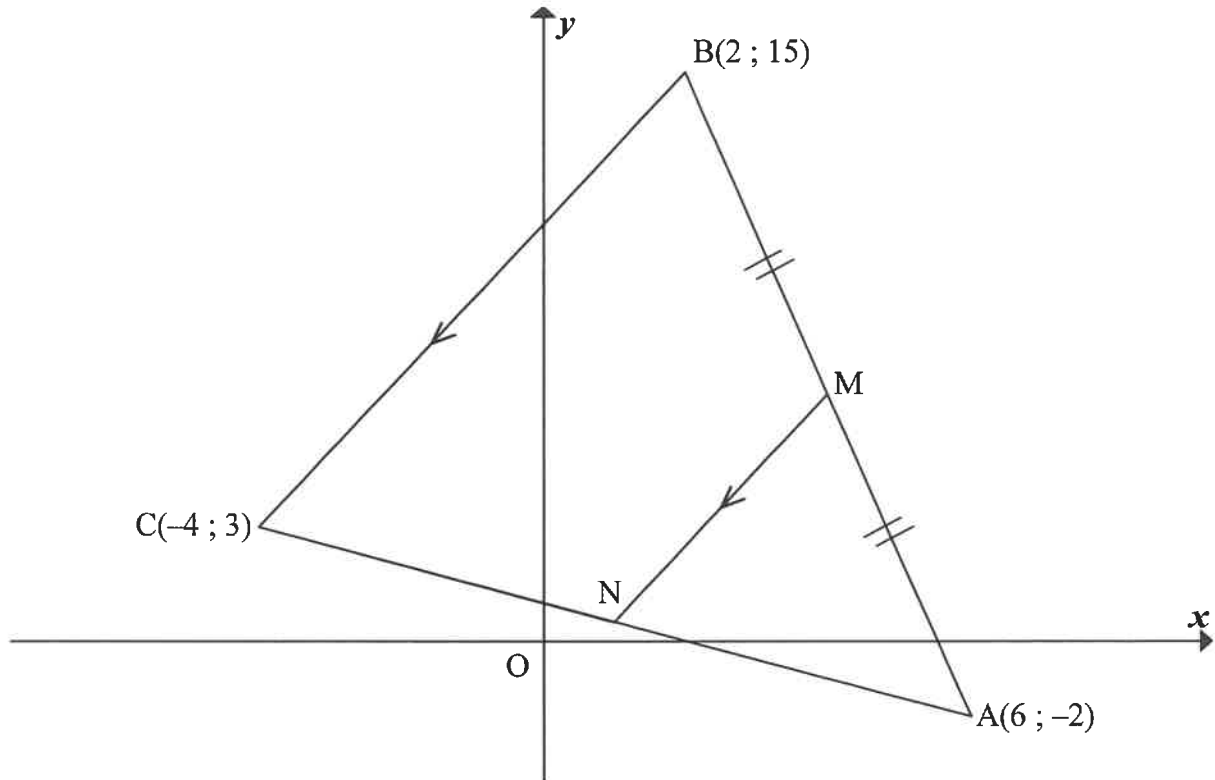
The table below shows the time (in minutes) that 200 learners spent on their cellphones during a school day.

TIME SPENT (IN MINUTES)	FREQUENCY
$95 < x \leq 105$	15
$105 < x \leq 115$	27
$115 < x \leq 125$	43
$125 < x \leq 135$	52
$135 < x \leq 145$	28
$145 < x \leq 155$	21
$155 < x \leq 165$	10
$165 < x \leq 175$	4

- 2.1 Complete the cumulative frequency column in the table provided in the ANSWER BOOK. (2)
- 2.2 Draw a cumulative frequency graph (ogive) of the data on the grid provided. (3)
- 2.3 Use the cumulative frequency graph to determine the value of the lower quartile. (2)
- 2.4 Determine, from the cumulative frequency graph, the number of learners who used their cellphones for more than 140 minutes. (2)
- [9]**

QUESTION 3

In the diagram, $A(6 ; -2)$, $B(2 ; 15)$ and $C(-4 ; 3)$ are the vertices of $\triangle ABC$.
 M is the midpoint of AB . N is a point on CA such that $MN \parallel BC$.



