basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS P2

NOVEMBER 2014

MARKS: 150

TIME: 3 hours

This question paper consists of 14 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 10 questions.

2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.

3. Clearly show ALL calculations, diagrams, graphs, et cetera which you have used in determining the answers.

4. Answers only will NOT necessarily be awarded full marks.

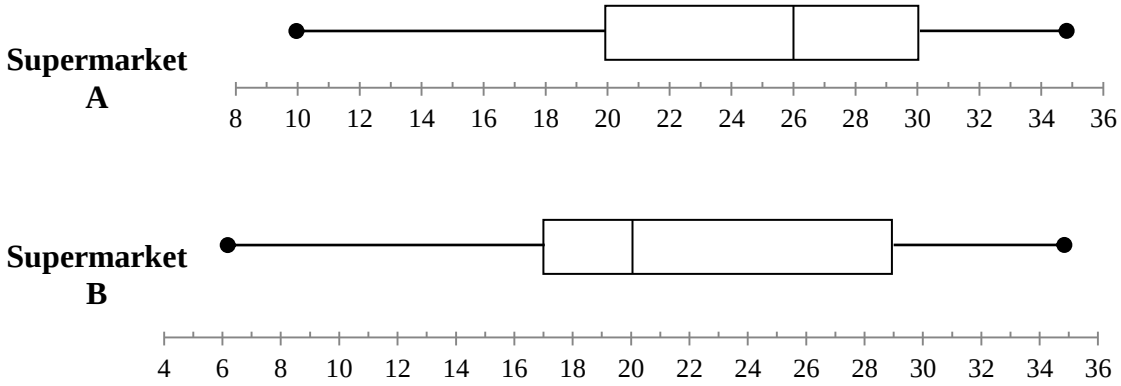
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.

6. If necessary, round off answers to TWO decimal places, unless stated otherwise.

7. Write neatly and legibly

QUESTION 1

1.1 The number of delivery trucks making daily deliveries to neighbouring supermarkets, Supermarket A and Supermarket B, in a two-week period are represented in the box-and-whisker diagrams below.



1.1.1 Calculate the interquartile range of the data for Supermarket A. (2)

1.1.2 Describe the skewness in the data of Supermarket A. (1)

1.1.3 Calculate the range of the data for Supermarket B. (2)

1.1.4 During the two-week period, which supermarket receives 25 or more deliveries per day on more days? Explain your answer. (2)

1.2 The number of delivery trucks that made deliveries to Supermarket A each day during the two-week period was recorded. The data is shown below.

