QUESTION 1 (6 marks)

1. The box and whisker diagram, with values as shown, for a grade 10 class of maths test results out of a 100 is drawn below:

   10  A  30  60   B

   1.1 For the data, determine:

   1.1.1 The median
   1.1.2 The highest test result, if the range is 80
   1.1.3 Q₁, if the interquartile range is 44

   1.2 What percentage of the data lies between the median and Q₂

   1.3 Comment on whether you think the class who these results belong to is a strong mathematical class or not; justify your comment.
QUESTION 2 (5 marks)

For the data given below:

<table>
<thead>
<tr>
<th>$x$</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10 &lt; x \leq 20$</td>
<td>2</td>
</tr>
<tr>
<td>$20 &lt; x \leq 30$</td>
<td>5</td>
</tr>
<tr>
<td>$30 &lt; x \leq 40$</td>
<td>8</td>
</tr>
<tr>
<td>$40 &lt; x \leq 50$</td>
<td>6</td>
</tr>
<tr>
<td>$50 &lt; x \leq 60$</td>
<td>3</td>
</tr>
<tr>
<td>$60 &lt; x \leq 70$</td>
<td>1</td>
</tr>
</tbody>
</table>

2.1. What is the modal interval (1)

2.2.1 What position does the median hold in the data represented? (1)

2.2.2 Hence, state what interval the median falls into. (1)

2.3 Estimate the mean (3) [6]

QUESTION 3 (4 marks)

The following data values have a mean of 30; calculate the value of $x$:

$2x; 3x - 3; 1 - x; 5x - 2; x; -2x$ [4]

QUESTION 4 (18 marks)

4. Consider the following quadrilateral $ABCD$, with coordinates $A(0; 4); B(9; 7); C(7; 3); D\left(\frac{5}{2}; 0\right)$ given Diagonals $AC$ and $BD$ are drawn.

4.1 Determine the midpoints of:

4.1.1 $DB$ (2)

4.1.2 $AC$ (1)

4.2 Hence give a reason why $ABCD$ is, in fact, a parallelogram. (1)

4.3 If the point of intersection of the diagonals is called $E$, what name can be given to the line $BE$ in $\Delta ABC$? (1)

4.4 If $K$ is a point on the cartesian plane so that $BK$ is perpendicular to the line $BC$, find the equation of the line $BK$ (4)

4.5 Points $B, C$ and $G(x; -4)$ are collinear; calculate the value of $x$. (4)

4.6 Point $C$ is equidistant from $B$ and $F(9; y)$, where $y < 0$; calculate the value of $y$, given that the distance of $BC = \sqrt{20}$. (3) [18]
QUESTION 5 (11 marks)

5.1 Use the diagram to complete the following trig statements:

\[
5.1.1 \quad \sin \theta = \frac{AC}{AB} \\
5.1.2 \quad \cos \theta = \frac{AC}{BC} \\
5.1.3 \quad \cos(90^\circ - \theta) = \frac{1}{AB} \\
\]

5.2 PQRS is a rhombus with diagonals intersecting at T. \( Q_1 = 36^\circ \) and \( QR = 96 \text{mm} \).

5.3 Given that \( x = 25^\circ \) and \( y = 5^\circ \) calculate, leaving your in decimal form:

\[
5.3.1 \quad -\cos^2(x - y) \\
5.3.2 \quad (-\cos(x - y))^2 \\
\]

QUESTION 6 (8 marks)

6.1 Sketch the special diagram/s used to evaluate, without the use of a calculator, the trigonometric ratios of 30\(^\circ\), 45\(^\circ\), 60\(^\circ\), 0\(^\circ\) and 90\(^\circ\) angles. (3)

6.2 Hence, without using a calculator, simplify the following, leaving your answer in surd form, if necessary:

\[
6.2.1 \quad \sin 45^\circ \\
6.2.2 \quad \tan 90^\circ \\
6.2.3 \quad \sin 30^\circ \\
6.2.4 \quad \cos 60^\circ \\
6.2.5 \quad \cos 0^\circ \\
\]

QUESTION 7 (9 marks)

7.1 If \( 2\tan \theta + 1 = 0 \) and \( 90^\circ < \theta < 270^\circ \),

7.1.1 Draw a diagram, in the correct quadrant, to represent this information, clearly indicating \( \theta, x, y \) and \( r \) on the diagram. (3)

7.1.2 Hence, determine \( \cos \theta \) without a calculator. (1)

7.2 Solve for the variable \( x \) in the following equations:

\[
7.2.1 \quad \frac{\sin x}{2} = \frac{\sin 18^\circ}{3} \quad \text{where} \quad x \in (0^\circ; 90^\circ) \\
7.2.2 \quad 4^2 + 3^2 - 2.4.3 \cos(2x + 10^\circ) = 2^2 \\
\quad \text{where} \quad (2x + 10^\circ) \in (0^\circ; 90^\circ) \\
\]

(3) [9]
QUESTION 8 (9 marks)

An eagle is surveying his hunting area, from a perch above the ground. To the left, he sees a rabbit, \( x \) m away and to the right, he sees a chicken. The angle of depression to the rabbit from the eagle is 50°. The angle of elevation from the chicken to the eagle is 30°. The rabbit and the chicken are 80 m apart. \( RC \perp BE \)

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![Diagram of an eagle with angles 50° and 30° and distances labeled]

8.1 State, with reason the size of \( \angle E \overline{RB} \). 

8.2 Determine the distance (RB) the rabbit is from the base of the eagle’s perch in terms of \( x \) and a trigonometric ratio of 50°.

8.3 Hence, write down an expression for the distance (CB) the chicken is from the base of the eagle’s perch, in terms of \( x \) and a trigonometric ratio of 50°.

8.4 Show that the distance the chicken is from the eagle (CE) is given by the following expression:

\[
CE = \frac{80 - x \cos 50°}{\cos 30°}
\]

8.5 If \( x = 40 \) m, calculate how far the chicken is from the eagle (CE), in meters.

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QUESTION 9 (7 marks)

9.1 On the given set of axes, sketch a neat graph of \( f(x) = \tan x - 1 \) for \( x \in [0°; 180°] \), and label all relevant points.

9.2 The following function \( g(x) = a\cos x - b \) is represented below:

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9.2.1 State the value of:

- 9.2.1.1 \( a \) 
- 9.2.1.2 \( b \)

9.2.2 If \( g(x) \) is shifted up by 3 units to become \( h(x) \) write down the equation of \( h(x) \) in the form \( h(x) = \)

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QUESTION 10 (7 marks)

The accompanying diagram shows a 3 dimensional shape, made up of a hemisphere with a radius of 3 cm, and a cone with a perpendicular height of 7 cm.

For this solid, calculate the:

10.1 volume

10.2 total surface area
QUESTION 11 (15 marks)

In the following diagram, O is the centre of the circle, \( O_1 = O_2 = O_3 \),
\( OG = HG = x, \ O F // C D \), and \( A B // H C // F E \)

11.1 Prove that:

11.1.1 \( \triangle GOH \equiv \triangle DOC \) (4)
11.1.2 Hence, prove that OCDG is a parallelogram (4)

11.2 Using the given information:

11.2.1 Prove that \( \triangle OCG // \triangle OFE \) (3)
11.2.2 Hence, if \( FG = 2x \), and \( OE = 24 \) units, determine the length of \( OD \) (2)

11.3 Determine the length of \( AB \) in terms of \( x \) (2) [15]

Total 100 mark
9.2 The following function \( g(x) = \cos x - b \) is represented below:

9.2.1

9.2.2

(1)