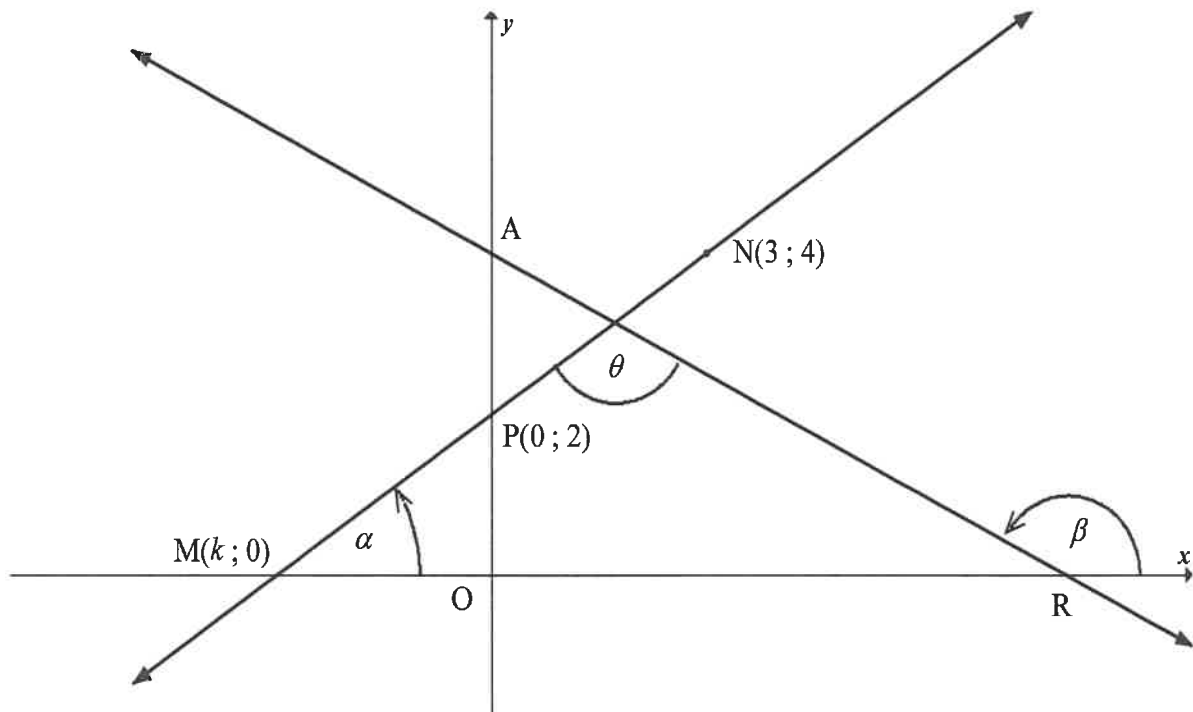
- 3.1 Determine the coordinates of M , the midpoint of AB . (2)
- 3.2 Determine the gradient of line MN . (3)
- 3.3 Hence, or otherwise, determine the equation of line MN , in the form $y = mx + c$. (2)
- 3.4 Calculate, with reasons, the coordinates of point N . (4)
- 3.5 If $ABCD$ (in that order) is a parallelogram, determine the coordinates of point D . (4)
- [15]**

QUESTION 4

In the diagram, R and A are the x- and y-intercepts respectively of the straight line AR.

The equation of AR is $y = -\frac{1}{2}x + 4$. Another straight line cuts the y-axis at P(0 ; 2) and passes through the points M(k ; 0) and N(3 ; 4).

