BERGVLIET HIGH SCHOOL

**MATHEMATICS DEPARTMENT**

# NOVEMBER EXAMINATION

## GRADE 11 PAPER 2

## 2021

**MARKS: 125**

**TIME: 2 HRS 30 MIN**

**SET BY: K Grebe**

**MODERATOR: B Jorge**

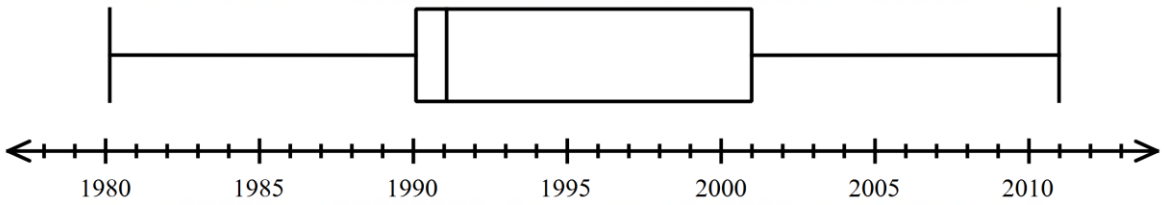
## INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 10 questions.
2. **All answers** are to be completed in the answer booklet provided.
3. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your 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. Diagrams are NOT necessarily drawn to scale.

**QUESTION 1**

1.1) The box and whisker plot given below represents the year that 15 countries gained their independence (they are some of the 37 countries that only gained their independence since 1980).




1.1.1) Determine the range of years that the countries attained their independence over. (1)

1.1.2) What is the median year according to the graph given? (1)

1.1.3) What percentage of countries attained their independence between 1990 and 1991? (1)

1.1.4) If another 12 countries were added to the above 15, and all twelve achieved independence in 1991, explain how the box and whisker diagram would change. (2)

1.2) The table below indicates the number of public holidays in countries across the world (as listed on Wikipedia). Where holidays vary according to region, the fewest number of holidays have been used. Out of interest, South Africa has 12 public holidays.

| NUMBER OF HOLIDAYS | TOTAL NUMBER OF COUNTRIES |
|---|---|
| $5 < x \leq 10$ | 3 |
| $10 < x \leq 15$ | 28 |
| $15 < x \leq 20$ | 16 |
| $20 < x \leq 25$ | 4 |
| $25 < x \leq 30$ | 2 |

1.2.1) Complete the cumulative frequency in the table given. (1)

1.2.2) Draw the cumulative frequency graph (the ogive). (4)

1.2.3) Use the ogive to determine the median number of public holidays. (2)

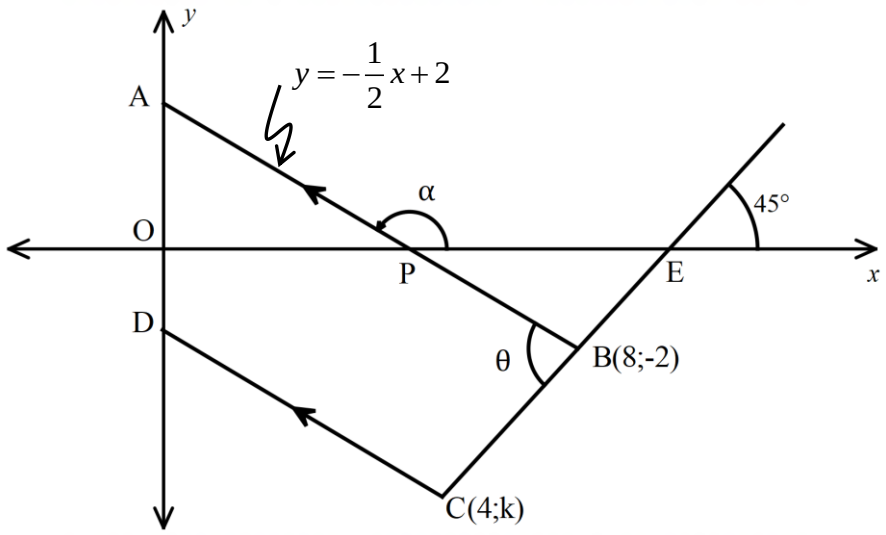
1.2.4) Determine the percentage of countries that have 20 or more public holidays. (3)

**[15]**

**QUESTION 2**

In the diagram below, the inclination of AB is $\alpha$ and the equation is given as $y = -\frac{1}{2}x + 2$.