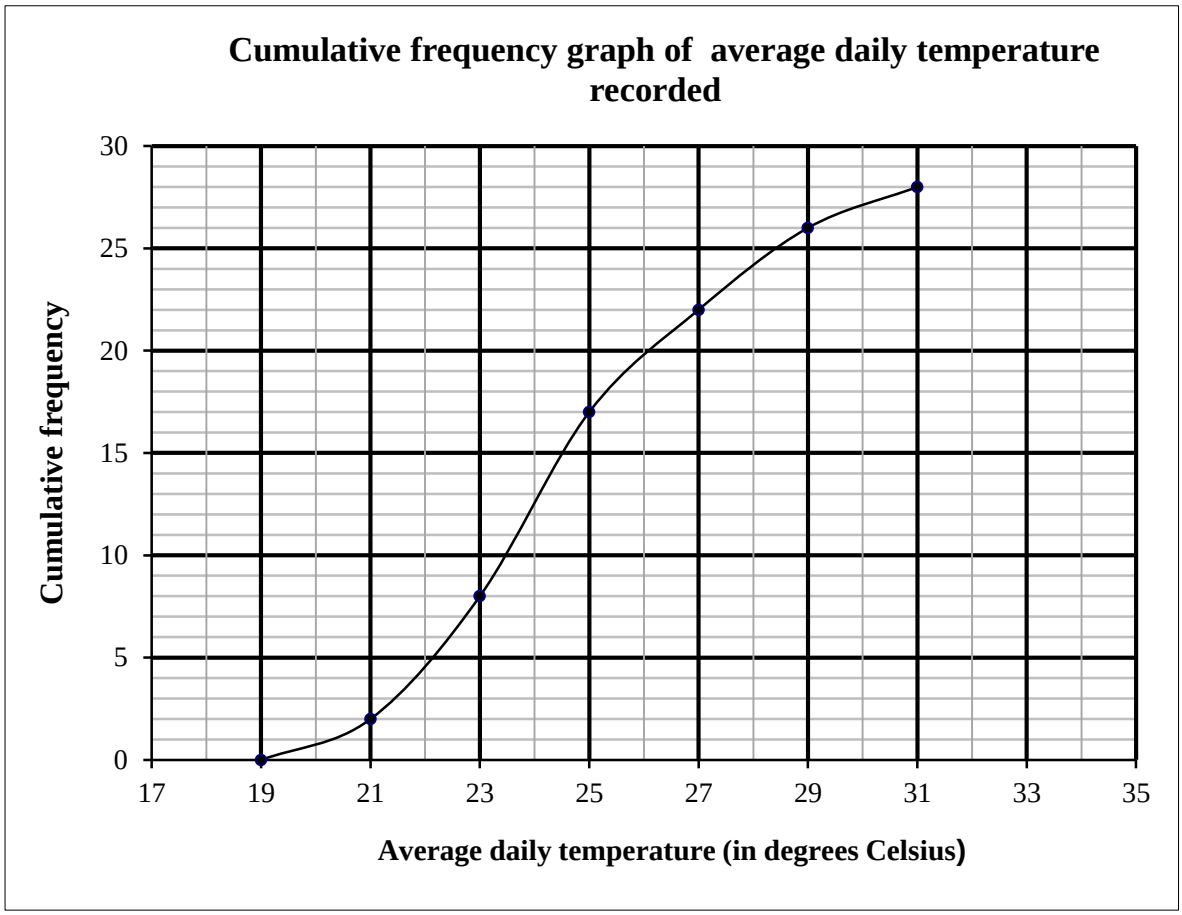
10	15	20	***x***	30	35	15	31	32	21	***x***	27	28	29

If the mean of the number of delivery trucks that made deliveries to supermarket A is 24,5 during these two weeks, calculate the value of x. (3)

[10]

QUESTION 2

The 2012 Summer Olympic Games was held in London. The average daily temperature, in degrees Celsius, was recorded for the duration of the Games. A cumulative frequency graph (ogive) of this data is shown below.