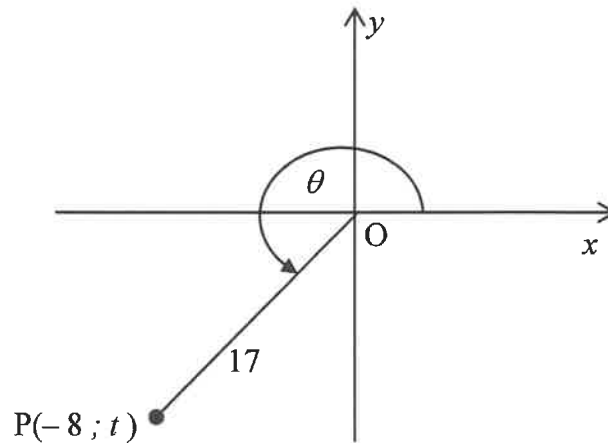
α and β are the angles of inclination of the lines MN and AR respectively.



- 4.1 Given that M, P and N are collinear points, calculate the value of k . (3)
- 4.2 Determine the size of θ , the obtuse angle between the two lines. (4)
- 4.3 Calculate the length of MR. (3)
- 4.4 Calculate the area of $\triangle MNR$. (3)
- [13]**

QUESTION 5

- 5.1 In the diagram below, $P(-8 ; t)$ is a point in the Cartesian plane such that $OP = 17$ units and reflex $\widehat{XOP} = \theta$.

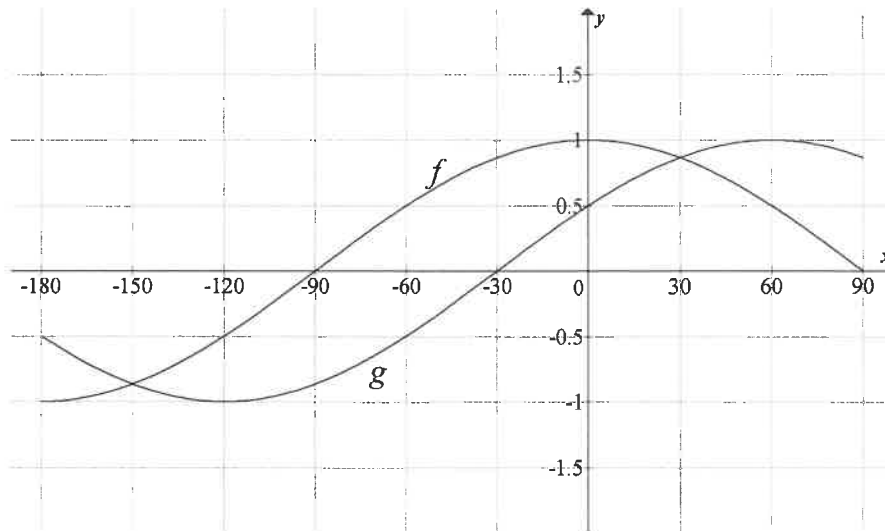


- 5.1.1 Calculate the value of t . (2)
- 5.1.2 Determine the value of each of the following WITHOUT using a calculator:
- (a) $\cos(-\theta)$ (2)
- (b) $1 - \sin \theta$ (2)
- 5.2 If $\sin 17^\circ = a$, WITHOUT using a calculator, express the following in terms of a :
- 5.2.1 $\tan 17^\circ$ (3)
- 5.2.2 $\sin 107^\circ$ (2)
- 5.2.3 $\cos^2 253^\circ + \sin^2 557^\circ$ (4)
- 5.3 Simplify fully, WITHOUT the use of a calculator:
- $$\frac{\cos(-225^\circ) \cdot \sin 135^\circ + \sin 330^\circ}{\tan 225^\circ}$$
- (6)
- 5.4 Prove the identity: $\frac{1}{(\cos x + 1)(\cos x - 1)} = \frac{-1}{\tan^2 x \cdot \cos^2 x}$ (4)
- 5.5 Determine the general solution for $2\sin x \cdot \cos x = \cos x$. (6)

[31]