The line passing through E and B has an inclination of 45° and cuts the *x*-axis at E. $A\hat{B}C = \theta$.




2.1) Calculate the gradient of BC. (1)

2.2) Show that the value of *k* is -6. (3)

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

2.4) Calculate the:

2.4.1) Size of $\theta$ (3)

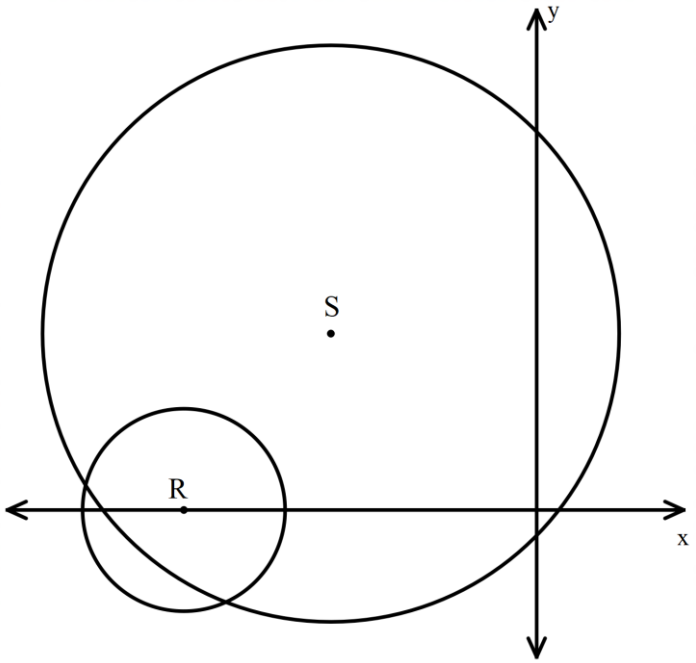
2.4.2) Length of AB (3)

2.4.3) Area of $\Delta ABC$ (4)

**[17]**

**QUESTION 3**

The equation of the circle centred at R is $(x+8)^2 + y^2 = 9$ and the equation of the circle centred at S is $x^2 + 10x + y^2 - 8y = 8$.




3.1) Write down the co-ordinates of R. (2)

3.2) Determine the co-ordinates of the centre of circle S. (4)

3.3) Determine the values of *x* that circle R must be shifted in order to lie completely to the left of circle S (the circles mustn't touch each other). (2)

**[8]**

**QUESTION 4 (DO NOT USE A CALCULATOR IN THIS QUESTION)**

4.1) Given: $\sin 23° = k$

Determine the following in terms of k:

4.1.1) $\tan^2(23°)$ (4)

4.1.2) $\sin(247°)$ (2)

4.2) Simplify to a single trig ratio:

$$\frac{\tan(540° + x).\cos(-x)}{\cos(90° - x)}$$ (5)

4.3) Simplify the following:

$$\frac{2\cos(1020°) + \sin^2(315°)}{\tan(-135°) + \sin(210°)}$$ (6)

4.4) Prove the identity:

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

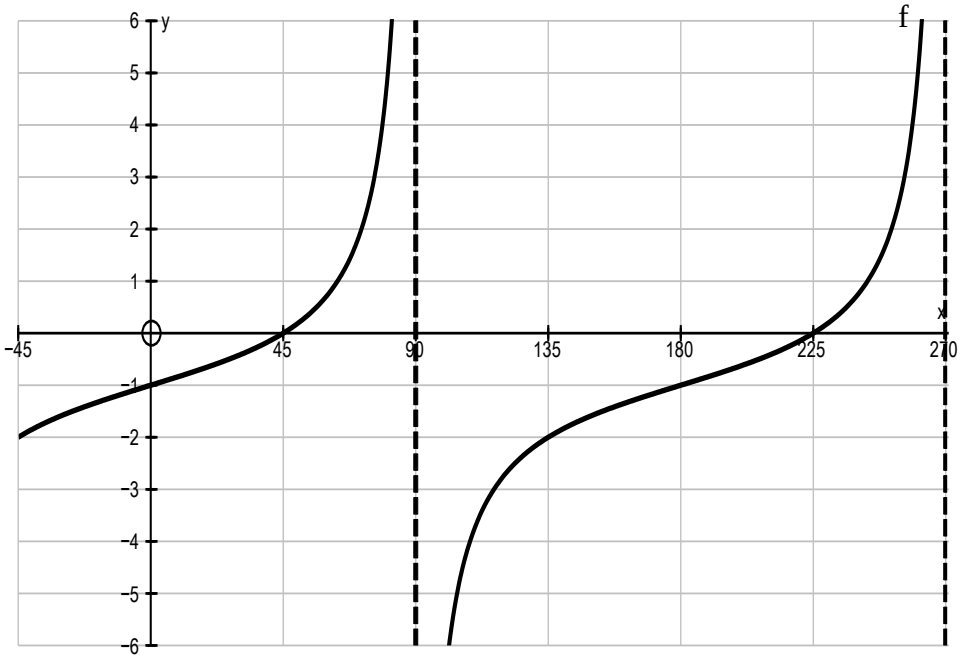
4.5) Determine the value of the following, without the aid of a calculator:

$$\sin^2 1° + \sin^2 2° + \sin^2 3° + ... + \sin^2 88° + \sin^2 89° + \sin^2 90°$$ (3)

**[24]**

**QUESTION 5**

5.1) In the diagram below, the graph of $f(x)=\tan(x)-1$ is drawn for the interval $x\in[-45°;270°]$.



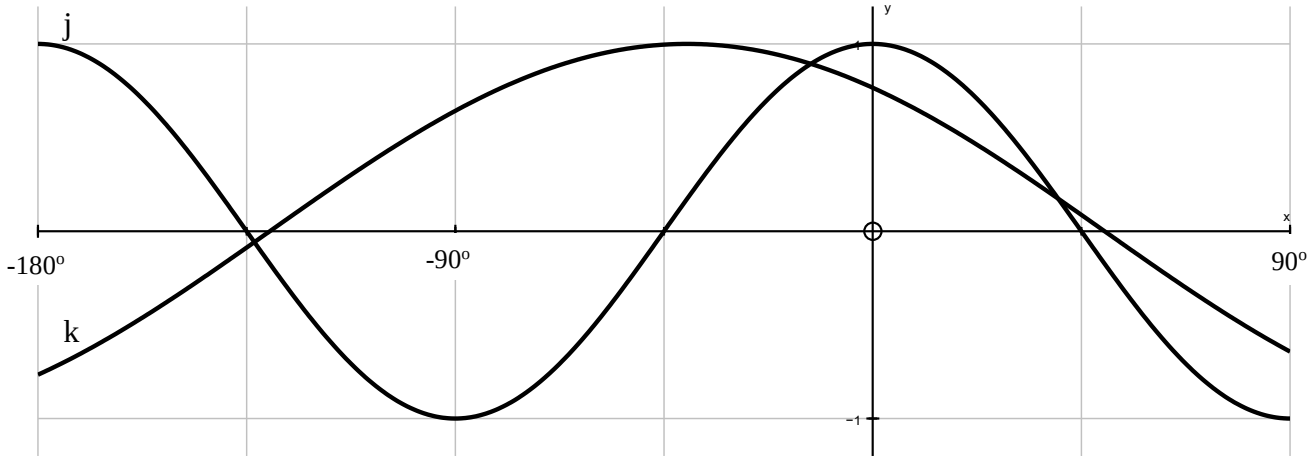

5.1.1) On the grid provided, draw the graph of $g(x)=-3\sin(x-45°)$ for $x\in[-45°;270°]$. Clearly show all intercepts with the axes and turning points of the graph. (3)

5.1.2) Write down the amplitude of g. (1)

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

5.1.4) Use the graphs to determine the value(s) of $x$ in the interval $x\in[-45°;270°]$ for which $f(x)-g(x)=1$. (1)

5.2) In the diagram below, the graph of $j(x)=\cos 2x$ and $k(x)=\cos(x+40°)$ are drawn for the interval $x\in[-180°;90°]$.




