HILLCREST HIGH SCHOOL

MATHEMATICS P2

JUNE 2018

NATIONAL
SENIOR CERTIFICATE

GRADE 11

MARKS: 100

TIME: 2 hours

This question paper consists of 6 pages and a formula sheet.

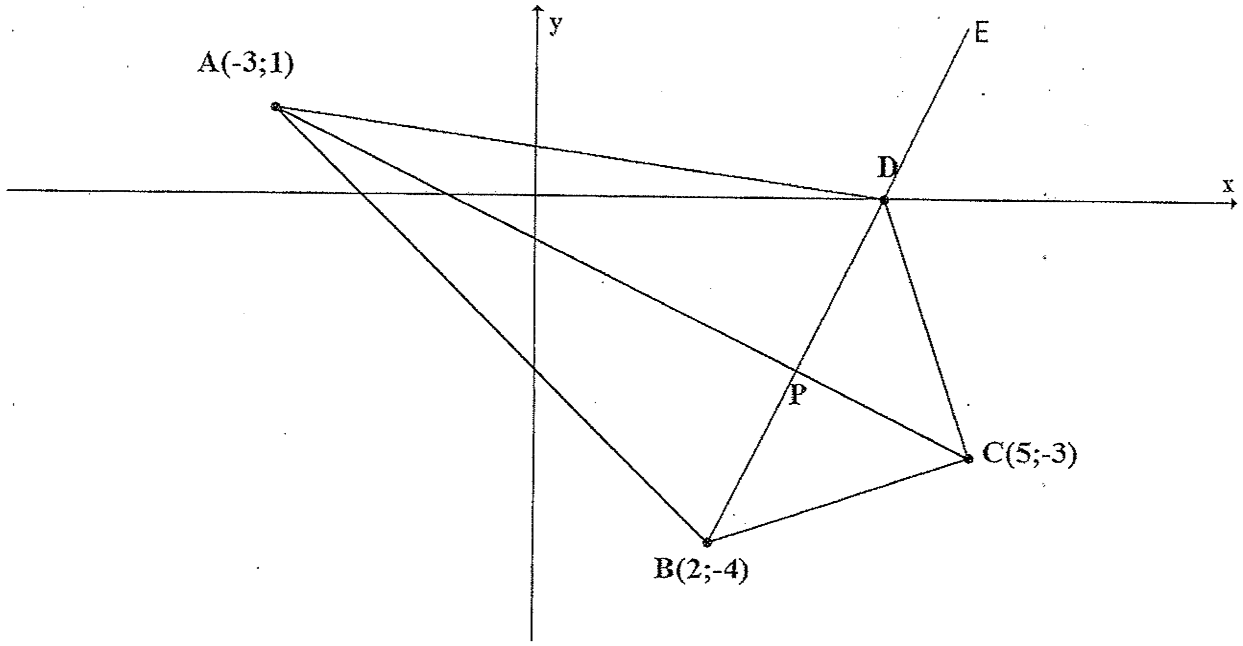
INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 7 questions.
2. Answer ALL the questions.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your answers.
5. Answers only will not necessarily be awarded full marks.
6. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
7. If necessary, round off answers to TWO decimal places, unless stated otherwise.
8. Diagrams are NOT necessarily drawn to scale.
9. Write neatly and legibly.

QUESTION 1

A kite **ABCD** has been drawn in the diagram.



1.1 Calculate the length of **AC**, giving your answer in simplified surd form. (2)

1.2 Calculate the gradient of **AC**. (2)

1.3 Determine the equation of **BD**. (3)

1.4 Show that **D** is the point (4;0). (2)

1.5 Find the co-ordinates of **P**, the intersection point of the diagonals. (3)

1.6 Calculate the angle of inclination of **DC**. (3)

1.7 Find the size of $B\hat{C}D$. (4)

[19]

QUESTION 2

Given the points P $(-1; 4)$, S $(3; a)$ and W $\left(t; \frac{17}{2}\right)$. $a > 0$

The length of PS is $2\sqrt{13}$.

