BERGVLIET HIGH SCHOOL

MATHEMATICS DEPARTMENT

NOVEMBER ASSESSMENT

GRADE 11

MATHEMATICS PAPER 2

26 NOVEMBER 2020

MARKS: **100** **SET BY:** **K Grebe**

TIME: **2 HOURS** **MODERATOR:** **A Naysmith**

This question paper consists of 8 pages and 6 questions.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of SIX questions.
2. Answer ALL the questions, on this question paper, in the spaces 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.
8. Number the questions correctly according to the numbering system used in this question paper.
9. Write neatly and legibly.

INFORMATION SHEET

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$A = P(1+ni) \quad A = P(1-ni) \qquad A = P(1-i)^n \qquad A = P(1+i)^n$$

$$T_n = a + (n-1)d \qquad S_n = \frac{n}{2}\{2a + (n-1)d\}$$

$$T_n = ar^{n-1} \qquad S_n = \frac{a\left(r^n - 1\right)}{r-1} \; ; \quad r \neq 1 \qquad S_\infty = \frac{a}{1-r} \; ; -1 < r < 1$$

$$\mathrm{F} = \frac{x\left[\left(1+i\right)^n - 1\right]}{i} \qquad \mathrm{P} = \frac{x\left[1-(1+i)^{-n}\right]}{i}$$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \qquad \mathrm{M}\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c \qquad y - y_1 = m(x - x_1) \qquad m = \frac{y_2 - y_1}{x_2 - x_1} \qquad m = \tan\theta$$

$$\left(x-a\right)^2 + \left(y-b\right)^2 = r^2$$

In ΔABC: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$area\,\Delta ABC = \frac{1}{2}ab.\sin C$$

$$\sin(\alpha + \beta) = \sin\alpha.\cos\beta + \cos\alpha.\sin\beta \qquad \sin(\alpha - \beta) = \sin\alpha.\cos\beta - \cos\alpha.\sin\beta$$

$$\cos(\alpha + \beta) = \cos\alpha.\cos\beta - \sin\alpha.\sin\beta \qquad \cos(\alpha - \beta) = \cos\alpha.\cos\beta + \sin\alpha.\sin\beta$$

$$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases} \qquad \sin 2\alpha = 2\sin\alpha.\cos\alpha$$

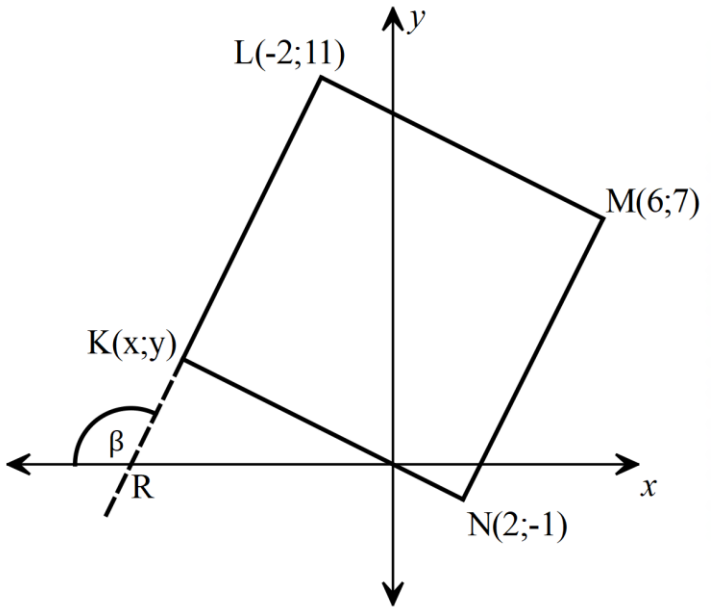
$$\bar{x} = \frac{\sum fx}{n} \qquad \sigma^2 = \frac{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}{n}$$

$$P(A) = \frac{n(A)}{n(S)} \qquad P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$\hat{y} = a + bx \qquad b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$$

QUESTION 1

1.1 K($x;y$), L(-2;11), M(6;7) and N(2;-1) are the vertices of a **parallelogram** as shown below. LK is extended to intersect the x-axis at R, forming β.