5.2.1) Write down the values of *x* for which both j and k are increasing, (2)

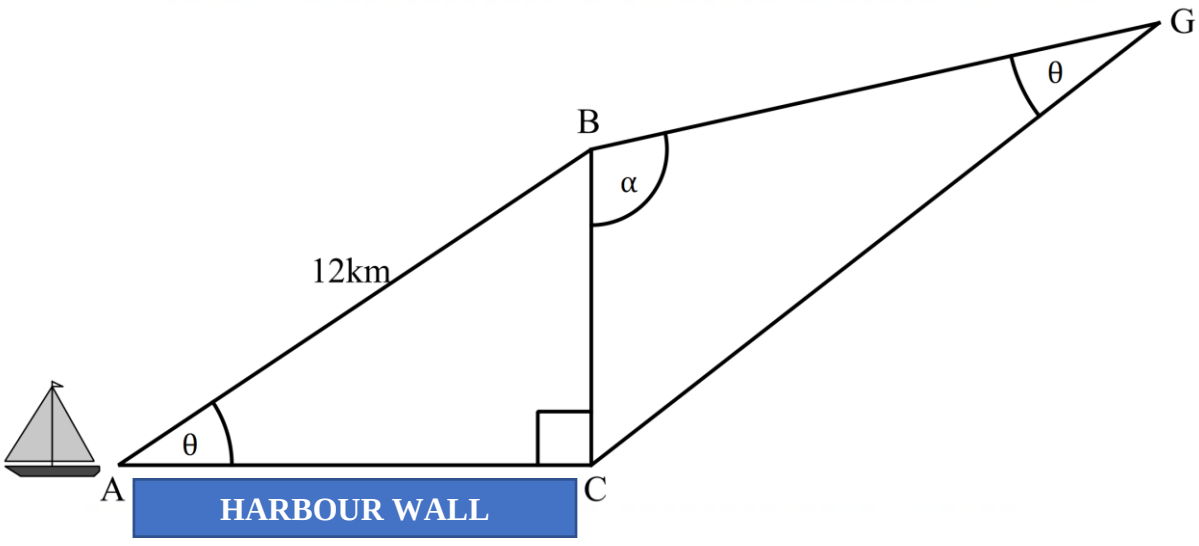
5.2.2) Write down the range of $3j(x)+2$. (2)

5.2.3) Determine the points of intersection of j and k in the interval $x\in[-180°;90°]$, i.e. where $j(x)=k(x)$. (6)

**[17]**

**QUESTION 6**

A boat sails 12km from point A at the harbour to point B at sea. It then changes direction and sails further out to point G.




Show that the distance of the boat from the harbour wall is given by $CG=12\sin\alpha$. **[4]**

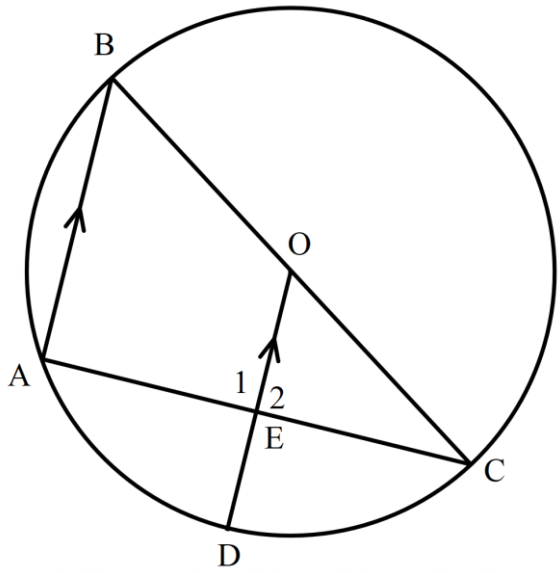
**REMEMBER TO GIVE REASONS FOR ALL YOUR ANSWERS IN GEOMETRY**

**WORK ON THE DIAGRAMS IN YOUR ANSWER BOOKS, NOT THE ONES IN THIS QUESTION PAPER.**

**QUESTION 7**

BC is a diameter of circle ABCD with centre O.