2.1 Over how many days was the 2012 Summer Olympic Games held? (1)

2.2 Estimate the percentage of days that the average daily temperature was less than 24 °C. (2)

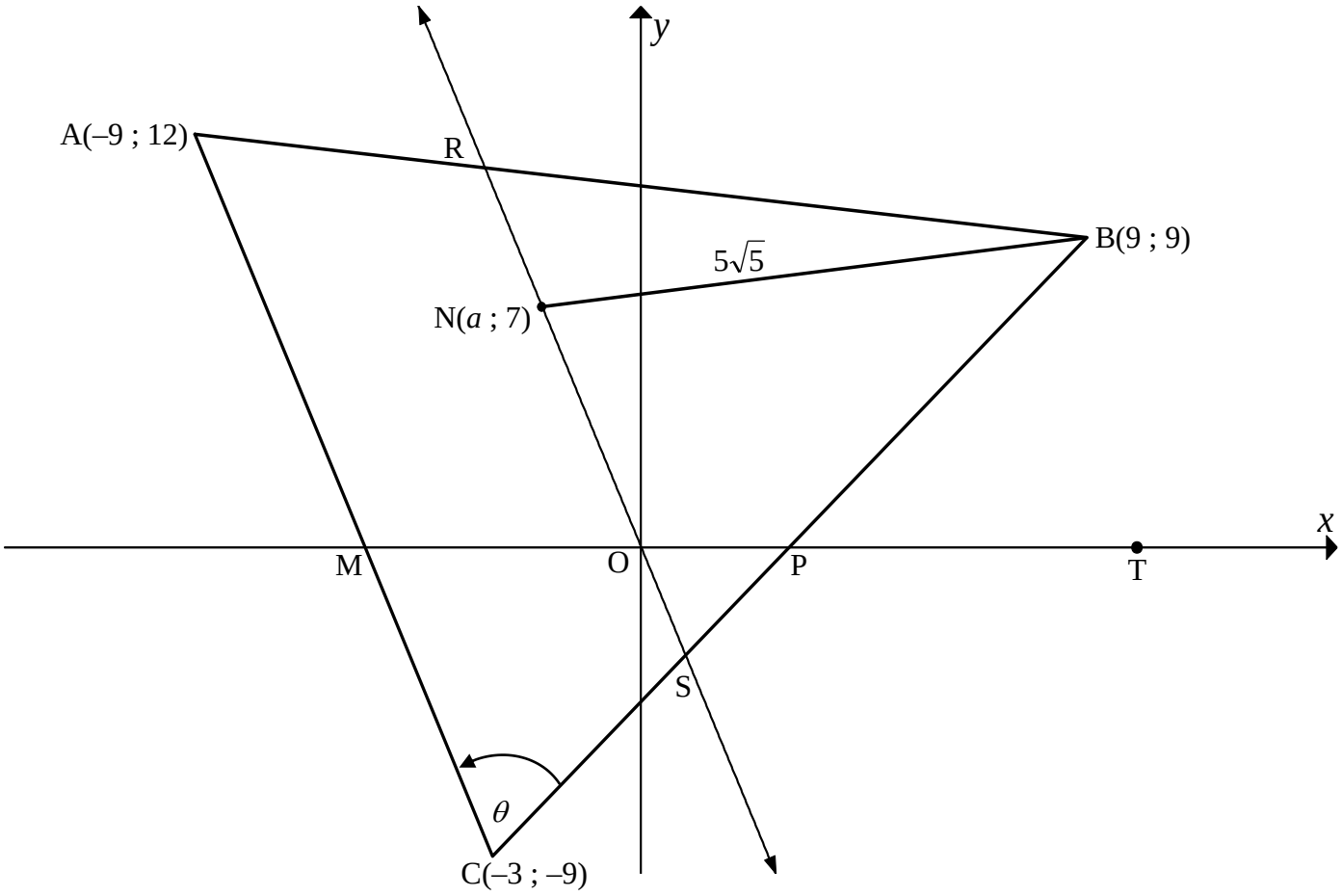
2.3 Complete the frequency table for the data in the SPESCIAL ANSWER BOOK. (3)

2.4 Hence, use the grid provided in the SPECIAL ANSWER BOOK to draw a frequency polygon of the data. (4)

[10]

QUESTION 3

In the diagram A(–9 ; 12), B(9 ; 9) and C(–3 ; –9) are the vertices of ΔABC. N(a ; 7) is a point such that BN = $5\sqrt{5}$. R is a point on AB and S is a point on BC such that RNS is parallel to AC and RNS passes through the origin. T lies on the x-axis to the right of point P.
$A\hat{C}B = \theta$, $A\hat{M}O = \alpha$ and $B\hat{P}T = \beta$.



