basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS P2

NOVEMBER 2019

MARKS: 150

TIME: 3 hours

This question paper consists of 14 pages and a 21-page answer book.

IMAT2

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EASTERN CAPE

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of ELEVEN 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.

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QUESTION 1

Mary wants to buy a car and visits a popular website. She finds a number of advertisements for the make of car that she would like to buy. She summarises the selling prices (in thousands of rands) of the cars on sale in the cumulative frequency table below.

SELLING PRICE (IN THOUSANDS OF RANDS)	FREQUENCY	CUMULATIVE FREQUENCY
$50 \leq x < 60$	3	3
$60 \leq x < 70$	4	7
$70 \leq x < 80$	a	14
$80 \leq x < 90$	19	33
$90 \leq x < 100$	12	b
$100 \leq x < 110$	5	50

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

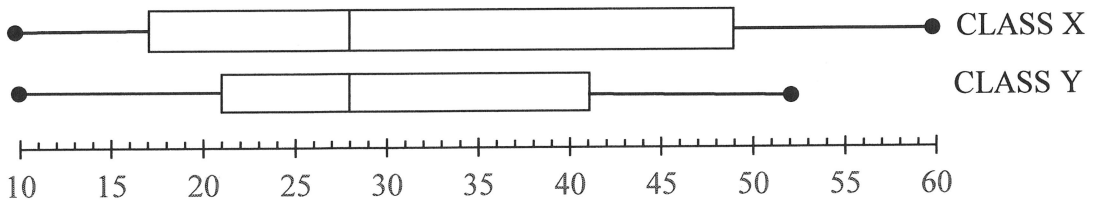
1.2 Draw a cumulative frequency graph (ogive) of the data on the grid provided in the ANSWER BOOK. (3)

1.3 Mary wants to spend a maximum of R95 000. Use the cumulative frequency graph to estimate the number of cars that are on sale in the price range that Mary can afford. (1)
[6]

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QUESTION 2

2.1 Two classes wrote a Mathematics test that had a maximum mark of 60. The results of each class are summarised in the box and whisker diagrams below.



2.1.1 Comment on the skewness of the results in class X. (1)

2.1.2 In which class is the standard deviation of the marks bigger? (1)

2.1.3 Comment on the average performance in the test of the two classes. Use relevant statistics to support your argument. (2)

2.2 The time, in minutes, that it took for the first goal to be scored in seven football games was recorded. The times, in ascending order, are represented by a, b, c, d, e, f and g in the table below.

a	b	c	d	e	f	g

The following observations were made about the data:

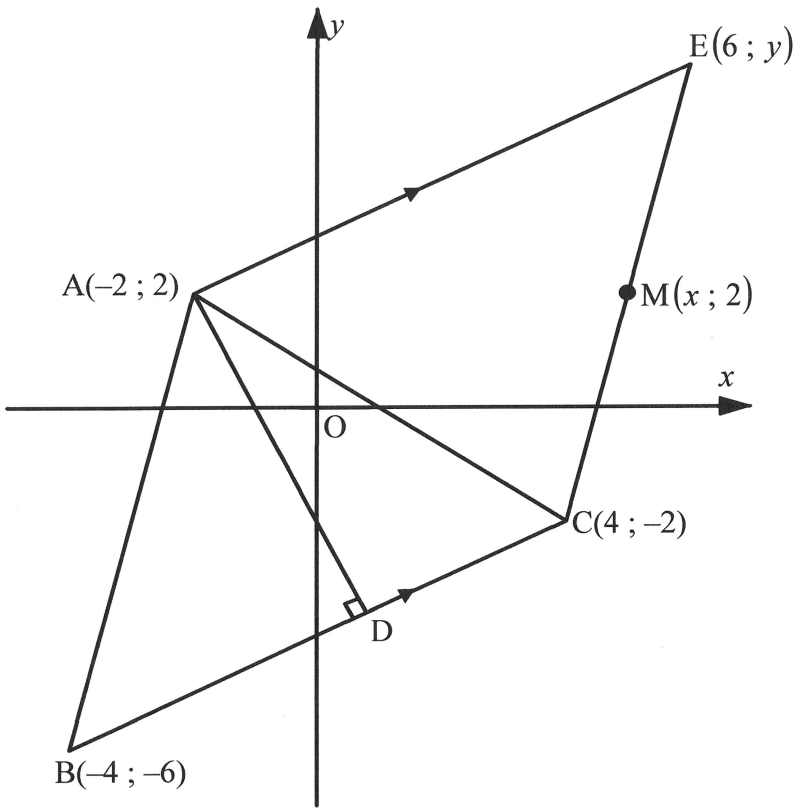
- All these goals were scored at different times.
- The minimum time for the first goal was 5 minutes.
- The range of the times was 48 minutes.
- The median time was 22 minutes.
- The difference between the time at the lower quartile and the minimum time was 7 minutes.
- The IQR of the times was 28 minutes.
- The mean time was 27 minutes.
- $e = 2c$

