HILLCREST HIGH SCHOOL

Grade 11 Paper 2 Exam
June 2019

Examiner: Mrs Sparks — Moderator: Mrs Woodrow

MARKS: 100 — TIME: 2 hours

INSTRUCTIONS AND INFORMATION

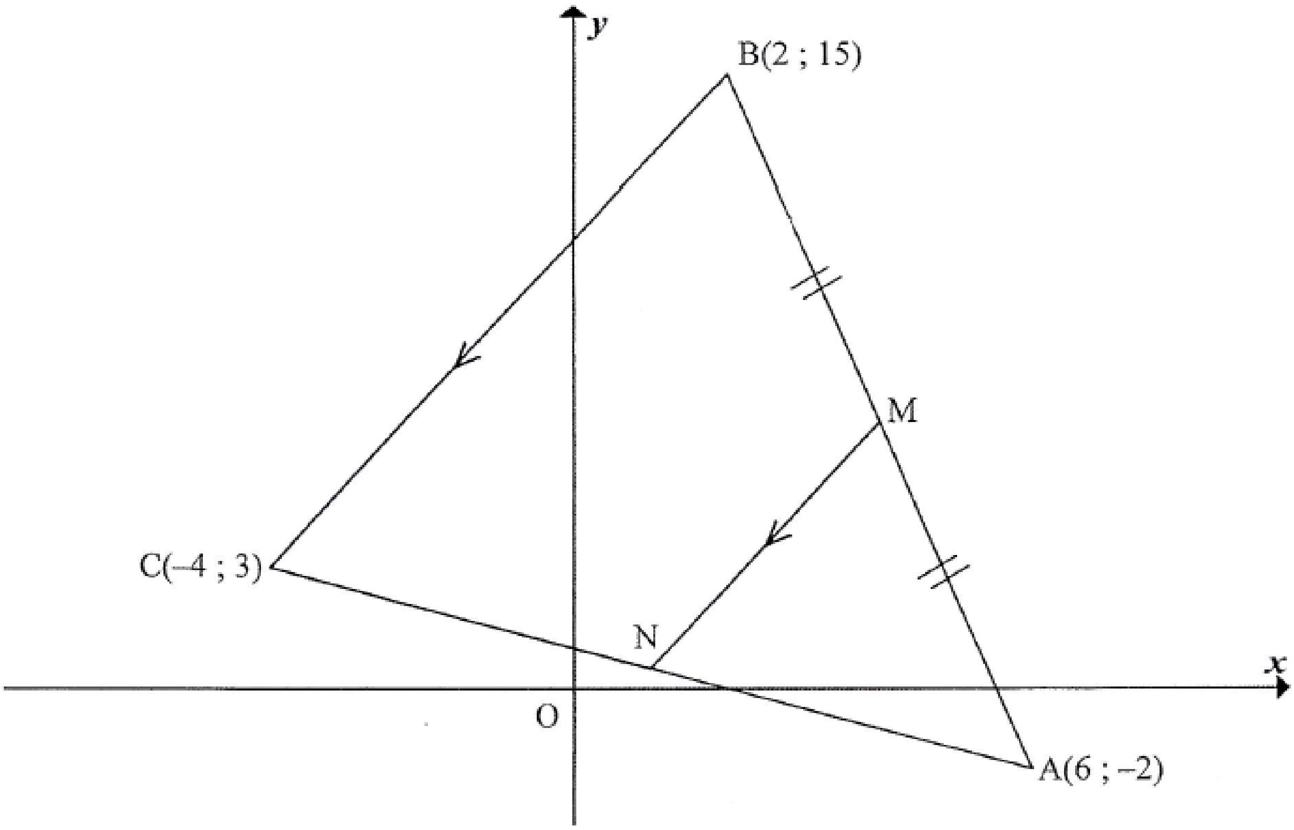
Read the following instructions carefully before answering the questions.