3.1 Calculate the gradient of the line AC. (2)

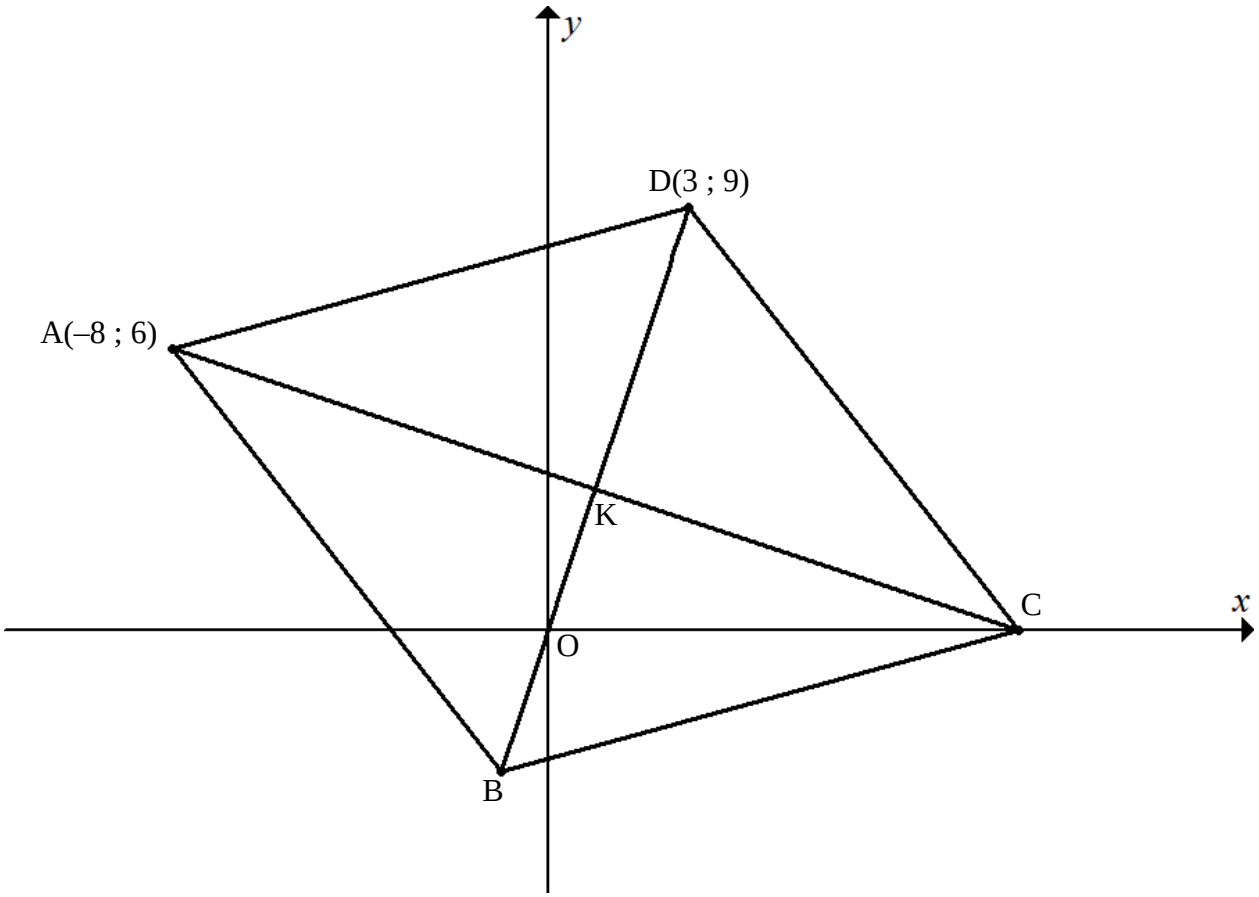
3.2 Determine the equation of line RNS in the form $y = mx + c$. (2)

3.3 Calculate the value of a. (4)

3.4 Calculate the size of θ. (5)
[13]

QUESTION 4

In the diagram A(–8 ; 6), B, C and D(3 ; 9) are the vertices of a rhombus. The equation of BD is $3x - y = 0$. The diagonals of the rhombus intersect at point K.



4.1 Calculate the perimeter of ABCD. Leave your answer in simplest surd form. (3)

4.2 Determine the equation of diagonal AC in the form $y = mx + c$. (4)

4.3 Calculate the coordinates of K if the equation of AC is $x + 3y = 10$. (3)

4.4 Calculate the coordinates of B. (2)

4.5 Determine, showing ALL your calculations, whether rhombus ABCD is a square or not. (5)
[17]

QUESTION 5

5.1 If $\cos 23° = p$, express, **without the use of a calculator**, the following in terms of p:

5.1.1 $\cos 203°$ (2)

5.1.2 $\sin 293°$ (3)

5.2 Simplify the following expression to a single trigonometric term:

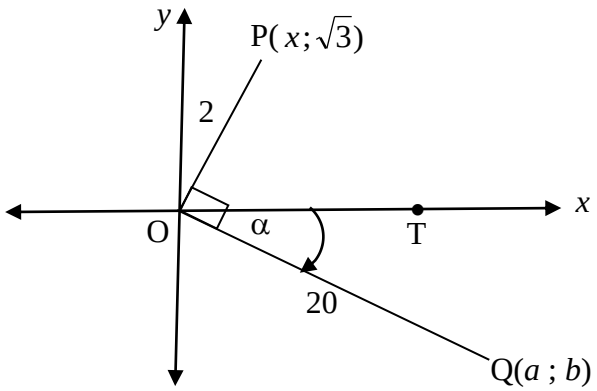
$$\frac{\sin(360° - x).\tan(-x)}{\cos(180° + x).(\sin^2 A + \cos^2 A)}$$ (6)