QUESTION 6

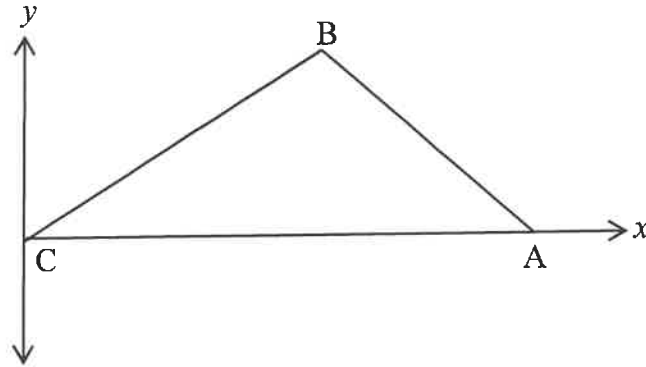
In the diagram the graphs of $f(x) = \cos x$ and $g(x) = \sin(x + b)$ are drawn for the interval $-180^\circ \leq x \leq 90^\circ$.



- 6.1 Write down the value of b . (1)
- 6.2 Write down the period of g . (1)
- 6.3 Write down the value(s) of x in the interval $-180^\circ \leq x \leq 90^\circ$ for which $f(x) - g(x) = 0$. (2)
- 6.4 For which values of x in the interval $-180^\circ \leq x \leq 90^\circ$ is $\sin(90^\circ - x) > g(x)$? (3)
- 6.5 The graph of h is obtained by shifting f 3 units upwards. Determine the range of h . (2)
- [9]**

QUESTION 7

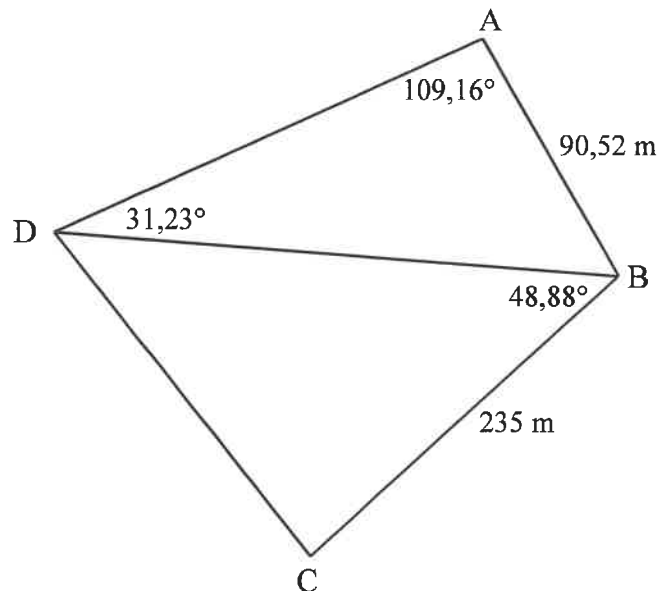
7.1 In the figure below, acute-angled $\triangle ABC$ is drawn having C at the origin.



7.1.1 Prove that $c^2 = a^2 + b^2 - 2ab \cos C$. (6)

7.1.2 Hence, deduce that $1 + \cos C = \frac{(a+b+c)(a+b-c)}{2ab}$ (4)

7.2 Quadrilateral $ABCD$ is drawn with $BC = 235\text{ m}$ and $AB = 90,52\text{ m}$. It is also given that $\hat{A}DB = 31,23^\circ$; $\hat{D}AB = 109,16^\circ$ and $\hat{C}BD = 48,88^\circ$.



Determine the length of:

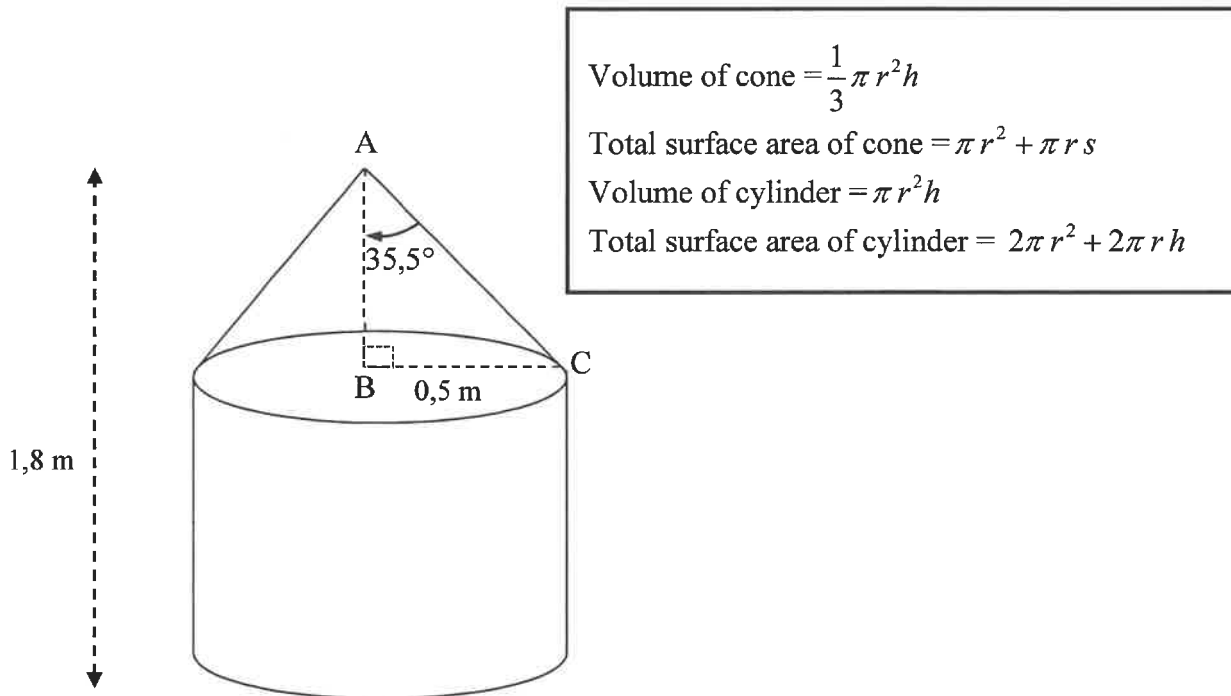
7.2.1 BD (3)

7.2.2 CD (3)

[16]

QUESTION 8

The diagram below shows a water tank which is made up of a cylinder and cone having equal radii. The height of the tank is 1,8 m and the radius is 0,5 m. The angle between the perpendicular height, AB, and the slant height, AC, of the conical section is $35,5^\circ$.



- 8.1 Calculate the perpendicular height, AB, of the cone. (2)
- 8.2 When the tank is full, an electric pump switches on and pumps the water from the tank into an irrigation system at a rate of $0,52 \text{ m}^3/\text{h}$. The pump automatically switches off when the tank is $\frac{1}{4}$ full. Calculate how long, in hours, the pump feeds water into the irrigation system. (4)

[6]

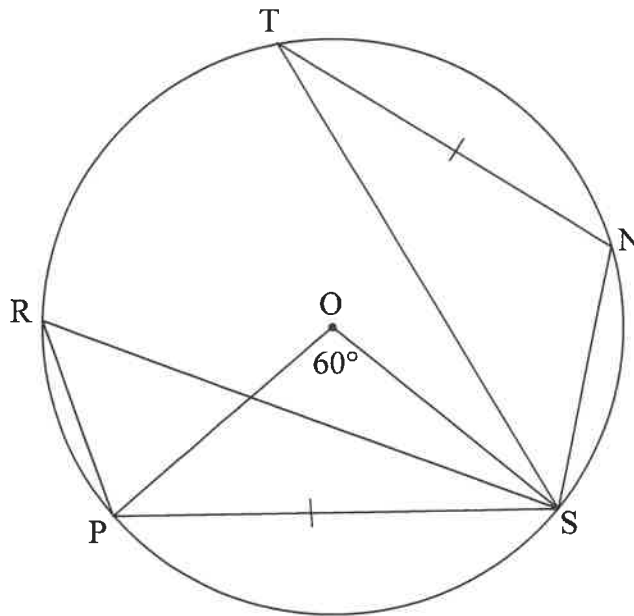
Give reasons for your statements and calculations in QUESTIONS 9, 10, 11 and 12.