2.2.1 Determine the values of a, b, c, d, e, f and g. (8)

2.2.2 If the standard deviation of the data set is 15,87 minutes, how many goals were scored within ONE standard deviation of the mean time? (3)
[15]

QUESTION 3

In the diagram, A(–2 ; 2), B(–4 ; –6), C(4 ; –2) and E(6 ; y) are the vertices of a quadrilateral having AE || BC. D lies on BC such that AD ⊥ BC and AC is drawn. M(x ; 2) is a point on EC.



3.1 Calculate the gradient of BC. (3)

3.2 If M is the midpoint of EC, determine the values of x and y. (3)

3.3 Calculate the length of BC. (2)

3.4 If it is further given that AE = $\sqrt{80}$, to which group of special quadrilaterals does ABCE belong? (1)

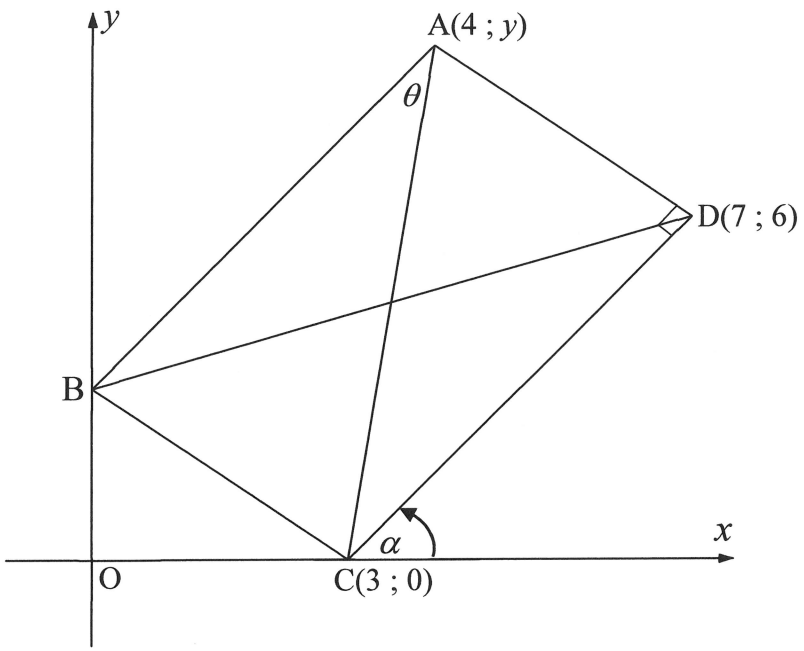
3.5 Determine the equation of AD in the form $y = mx + c$. (3)

3.6 Calculate the coordinates of D. (5)

3.7 Determine the area of ΔAEC. (3)
[20]

QUESTION 4

In the diagram, B is a point on the y-axis. A(4 ; y), B, C(3 ; 0) and D(7 ; 6) are the vertices of rectangle ABCD. Diagonals BD and AC are drawn. The inclination of DC is α and $B\hat{A}C = \theta$.