5.3 5.3.1 Prove the identity: $\frac{\cos x}{1+\sin x} + \frac{1+\sin x}{\cos x} = \frac{2}{\cos x}$ (5)

5.3.2 For which values of x in the interval $0° \leq x \leq 360°$ will the identity in QUESTION 5.3.1 be undefined? (2)

5.4 Determine the general solution of: $\sin 2x = 4\cos 2x$ (5)

5.5 In the diagram below $P(x;\sqrt{3})$ is a point on the Cartesian plane such that OP = 2. $Q(a\ ;\ b)$ is a point such that $T\hat{O}Q = \alpha$ and OQ = 20. $P\hat{O}Q = 90°$.



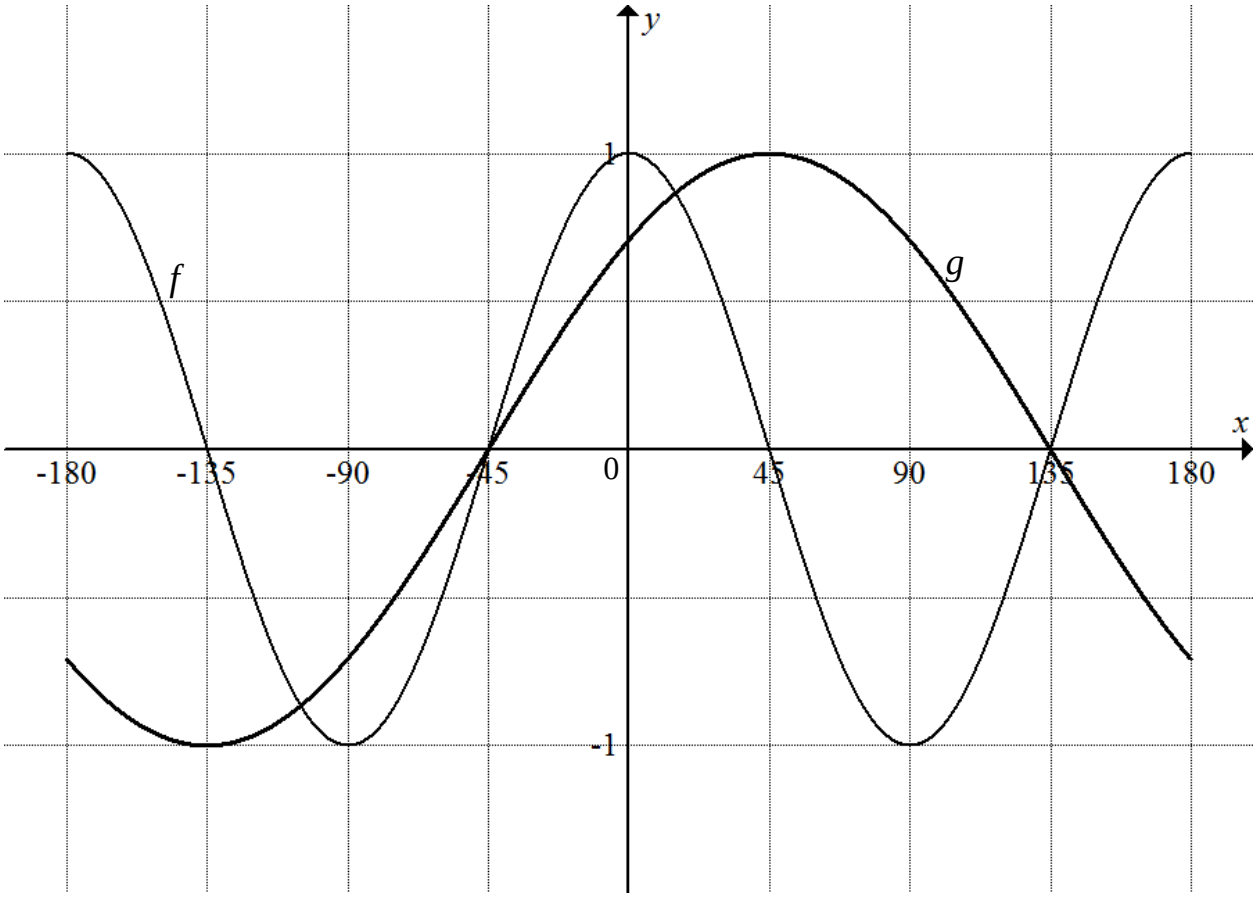
5.5.1 Calculate the value of x. (2)

