HILLCREST HIGH SCHOOL

GRADE 11

MATHEMATICS EXAM

JUNE 2021

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of **7** questions. Answer ALL the questions.

2. Write your name and **your Mathematics teacher's** name on the cover of your answer booklet.

3. Clearly show ALL calculations, diagrams, graphs, etc. which 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 correct to TWO decimal places, unless stated otherwise.

7. Diagrams are NOT necessarily drawn to scale.

8. Write neatly and legibly.

MARKS:	**100**	**EXAMINER:**	**MR. GA Mac Tavish**
TIME:	**2 hours**	**MODERATOR:**	**MR. D Reuben**

This question paper consists of 7 pages and 1 information sheet.

QUESTION 1

1.1 Solve for x in each of the following:

1.1.1 $x(3x-1)=0$ (2)

1.1.2 $3x^2=2x+6$ (correct to TWO decimal places) (4)

1.1.3 $(5-x)(5+x)\geq 0$ (3)

1.1.4 $\sqrt{7-3x}=x-1$ (4)

1.2 Solve for x and y simultaneously:

$2x-y=8$ and $x^2-xy+y^2=19$ (5)

[18]

QUESTION 2

Simplify each of the following, WITHOUT THE USE OF A CALCULATOR:

2.1 $\dfrac{\sqrt{27}.\sqrt{18}.\sqrt{32}}{\sqrt{12}.\sqrt{8}}$ (4)

2.2 $\dfrac{8^{2n+1}.16^{1-2n}}{4^{n+1}}$ (4)

[8]

QUESTION 3

Given the following quadratic number pattern: $244;\ 193;\ 148;\ 109;$ ...

3.1 Write down the next term of the pattern? (1)

3.2 Determine the formula for the general term, T_n , of the sequence. (4)

3.3. Which term of the pattern will have a value of 508? (4)

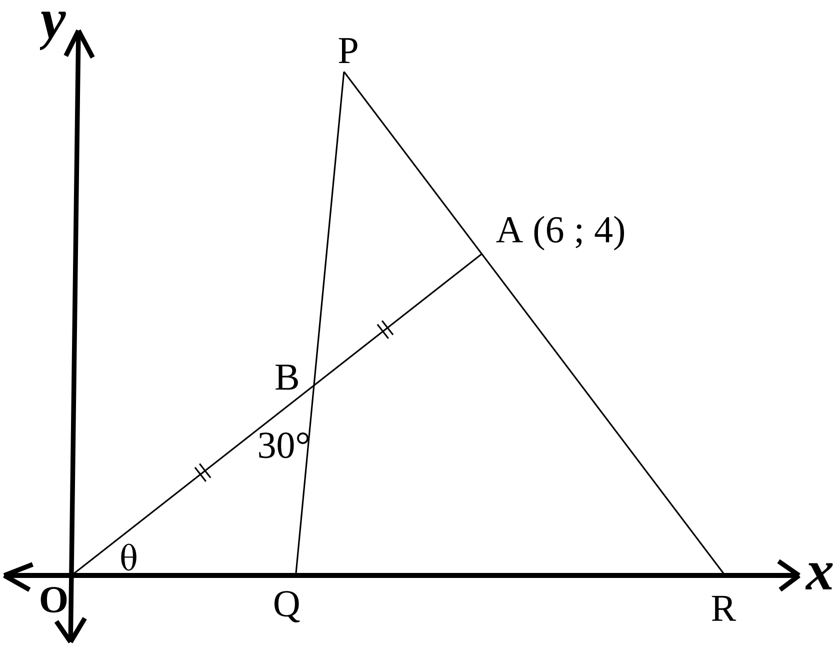
3.4 Between which TWO consecutive terms of the quadratic pattern will the first difference be 453 (3)

[12]

QUESTION 4

4.1 In the diagram below, B is the midpoint of the line segment OA.

$B\hat{O}Q = \theta$ and $O\hat{B}Q = 30°$.



Determine:

4.1.1 the coordinates of B. (2)

4.1.2 the gradient of OA. (2)

4.1.3 θ , the inclination of OA , correct to two decimal place. (2)

4.1.4 the gradient of PQ , correct to two decimal places. (3)

4.2 The points A (4; – 3), B (– 5; 0) and C(– 3; *m*) are given.
Determine the value(s) of m if:

4.2.1 A, B and C are collinear. (3)

4.2.2 AB $\perp$ BC (2)

4.2.3 BC = $\sqrt{20}$ (4)

[18]

QUESTION 5

5.1 Given: $cos\theta = -\frac{2}{5}$ and $\theta \in [180°; 360°]$.

With the aid of a diagram, and without the use of a calculator, determine $sin^2\theta$. (4)

5.2 Simplify fully, without the use of a calculator:

5.2.1 $\frac{\cos 140°.\tan(-320°)}{\sin 220°}$ (4)

5.2.2 $\frac{\cos(90° + x).\sin(180° + x)}{tan225° - cos^2(-x)}$ (6)

5.3 Prove the following identity:

$$\left(tan\alpha + \frac{1}{tan\alpha}\right)(1 - cos^2\alpha) = tan\alpha$$ (6)