4.1 Determine the gradient of CD. (2)

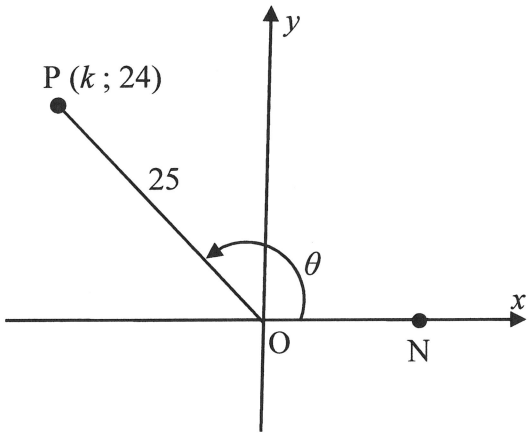
4.2 Calculate the size of α. (2)

4.3 Determine the value of y. (4)

4.4 Calculate the size of θ. (5)
[13]

QUESTION 5

5.1 In the diagram below, P(k ; 24) is a point in the second quadrant such that OP = 25 units. N is a point on the positive x-axis and $\hat{PON} = \theta$.



WITHOUT calculating the size of θ, determine the value of the following:

5.1.1 k (2)

5.1.2 $\tan\theta$ (1)

5.1.3 $\sin\alpha$ if $\theta + \alpha = 360°$ (3)

5.1.4 $\cos^2\theta - \sin^2\alpha$ (3)

5.2 Simplify WITHOUT using a calculator:

$$\frac{\cos 210°.\tan 135°}{\sin(-60°).\cos 420°}$$ (5)

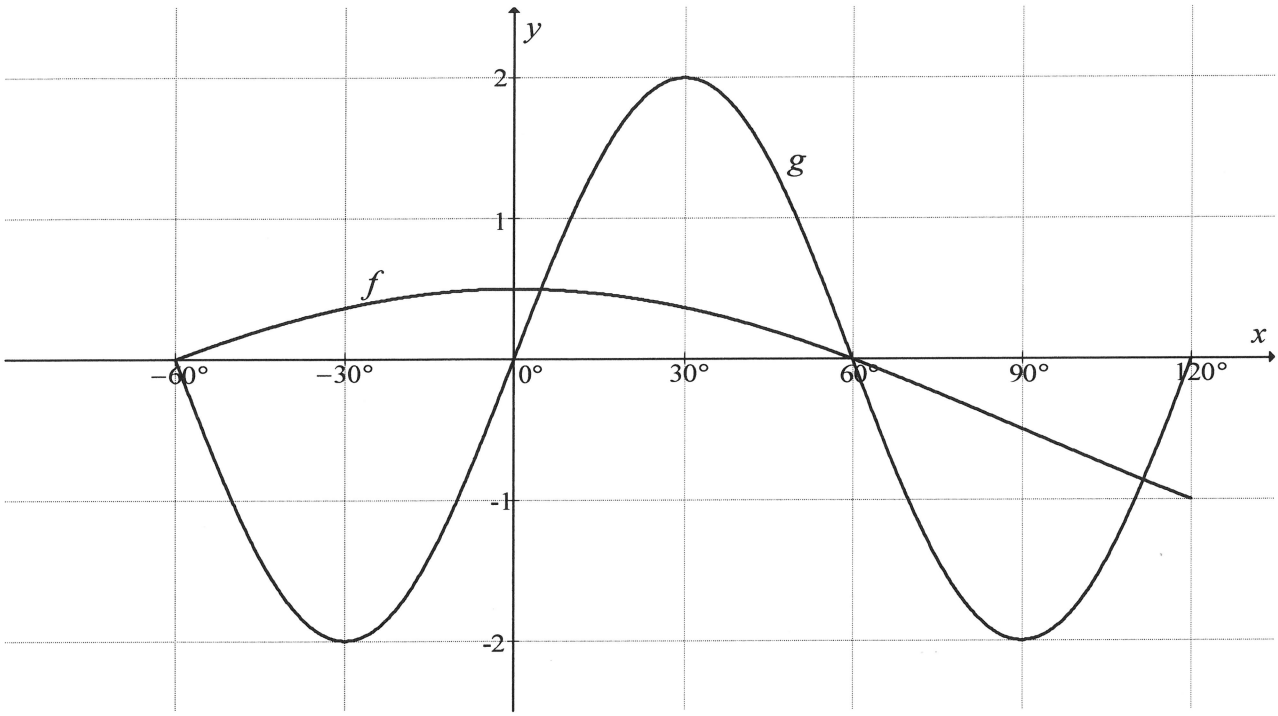
5.3 Prove the identity:

$$\frac{1}{\tan^2 x} - \cos^2 x = \frac{\cos^4 x}{\sin^2 x}$$ (4)

5.4 Determine the general solution of $\sqrt{2}\sin x\cos x = \cos x$. (6)
[24]

QUESTION 6

Sketched below are the graphs of the functions $f(x) = \cos x + q$ and $g(x) = 2\sin bx$ for $x \in [-60° ; 120°]$.



6.1 Write down the coordinates of the maximum turning point of g in the given interval. (1)

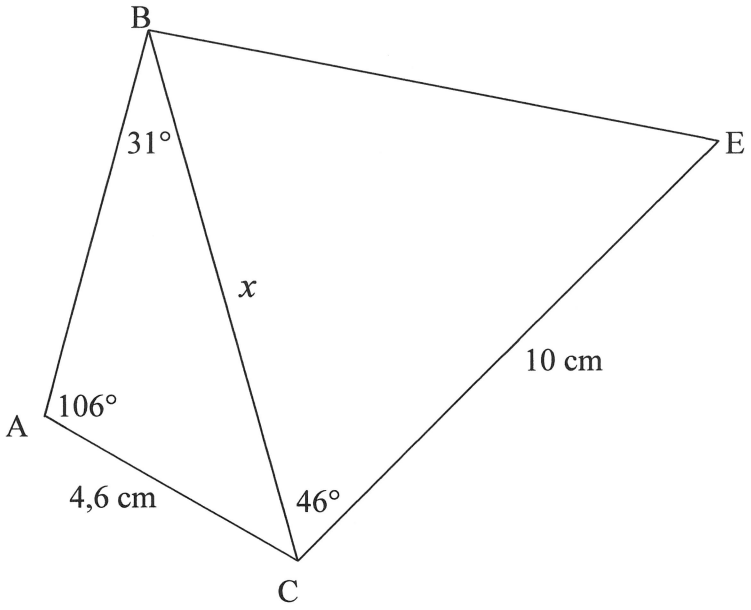
6.2 Determine the values of x where f is strictly increasing in the given interval. (2)

6.3 Determine the values of q and b. (2)

6.4 Use your graphs to determine the values of x for which $2\cos x \sin 3x - \sin 3x \geq 0$. (4)
[9]

QUESTION 7

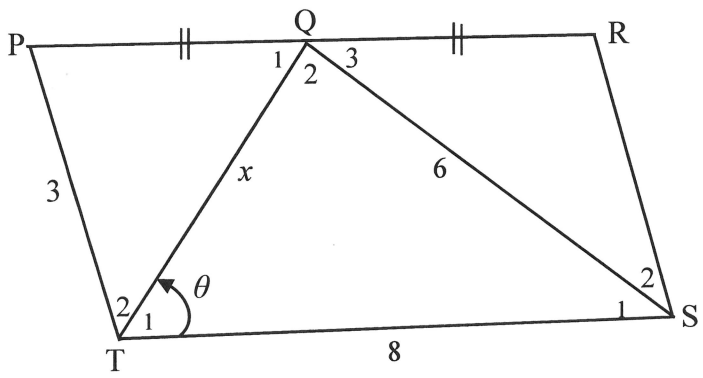
7.1 In the diagram A, C, E and B are the vertices of a quadrilateral.
$A\hat{B}C = 31°$, $B\hat{A}C = 106°$, $B\hat{C}E = 46°$, $AC = 4{,}6$ cm, $CE = 10$ cm and $BC = x$.