5.5.2 Hence, calculate the size of α. (3)

5.5.3 Determine the coordinates of Q. (5)
[33]

QUESTION 6

In the diagram below the graphs of $f(x) = a \cos bx$ and $g(x) = \sin (x + p)$ are drawn for $x \in [-180° ; 180°]$.



6.1 Write down the values of a, b and p. (3)

6.2 For which values of x in the given interval does the graph of f increase as the graph of g increases? (2)

6.3 Write down the period of $f(2x)$. (2)

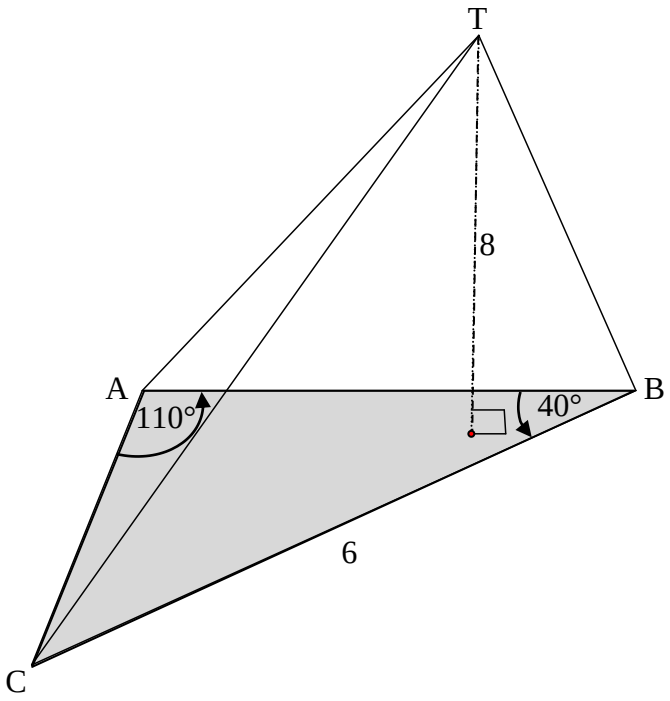
6.4 Determine the minimum value of h if $h(x) = 3f(x) - 1$. (2)

6.5 Describe how the graph g must be transformed to form the graph k, where $k(x) = -\cos x$. (2)
[11]

QUESTION 7

Surface area = $\pi r^2 + \pi r S$ where S is the slant height.
Volume = $\frac{1}{3}$ area of base × perpendicular height
Volume = $\frac{1}{3}\pi r^2 h$

7.1 In the diagram, the base of the pyramid is an obtuse-angled ΔABC with $\hat{A} = 110°$, $\hat{B} = 40°$ and BC = 6 metres. The perpendicular height of the pyramid is 8 metres.



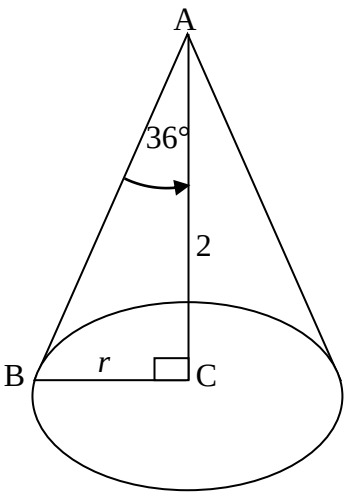
7.1.1 Calculate the length of AB. (3)