OD is drawn parallel to AB and meets AC at E.




7.1) Determine $\hat{E}_2$. (3)

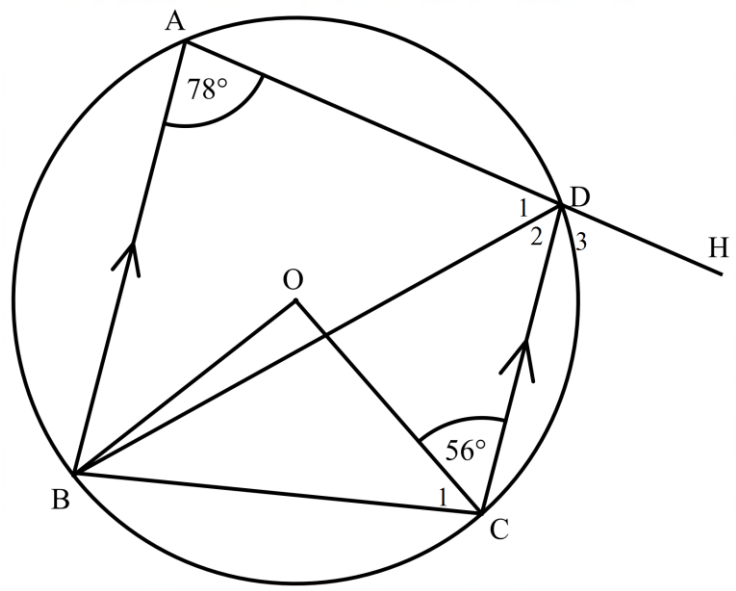
7.2) If the radius is 10cm and AC=16cm, calculate the length of ED. (4)

**[7]**

**QUESTION 8**

8.1) Complete the statement: the opposite angles of a cyclic quad _____. (1)

8.2) In the diagram below, circle ABCD with centre O is given.
AD is extended to H and $AB \parallel CD$.




Determine the size of each of the following angles, with reasons:

8.2.1) $\hat{C}_1$ (2)

8.2.2) $\hat{O}$ (3)

8.2.3) $\hat{D}_2$ (2)

8.2.4) $\hat{D}_3$ (2)

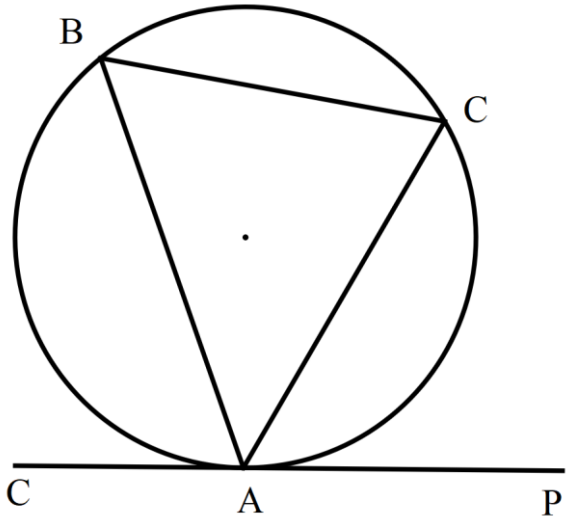
8.2.5) $\hat{D}_1$ (2)