7.1.1 Calculate the length of BC. (3)

7.1.2 Calculate the area of quadrilateral ACEB. (4)

7.2 In the diagram below, PTSR is a parallelogram. Q is the midpoint of PR.
QS = 6 units, PT = 3 units, TS = 8 units, QT = x units and $\hat{T}_1 = \theta$.

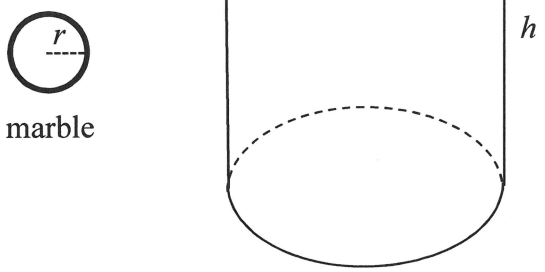


7.2.1 Show that $\cos\theta = \dfrac{x^2 + 28}{16x}$ (3)

7.2.2 Hence, determine the length of QT. (6)
[16]

QUESTION 8

8.1 The cylindrical container shown below will be filled with spherical marbles. The container has a radius of R cm and a perpendicular height of h cm. The volume of the container is 300 cm^3. The radius of each marble is 0,75 cm.



marble

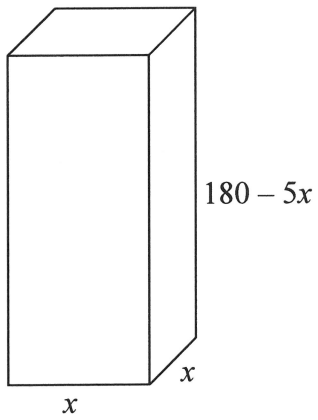
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of a sphere = $4\pi r^2$

8.1.1 Show that the height of the container, h, is given by $h = \frac{300}{\pi R^2}$ (2)

8.1.2 The container is filled with 100 marbles. Then water is poured into the container until the water reaches the top of the container.
Calculate the volume of water that was poured into the container. (3)

8.2 In the diagram below, the right rectangular prism has a square base of x cm and a height of $(180 - 5x)$ cm.

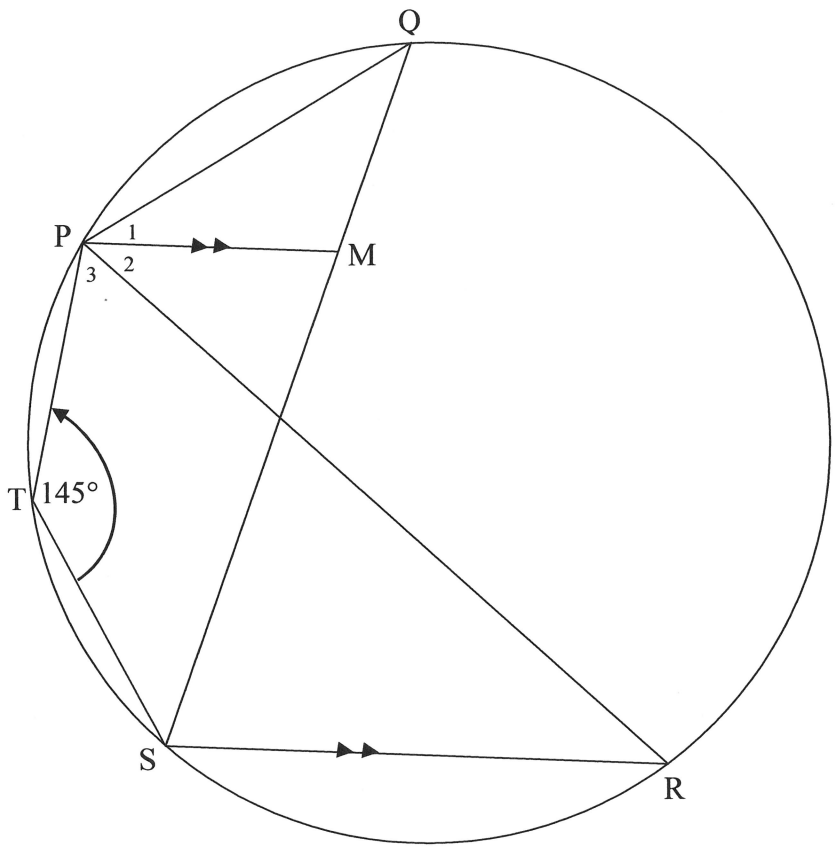


Calculate the maximum surface area of the prism. (5)
[10]