1. This question paper consists of 8 questions. Answer ALL the questions.
2. Write your name and **your Mathematics teacher**'s name on your answer booklet.
3. Clearly show ALL calculations, diagrams, graphs, etc, which you have used to determine your answers.
4. Answers only will NOT necessarily be awarded full marks.
5. An approved scientific calculator (non-programmable) may be used, unless otherwise stated.
6. If necessary, answers should be rounded off to TWO decimal places, unless otherwise stated.
7. Diagrams are not necessarily drawn to scale.
8. It is in your own interest to write legibly and to present your work neatly.
9. A special answer booklet with all diagrams has been provided with extra space at the back if required.

QUESTION 1:

In the diagram below, A(6 ; -2), B(2 ; 15) and C(-4 ; 3) are the vertices of ΔABC.

M is the midpoint of AB. N is a point on CA such that $MN \parallel BC$.

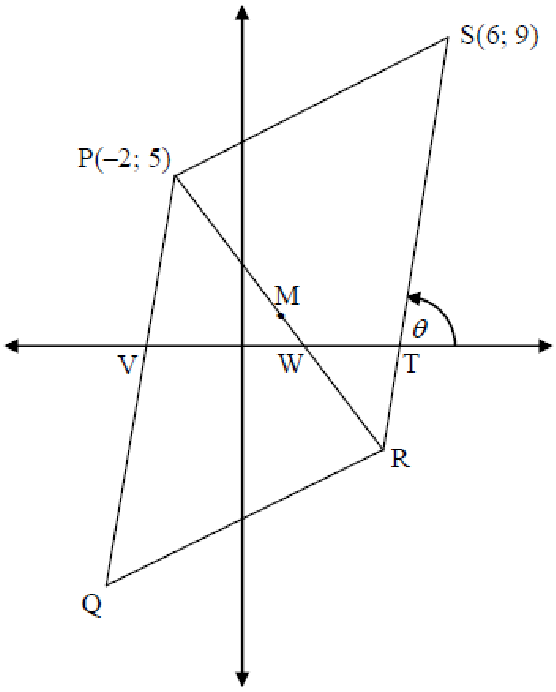


1.1	Calculate the length of BC. (Leave your answer in simplest surd form)	(2)
1.2	Determine the coordinates of M, the midpoint of AB.	(2)
1.3	Determine the gradient of line MN.	(3)
1.4	Hence, or otherwise, determine the equation of line MN, in the form $y = mx + c$.	(2)
1.5	Calculate, with reasons, the coordinates of N.	(4)
1.6	Hence without further calculation, state the length of NM.	(2)
1.7	If ABCD is a parallelogram, determine the coordinates of point D.	(2)

[17]

QUESTION 2:

In the diagram below, PQRS is a parallelogram with vertices P(-2 ; 5), Q, R and S(6 ; 9). M(1 ; 1) is the midpoint of diagonal PR. θ is the angle of inclination of SR. PQ, PR and SR cut the x-axis at V, W and T respectively.



2.1 Show, by calculation, that the coordinates of R are (4 ; -3). (2)

2.2 Calculate the size of angle θ. (3)

2.3 Calculate the size of $W\hat{R}T$. (5)

2.4 Name another angle, giving reasons equal to $W\hat{R}T$. (2)

[12]

QUESTION 3:

3.1 In which quadrant will θ lie if and $\sin\theta > 0$ and $\tan\theta < 0$? (1)

3.2 If $13\cos\theta = -5$ and $180° \leq \theta \leq 360°$, determine, using a suitable diagram and **without the use of a calculator**, the value of:

3.2.1 $\sin\theta$ (5)

3.2.2 $1 - \tan(180° - \theta)$ (3)

3.3 Simplify as far as possible: $\frac{\cos(90°-x).\sin(-x)}{cos^2(180°+x)}$ (5)

3.4 Simplify fully, WITHOUT the use of a calculator:

$$\frac{\cos(-225°).\sin 135° + \sin 330°}{\tan 225°}$$ (6)

[20]

QUESTION 4:

4.1 If $\sin 17° = a$, **without the use of a calculator**, express the following in terms of a:

4.1.1 $\tan 17°$ (3)

4.1.2 $\sin 107°$ (3)