**[12]**

**QUESTION 9**

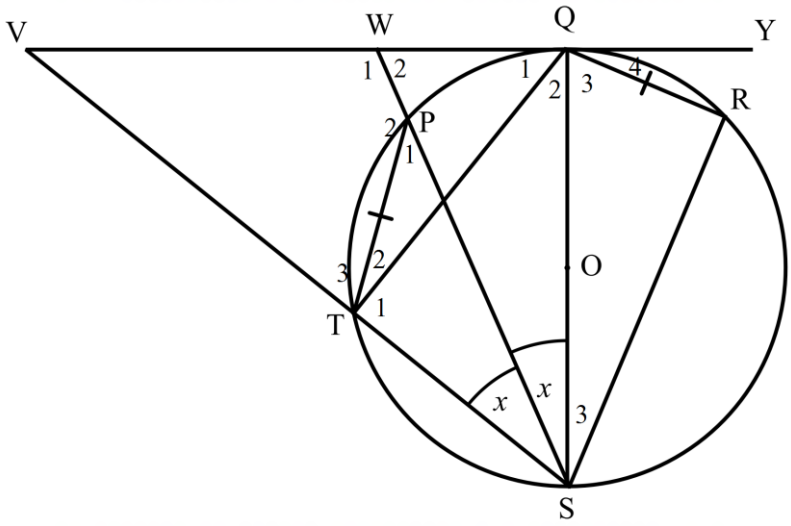
9.1) In the diagram below, $O$ is the centre of the circle. PQ is a tangent to the circle at A. B and C are points on the circumference of the circle. AB, AC and BC are joined.

Prove the theorem that states $C\hat{A}P = A\hat{B}C$.




(5)

9.2) QS is a diameter of the circle with centre O. Chord ST is produced to V. Chord SP produced meets the tangent VY at W. $PT = QR$ and $T\hat{S}W = x$. Chord SW bisects $V\hat{S}Q$.




9.2.1) Write down TWO other angles equal to $x$ (with reasons). (4)

9.2.2) Determine $\hat{V}$ in terms of $x$. (3)

9.2.3) Prove that VWPT is a cyclic quad. (4)

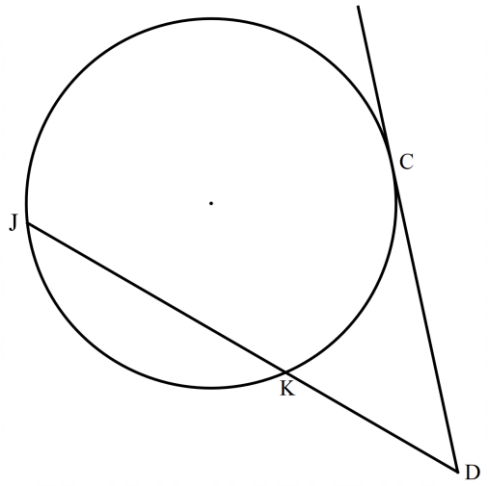
**[16]**

**QUESTION 10**

The "power of a point" theorem reflects the relative distance of a point that is given away from a circle that is also given.

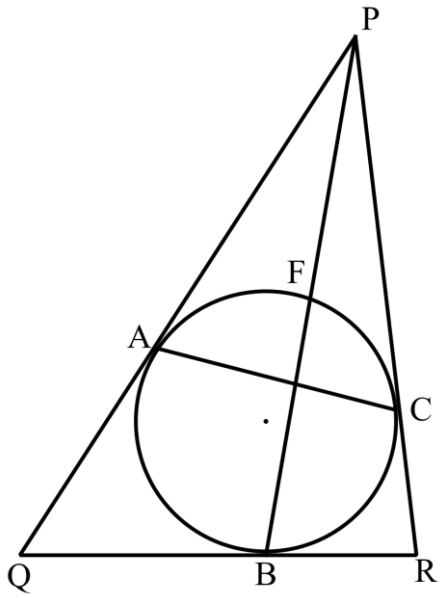
In the circle below CD is a tangent to the circle at C and chord JK extended meets the tangent at D.
It is further given that $\boldsymbol{CD}^2 = \boldsymbol{DK} \times \boldsymbol{DJ}$.

You may use this theorem to help you solve the question below without referencing a reason.




You are now given triangle PQR below, with $\hat{P} = 60°$.

The inscribed circle of triangle PQR is shown, where PQ, QR and PR are tangents to the circle at points A, B and C respectively. F is the point where PB intersects the circle.




Without the use of a calculator, determine the value of $\dfrac{\text{Area } \Delta PAC}{PF \times PB}$. **[5]**