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

QUESTION 9

In the figure Q, P, T, S and R lie on the circle. M lies on QS such that PM || SR.
$P\hat{T}S = 145°$



9.1 Calculate the size of:

9.1.1 $\hat{Q}$ (2)

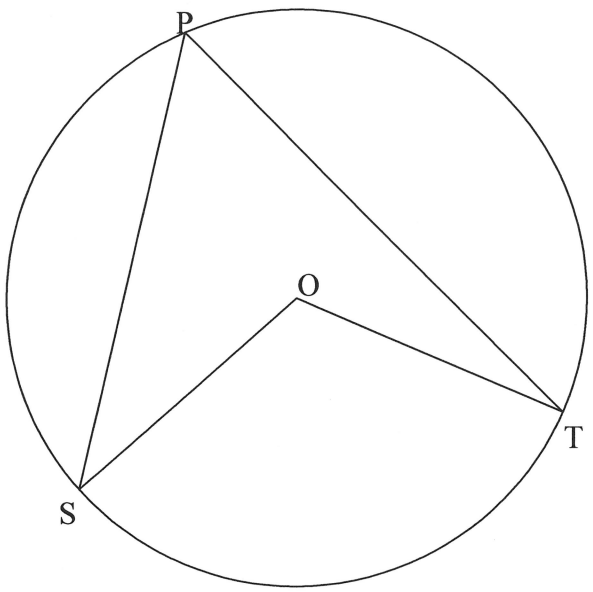
9.1.2 $\hat{R}$ (2)

9.1.3 $\hat{P}_2$ (1)

9.2 Why is PR a tangent to the circle passing through P, M and Q? (1)
[6]

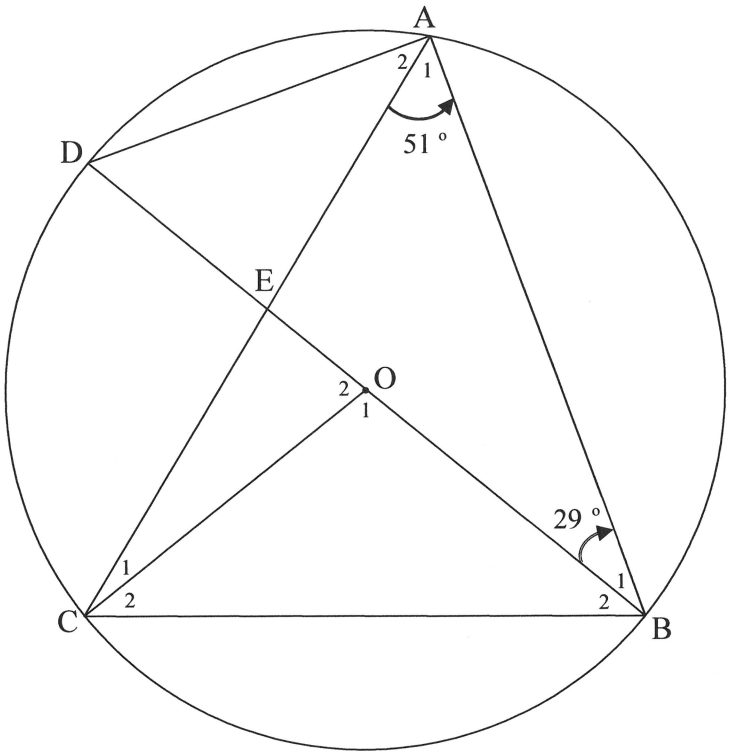
QUESTION 10

10.1 In the diagram below, O is the centre of the circle. P, T and S are points on the circumference of the circle. PS, PT and OT are drawn.