P, S and W are collinear points.

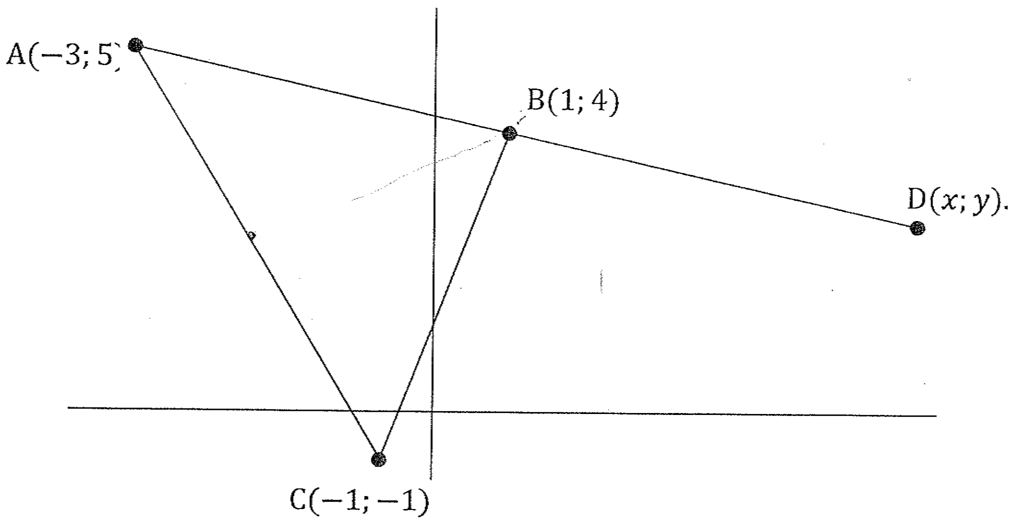
2.1.1 Calculate the value of a. (6)

2.1.2 If $a = 10$, calculate the value of t. (4)

[10]

QUESTION 3

In the diagram below, triangle ABC has vertices $A(-3;5)$, $B(1;4)$ and $C(-1;-1)$.
AB is extended to $D(x;y)$.



3.1 Give the coordinates of D if B is the midpoint of AD. (3)

3.2 Give the coordinates of K such that ABKC is a parallelogram. (2)

3.3 Find the length of the median, BM, of ΔABC, where M is the midpoint of AC. (4)

3.4 Find the equation of the line through B parallel to AC. (4)

3.5 Show that K (from QUESTION 3.2) lies on this line. (2)

[15]

QUESTION 4

4.1 In which quadrant is θ if:

4.1.1 $\cos\theta > 0$ and $\tan\theta < 0$ (1)

4.1.2 $\sin\theta < 0$ and $\cos\theta < 0$ (1)

4.2 If $\cos\theta = m$ find an expression, in terms of m, for:

4.2.1 $\sin(90° - \theta)$ (2)

4.2.2 $\cos(180° + \theta)$ (2)

4.2.3 $\cos(900° + \theta)$ (2)

4.2.4 $1 - \sin^2\theta$ (2)

4.2.5 $\sin\theta$ (2)

4.3 If $\sin\theta = -\frac{3}{5}$ and $\tan\theta \geq 0$, find with the aid of a diagram and without determining the value of θ:

4.3.1 $\cos\theta$ (3)

4.3.2 $2\tan\theta + 3\cos\theta$ (3)

[18]

QUESTION 5

5.1 Express as a single trigonometric function of θ, without the use of a calculator:

$$\frac{\cos(-\theta).\tan(180°+\theta).\tan(\theta-360°)}{\cos(180°+\theta).\tan(-\theta)}$$ (6)

5.2 Simplify the following:

5.2.1 $\sin\theta.\cos\theta.\tan\theta$ (2)