7.1.2 Calculate the area of the base, that is ΔABC. (2)

7.1.3 Calculate the volume of the pyramid. (3)

7.2 The perpendicular height, AC, of the cone below is 2 metres and the radius is *r*. AB is the slant height.

$B\hat{A}C = 36°$



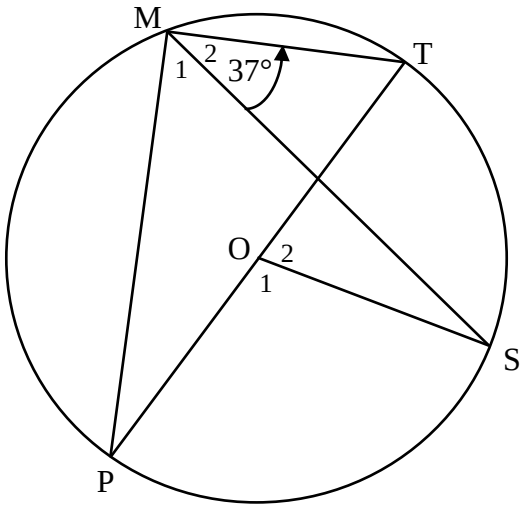
Calculate the total surface area of the cone. (6)
[14]

GIVE REASONS FOR YOUR STATEMENTS AND CALCULATIONS IN QUESTIONS 8, 9 AND 10.

QUESTION 8

8.1 In the diagram below, PT is a diameter of the circle with centre O. M and S are points on the circle on either side of PT.
MP, MT, MS and OS are drawn.

$\hat{M}_2 = 37°$

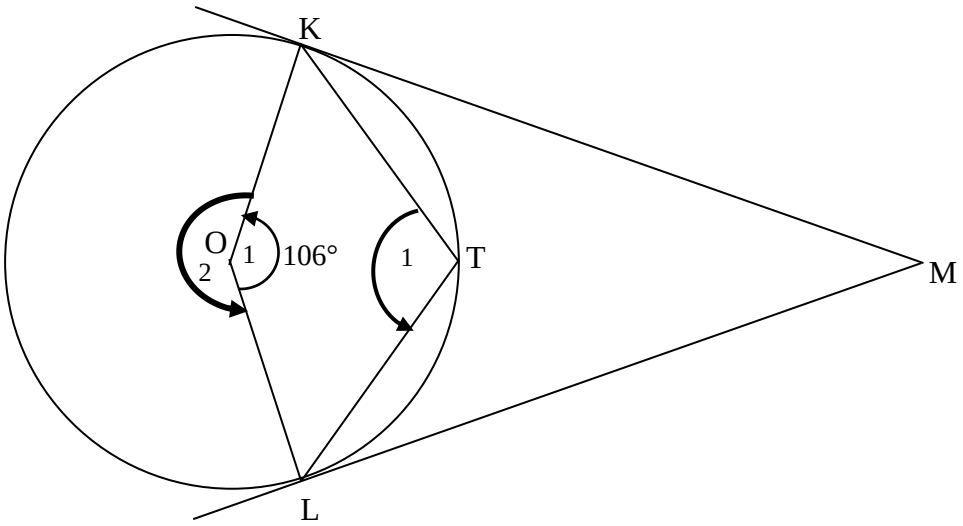


Calculate, with reasons, the size of:

8.1.1 $\hat{M}_1$ (2)

8.1.2 $\hat{O}_1$ (2)

8.2 In the diagram O is the centre of the circle. KM and LM are tangents to the circle at K and L respectively. T is a point on the circumference of the circle. KT and TL are joined. $\hat{O}_1 = 106°$.