Prove the theorem which states that $S\hat{O}T = 2 \times S\hat{P}T$. (5)

10.2 In the diagram, O is the centre of the circle.
Points A, B, C and D lie on the circumference of the circle. BOD is a diameter.
AC and BD intersect at E.
$\hat{A}_1 = 51°$ and $\hat{B}_1 = 29°$.



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

10.2.2 Determine the size of $\hat{A}_2$. (2)

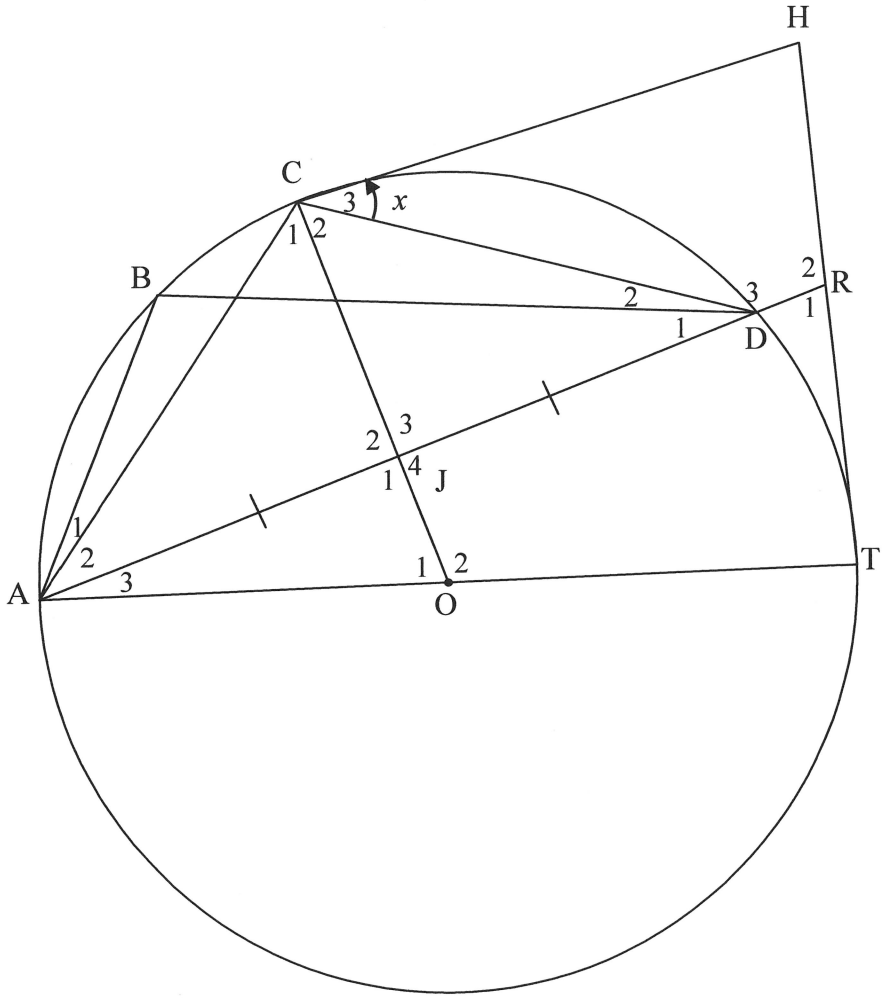
10.2.3 Determine the size of $\hat{D}$. (1)

10.2.4 Determine the size of $A\hat{C}O$. (3)

[13]

QUESTION 11

In the diagram, O is the centre of the circle through the points A, B, C, D and T.
HC and HT are tangents to the circle at C and T respectively.
AD is produced to meet HT at R.
OC bisects AD at J.
Let $\hat{C}_3 = x$.



11.1 Write down, with a reason, another angle equal to $\hat{C}_3$. (2)

11.2 Show that CHRJ is a trapezium. (5)

11.3 Prove that OC bisects $A\hat{C}D$. (3)

11.4 Write down, with a reason, $A\hat{B}D$ in terms of x. (2)

11.5 Determine $\hat{R}_2$ in terms of x. (6)

[18]

TOTAL: 150

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