1.1.1) Calculate the gradient of MN. (2)

1.1.2) Show that $LM \perp MN$. (2)

1.1.3) Determine the co-ordinates of G, the midpoint of NL. (2)

1.1.4) Determine the equation of KL. (3)

1.1.5) Write down the co-ordinates of K, a vertex of parallelogram KLMN. (2)

1.1.6) Determine the size of β, the angle formed at the x-axis with LKR. (2)

1.1.7) Calculate the lengths of LM and MN and hence determine whether KLMN is a square or not. (4)

1.2 Complete the square in order to determine the co-ordinates of the centre of the circle:

$$x^2 - 10x + y^2 + 8y = 40$$

Write down the co-ordinates of the centre as well as the length of the radius of the circle. (4)

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QUESTION 2

2.1 Given: $\cos\theta = \frac{3}{8}$ and $90° \le \theta \le 360°$.

Answer the following with the aid of a sketch and without the use of calculator.

2.1.1) Write down the value of $8\sin^2\theta$. (4)

2.1.2) 90° is added to the angle (θ) to form a new triangle in the first quadrant. If the new hypotenuse is double the one in the original triangle, calculate the length of the side of the triangle formed on the *x*-axis (the adjacent side). Working must be shown. (3)

2.2 Simplify fully without a calculator:

$$\frac{\cos(90° - x).\sin(360° + x) + \cos^2(-180° + x)}{\cos(-x)}$$ (5)

2.3 Determine the value without a calculator: $\frac{\sin 120°.\cos(-330)}{\tan 135°\tan 480°}$ (6)

2.4 Prove the identity: $\frac{\cos x}{1-\sin x} - \tan x = \frac{1}{\cos x}$ (5)

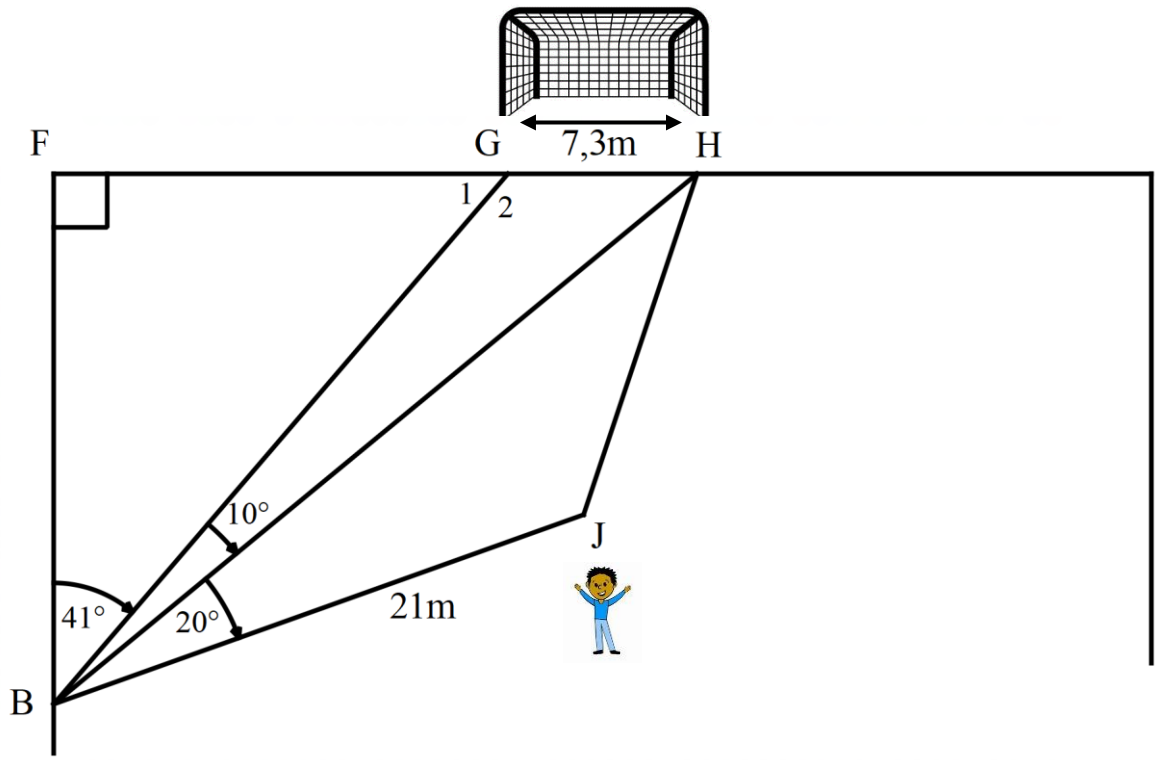
2.5 Determine the general solution: $\sin x = 3\cos x$ (4)