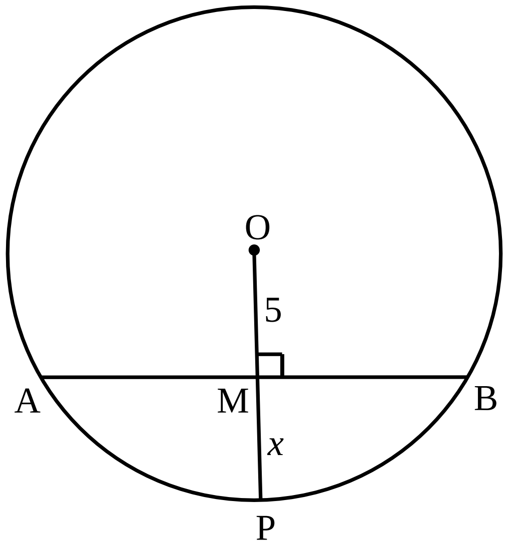
5.4 Determine the general solution of:

$2cos2\theta = -0,44$ (4)

[24]

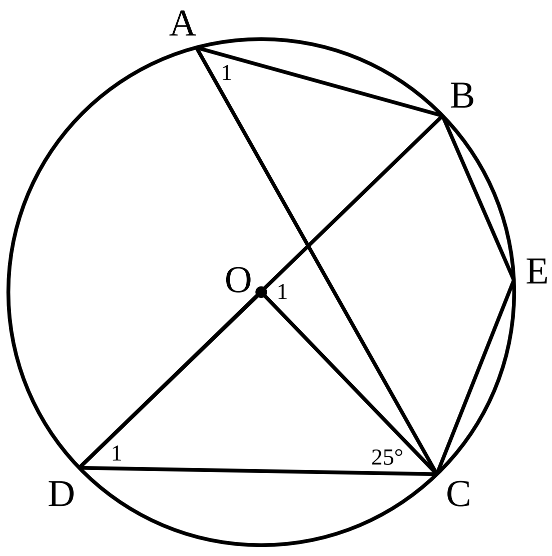
QUESTION 6

6.1 Given in the diagram below, circle centre O with OMP $\perp$ AMB .
AB = 20 cm and MP = 5 cm.
Let OM = x cm .



With reasons, determine the length of the radius of the circle. (4)

6.2 In the figure below, $D\hat{C}O = 25°$, and O is the centre of the circle.
A, B, E, C and D are points on the circumference.



Calculate, giving reasons, the sizes of:

6.2.1 $\hat{D}_1$ (1)

6.2.2 $\hat{O}_1$ (1)

6.2.3 $\hat{A}_1$ (1)

6.2.4 $\hat{E}$ (1)

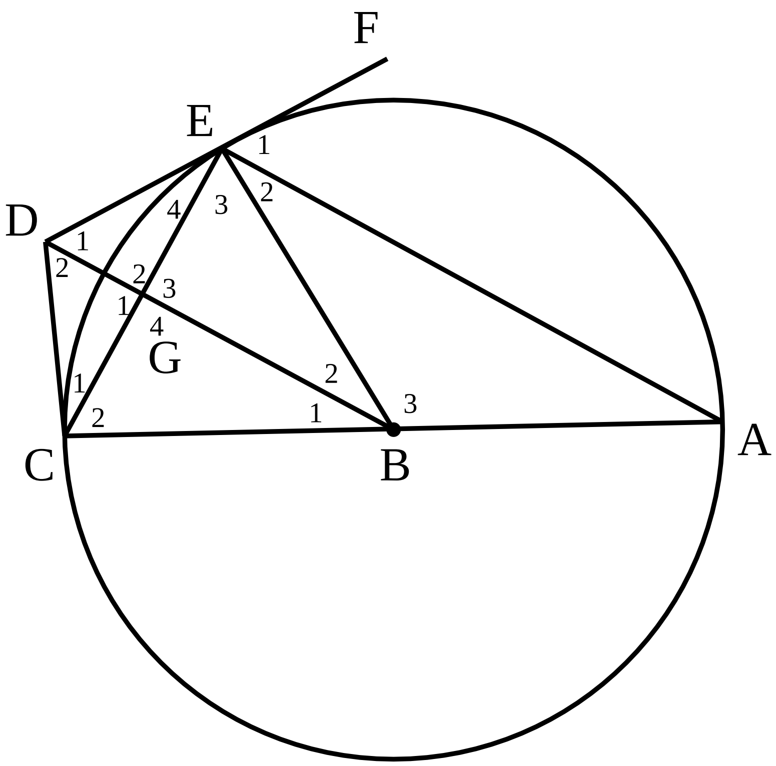
[8]

QUESTION 7

In the diagram below, AC is a diameter of the circle with centre B.

FED is a tangent to the circle at E and BG⊥EC.

BG produced cuts FE produced at D. DC is drawn.



Prove that:

7.1 BG∥AE . (4)

7.2 BCDE is a cyclic quadrilateral. (4)

7.3 DC is a tangent to circle EAC. (4)
[12]

TOTAL 100

INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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