QUESTION 9

9.1 Complete the statement so that it is TRUE:

The angle subtended by an arc at the centre of a circle is ... (2)

9.2 O is the centre of circle TNSPR. $\hat{POS} = 60^\circ$ and $PS = NT$.



Calculate the size of:

9.2.1 \hat{PRS} (2)

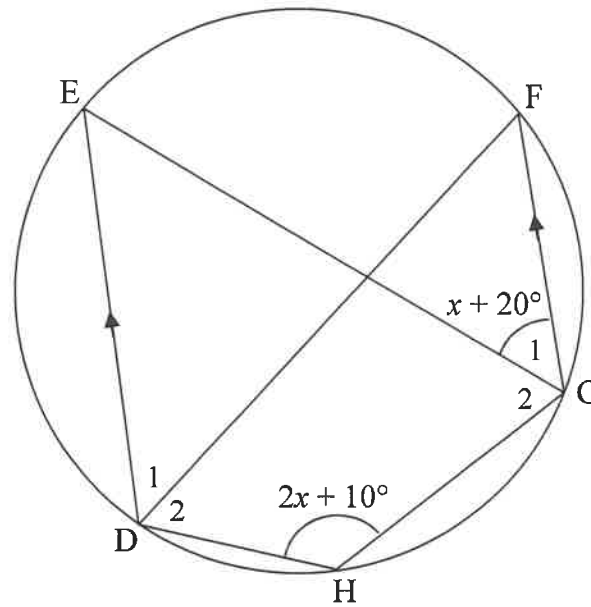
9.2.2 \hat{NST} (2)

[6]

QUESTION 10

D, E, F, G and H are points on the circumference of the circle.

$\hat{G}_1 = x + 20^\circ$ and $\hat{H} = 2x + 10^\circ$. $DE \parallel FG$.