2.6 Solve for *x*: $2\cos(3x) = -1,26$ for $x \in [-90°; 90°]$ (5)

[32]

QUESTION 3

The result of a soccer match is determined by a penalty kick during injury time. Point B indicated where the ball is placed for the penalty. The distance between the goal posts is 7,3m.



3.1 If the ball must be kicked at an angle of 10° from B in order to land inside the goals, determine the distance from the ball to the right goal post (BH). (4)

3.2 The person taking the penalty at B decides to kick the ball to the player standing at J. The player is 21m away from B as shown on the diagram.
Determine the distance from J to the right goal post (i.e. HJ). (3)

[7]

REMEMBER TO GIVE A REASON FOR ALL STATEMENTS MADE IN GEOMETRY.

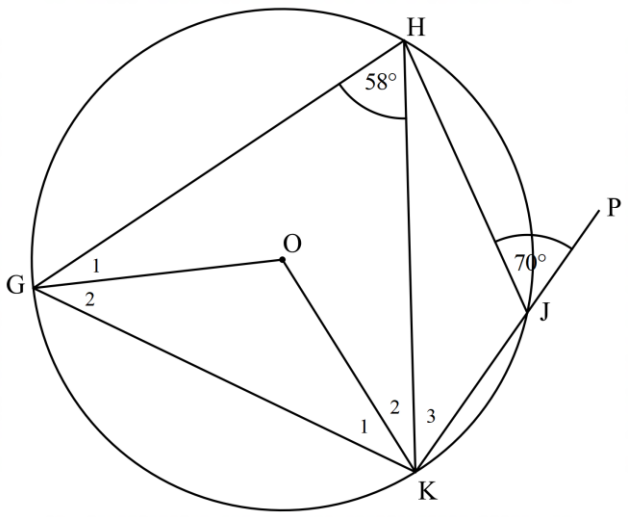
QUESTION 4

4.1 Complete the following statement: (2)

The angle formed at the centre of the circle is ……

4.2 Circle GHJK is given with centre O with chord KJ extended to P.

$G\hat{H}K = 58°$ and $H\hat{J}P = 70°$.



Determine the size of the following angles, with reasons:

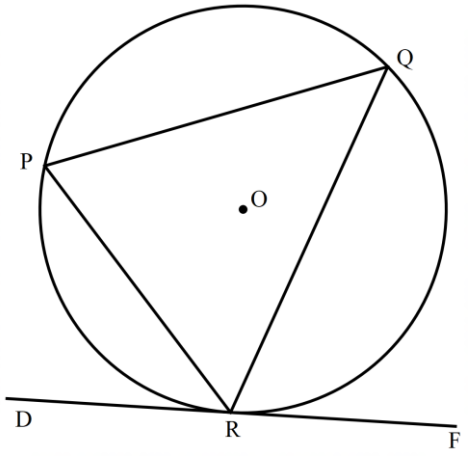
4.2.1 $G\hat{O}K$ (2)