4.1.3 $cos^2 253° + sin^2 557°$ (3)

4.2 Prove the identity: $\frac{1}{(1+\cos x)(1-\cos x)} = \frac{1}{tan^2 x.cos^2 x}$ (4)

4.3 Determine the general solution for $2\sin x.\cos x = \cos x$. (6)

[19]

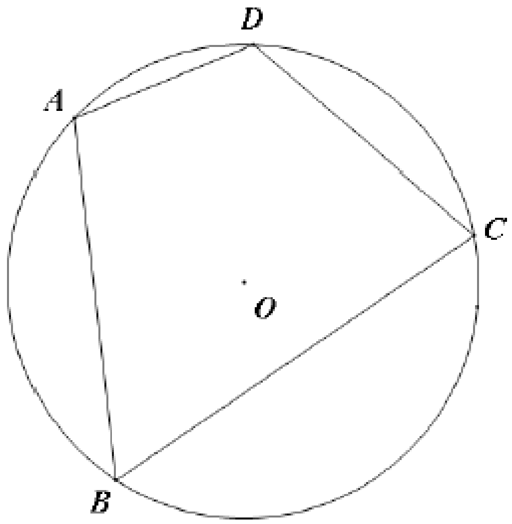
QUESTION 5:

5.1 Complete the following theorems: (just write the missing word(s))

5.1.1 The angle between a tangent and a chord is equal to the angle that … (1)

5.1.2 The exterior angle of a cyclic quadrilateral is equal to … (1)

5.2 Use the diagram provided below and in your answer booklet, to prove the theorem that states $\hat{B} + \hat{D} = 180°$.

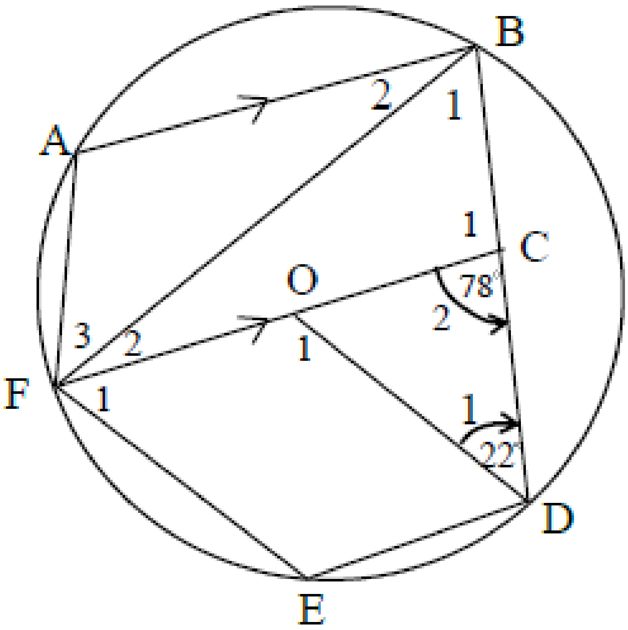


(5)

[7]

QUESTION 6:

In the figure below, O is the centre of the circle and A, B, D, E and F are points on the circle such that AB//FOC. $\widehat{D}_1 = 22°$ and $\hat{C}_2 = 78°$.



Calculate the size of each of the following angles, giving reasons:

6.1 $\hat{O}_1$ (2)

6.2 $\hat{B}_1$ (2)

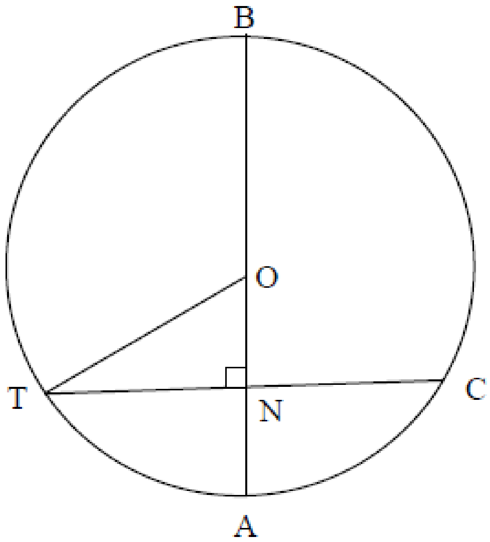
6.3 $\hat{E}$ (2)