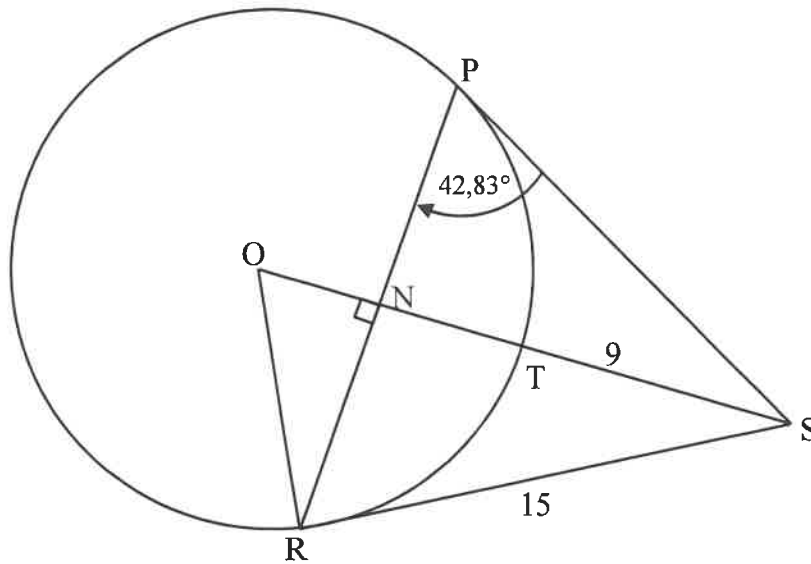


10.1 Determine the size of \hat{DEG} in terms of x . (2)

10.2 Calculate the size of \hat{DHG} . (4)
[6]

QUESTION 11

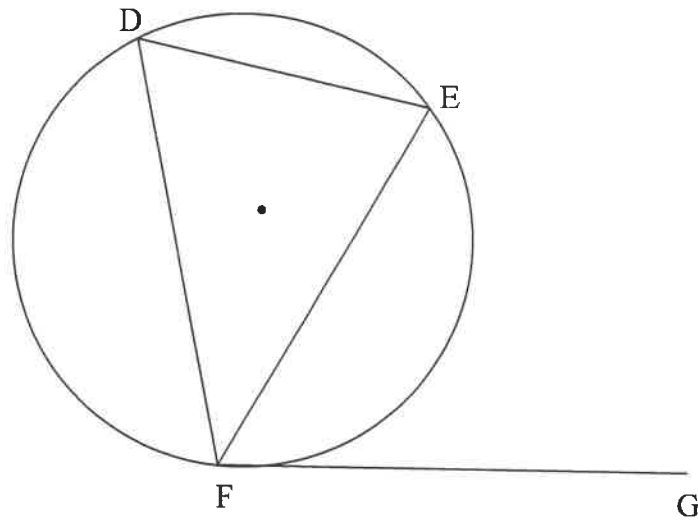
O is the centre of the circle PTR. N is a point on chord RP such that $ON \perp PR$. RS and PS are tangents to the circle at R and P respectively. $RS = 15$ units; $TS = 9$ units; $\widehat{RPS} = 42,83^\circ$.



- 11.1 Calculate the size of \widehat{NOR} . (5)
 - 11.2 Calculate the length of the radius of the circle. (4)
- [9]**

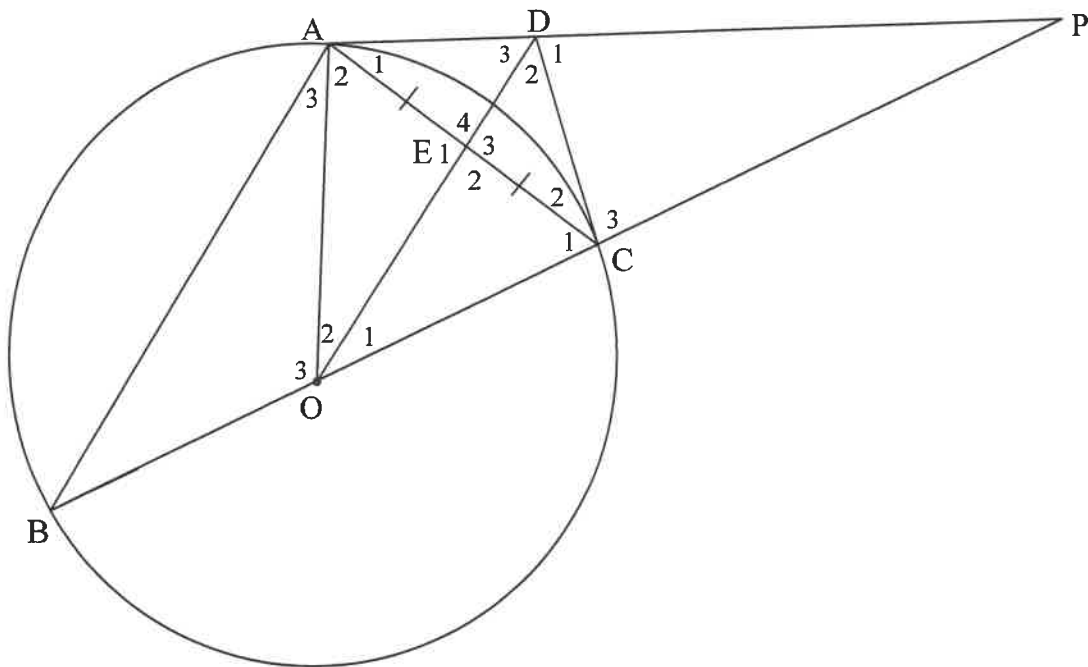
QUESTION 12

12.1 Use the diagram below to prove the theorem which states that $\hat{EFG} = \hat{EDF}$.



(5)

12.2 In the diagram below, BOC is a diameter of the circle. AP is a tangent to the circle at A and $AE = EC$.



Prove that:

12.2.1 $BA \parallel OD$ (4)

12.2.2 $AOCD$ is a cyclic quadrilateral (5)

12.2.3 DC is a tangent to the circle at C (4)

[18]

TOTAL: 150