4.2.2 $\hat{G}_1$ (4)

[8]

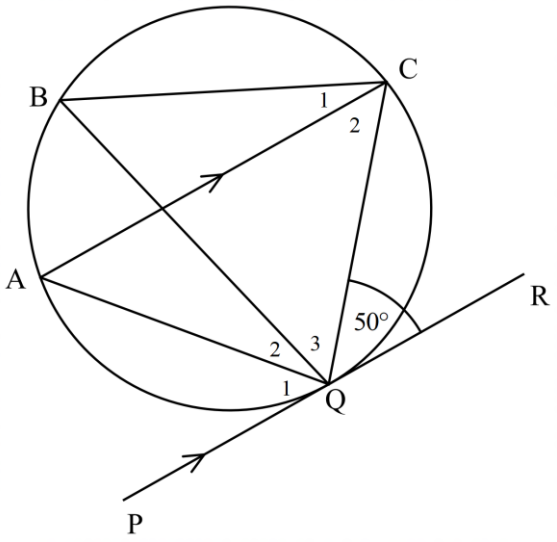
QUESTION 5

5.1 Use the diagram given below to prove the theorem that states that the angle formed between the tangent and the chord is equal to the angle in the alternate segment of the circle, i.e **prove that** $Q\hat{R}F = \hat{P}$.



(5)

5.2 Circle ABCQ is given with $AC \parallel PR$. PR is a tangent to the circle and $C\hat{Q}R = 50°$.



Determine the size of the following, with reasons:

5.2.1) $\hat{B}$ (2)

5.2.2) $\hat{A}$ (2)

5.2.3) $\hat{C}_2$ (2)

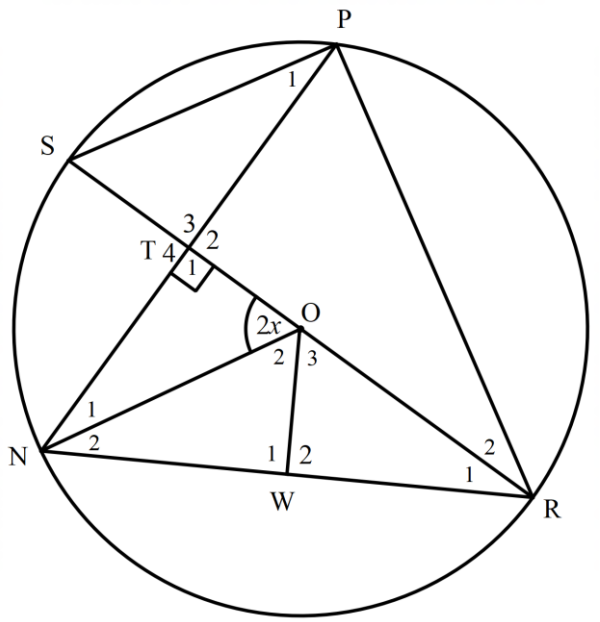
5.2.4) Is it possible for AC to be the diameter of the circle? Show working and give a reason for your answer. (3)

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QUESTION 6

6.1 State the 3 ways that you can prove that a quadrilateral is cyclic. (3)

6.2 In the diagram below, the vertices of ΔPNR lie on the circle with centre O.
Diameter SR and chord NP intersect at T. Point W lies on NR.
$OT \perp NP$ and $\hat{O}_1 = 2x$.



6.2.1) Write down, with reasons, 3 angles equal to x. (6)

6.2.2) Calculate $\hat{S}$ in terms of x. (2)

6.2.3) Show that SR bisects $N\hat{R}P$. (4)

6.2.4) If it is further given that NW=WR, prove that TNWO is a cyclic quadrilateral. (3)

[18]