5.2.2 $\frac{1}{\cos^2\theta} - \tan^2\theta$ (3)

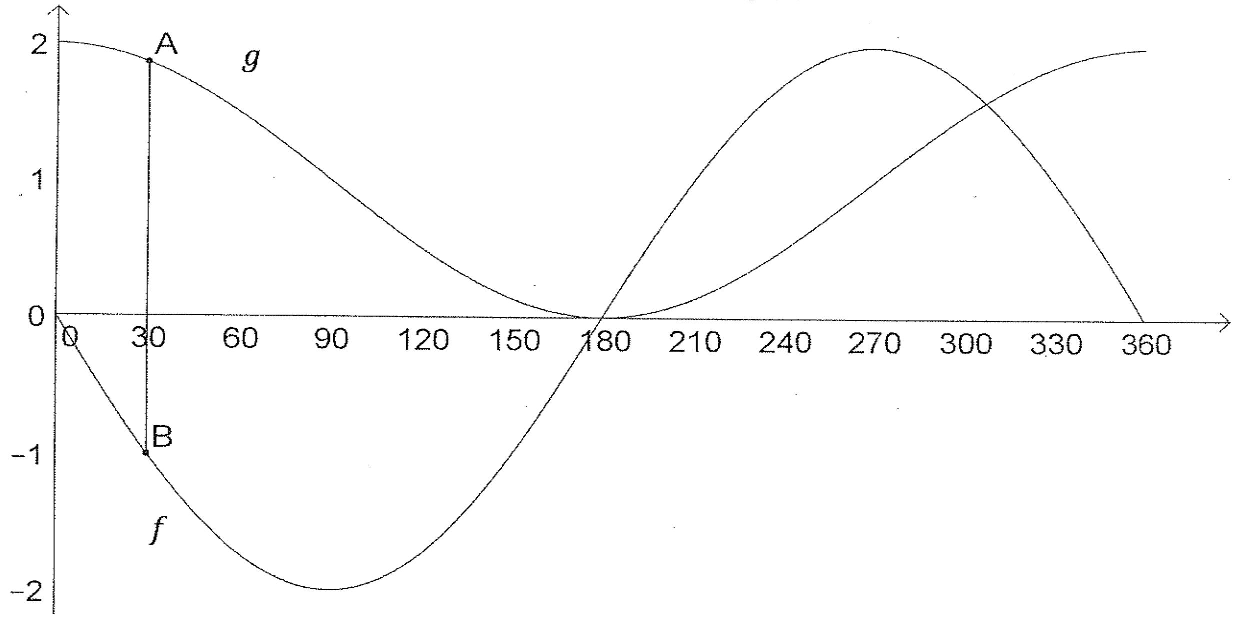
5.3 Prove the identity:

$(1 - \sin^2\theta)(1 + \tan^2\theta) = 1$ (5)

[16]

QUESTION 6

The diagram below contains graphs of $f(x) = a\sin x)$ and $g(x) = \cos x + b$



6.1 Determine the values of a and b. (2)

6.2 What is the period of $f(x)$? (1)

6.3 What is the range of $g(x)$? (1)

6.4 Estimate from the graph the x values for which $f(x) = g(x)$. (2)

6.5 For which values of x is $f(x) \geq g(x)$? (2)

6.6 Calculate the length of AB, a vertical line segment passing through $(30°; 0°)$.
Show ALL working. (3)

[11]

QUESTION 7

7.1 Solve for x:

7.1.1 $\sin 2x = -0{,}814$ if $0° \leq x \leq 360°$: (3)

7.1.2 $\tan^2 x = 11{,}4$ if $x\epsilon[-180°; 180°]$ (3)

7.2 Find the general solution for:
$3\cos(x - 15°) = 1{,}92$ (5)

[11]

INFORMATION SHEET

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

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

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

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

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

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

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

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

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

InΔABC: $\quad \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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

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

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

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

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

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

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

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