8.2.1 Calculate, with reasons, the size of $\hat{T}_1$. (3)

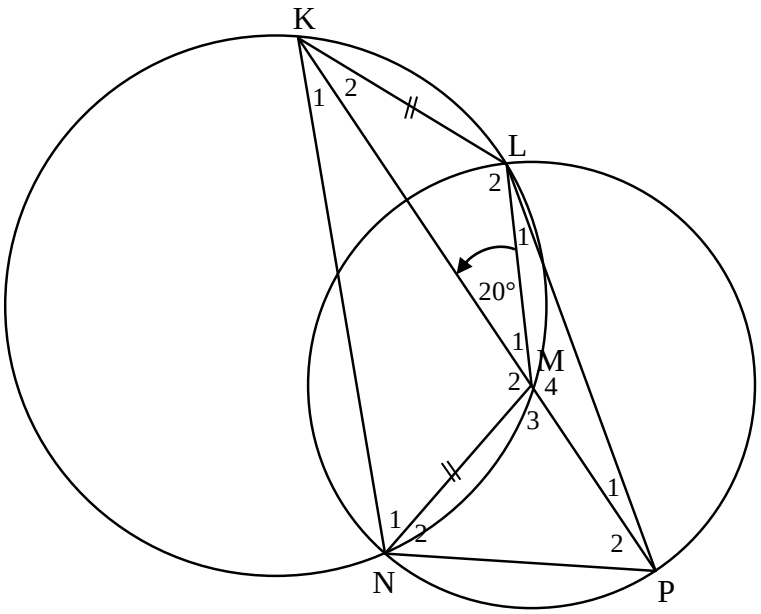
8.2.2 Prove that quadrilateral OKML is a kite. (3)

8.2.3 Prove that quadrilateral OKML is a cyclic quadrilateral. (3)

8.2.4 Calculate, with reasons, the size of $\hat{M}$. (2)
[15]

QUESTION 9

In the diagram M is the centre of the circle passing through points L, N and P.
PM is produced to K. KLMN is a cyclic quadrilateral in the larger circle having KL = MN.
LP is joined. $K\hat{M}L = 20°$.



9.1 Write down, with a reason, the size of $N\hat{K}M$. (2)

9.2 Give a reason why KN | | LM. (1)

9.3 Prove that KL = LM. (2)

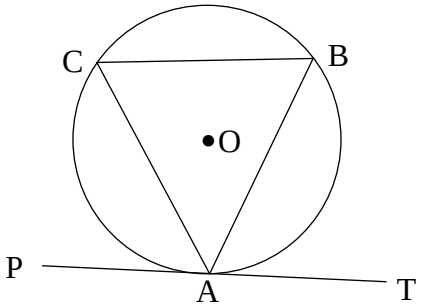
9.4 Calculate, with reasons, the size of:

9.4.1 $K\hat{N}M$ (4)

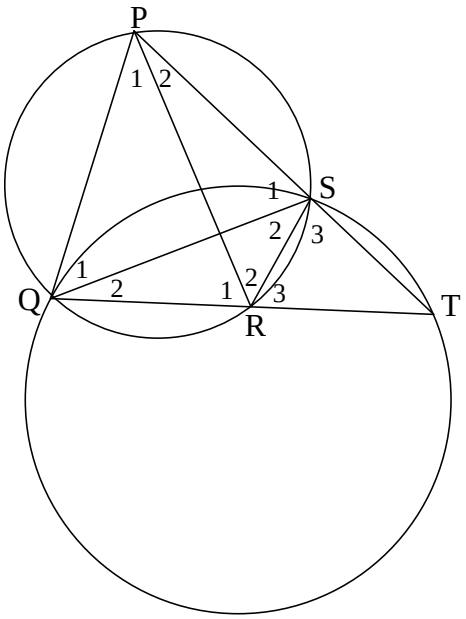
9.4.2 $L\hat{P}N$ (3)
[12]

QUESTION 10

10.1 Use the sketch in the SPECIAL ANSWER BOOK to prove the theorem which states that $B\hat{A}T = \hat{C}$. (6)



10.2 In the diagram PQ is a tangent to the circle QST at Q such that QT is a chord of the circle and TS produced meets the tangent at P. R is a point on QT such that PQRS is a cyclic quadrilateral in another circle. PR, QS and RS are joined.



10.2.1 Give a reason for each statement. Write down only the reason next to the question number in the SPECIAL ANSWER BOOK.

Statement	**Reason**
$\hat{Q}_1 = \hat{T}$	10.2.1 (a)
$\hat{Q}_2 = \hat{P}_2$	10.2.1 (b)

(2)

10.2.2 Prove that PQR is an isosceles triangle. (4)

10.2.3 Prove that PR is a tangent to the circle RST at point R. (3)
[15]

TOTAL: 150