6.4 $\hat{B}_2$ (4)

[10]

QUESTION 7:

O is the centre of the circle. BOA is a diameter and cuts chord TC at N such that BONA $\perp$ TC.
$\frac{NA}{BN} = \frac{4}{9}$. TC = 24 units. Let NA = $4x$



7.1 Write down, giving reasons, the length of TN. (2)

7.2 Write down, in terms of x, the lengths of:

7.2.1 BA (1)

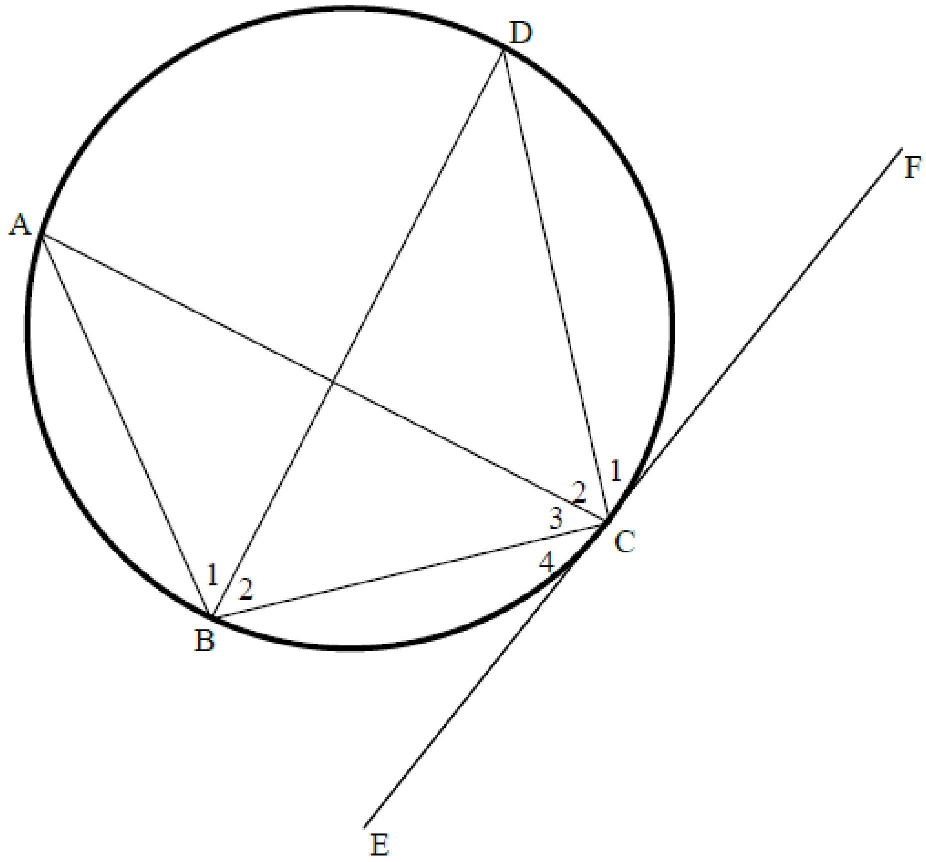
7.2.2 ON (2)

7.3 Calculate the length of the radius of the circle. (4)

[9]

QUESTION 8:

A,B,C and D are points on the circumference of the circle below. ECF is a tangent at C.



8.1 If $\hat{B}_1 = \hat{B}_2$ and $\hat{B}_1 = x$, find, with reasons, TWO other angles equal to x. (4)

8.2 If $x = 45°$, prove that AC is a diameter. (2)

[6]

INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

In ΔABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $\quad$ $a^2 = b^2 + c^2 - 2bc.\cos A$ $\quad$ $area\ \Delta ABC = \frac{1}{2}ab.\sin C$

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

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

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

$\sin 2\alpha = 2\sin\alpha.\cos\alpha$

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

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

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