Name:	
Class:	

YEAR 11

PRELIMINARY EXAMINATION 2012

MATHEMATICS EXTENSION 1

Time Allowed – 90 minutes
(Plus 5 minutes Reading Time)

- *All* questions may be attempted
- *All* questions are of equal value
- Department of Education approved calculators and templates are permitted
- In every question, show all necessary working
- Marks may not be awarded for careless or badly arranged work
- No grid paper is to be used unless provided with the examination paper

The answers to all questions are to be returned in separate *stapled* bundles clearly labeled Question 1, Question 2, etc. Each question must show your Candidate Number.

Question 1 **Marks**

(a) Solve for x : $\sin 2x = \frac{1}{2}$ for $0 < x < 360^0$. 2

(b) If $sinx = \frac{1}{3}$ for x obtuse and $cosy = \frac{2}{5}$ for y acute find the exact value of $sin(x+y)$. 3

(c) How many ways can 3 consonants and 2 vowels be chosen from the word : 2
LOGARITHMS

(d) Find $\frac{d}{dx}\left(\frac{\sin(x+3)}{\cos(x-3)}\right)$ in simplest terms. 2

(e) Solve for x to 4 decimal places: $4sinx = 5cosx$ for $0 < x < \pi$. 1

(f) A polynomial $P(x) = 2x^3 + 4x^2 - 10x + 7$ has roots α, β and γ.
Find the value of : (i) $\alpha + \beta + \gamma$ 1

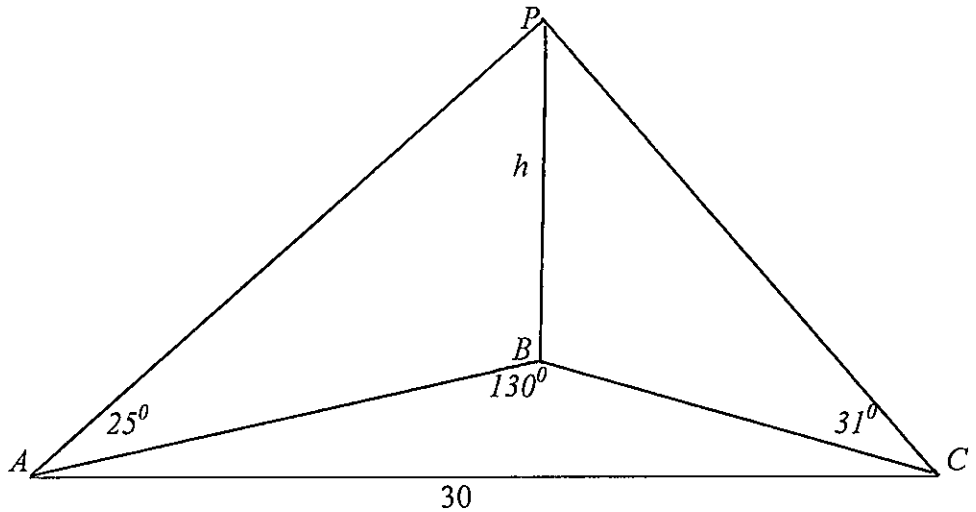
(ii) $\alpha^2 + \beta^2 + \gamma^2$ 2

(g) How many six letter words can be formed from the letters of the word LINEAR if no two vowels are together ? 2

Question 2 : Start A New Page

(a) A polynomial $P(x)$ of degree 3 is defined by : $P(x) = 4x^3 + ax^2 + 2x + b$. 3
If $x - 1$ is a zero of $P(x)$ and the remainder is -3 when $P(x)$ is divided by $x+2$ find the values of a and b.

(b)



A vertical pole PB has height h metres .
The angle of elevation of P from A is 25^0 and the angle of elevation of P from C is 31^0.
If $\angle ABC = 130^0$ and distance AC is 30 metres as shown then

(i) Show that the height h is given by : 3

$$h = \frac{30tan25^0tan31^0}{\sqrt{tan^2 31^0 + tan^2 25^0 - 2tan25^0tan31^0cos130^0}}$$

(ii) Evaluate the height h to the nearest centimetre. 1

(c) The point $P(x,y)$ divides the interval joining the points $A(-1,3)$ and $B(2,8)$ internally in the ratio $k:1$

(i) Find the coordinates of P in terms of k. 2

(ii) Find the ratio in which the line $5x+2y-10=0$ divides the interval AB. 2

(d) Using the substitution $t=\tan\frac{x}{2}$ solve for x to 4 decimal places the equation : 3

$$3\cos x+4\sin x=-3 \text{ for } 0<x<2\pi.$$

(e) Twenty students are divided into 2 teams each containing 10 players. 1
How many team combinations are possible ?

Question 3: Start A New Page

(a) The acute angle between the lines $y=mx$ ($m>0$) and $y=-3x$ is 60^0. 3
Find the exact value of m.

(b) In ΔXYZ , $\angle YXZ=50^0$ and $\angle XYZ=55^0$. 4
P is a point on the side XY such that $XP=ZP$, and Q is a point on the side YZ such that XQ bisects $\angle YXZ$.
Find the size of $\angle PQX$, giving reasons.

(c) (i) Write $16\cos x-17\sin x$ in the form $R\cos(x+\alpha)$, where $R>0$, and α to 4 decimal places $0<\alpha<2\pi$. 2

(ii) Hence solve $16\cos x-17\sin x=10$ for $0<x<2\pi$. 2

(d) Find the Cartesian equation if $y=3\cos 2\theta-2$ and $x=2\sin\theta$, stating the range and domain. 2

(e) Twelve councillors sit around a round table. 2
The Deputy Mayor and Treasurer sit alongside the Mayor, and the Planning Councillor sits directly opposite the Mayor.
How many ways can the councilors sit around the table?

Question 4: Start A New Page

(a) How many different arrangements are possible using all the letters from the word : 2

DIVIDING

(b) The points $P(2ap,ap^2)$ and $Q(2aq,aq^2)$ lie on the parabola with the equation $x^2=4ay$.

(i) Derive the equation of the normal at the point P. 2

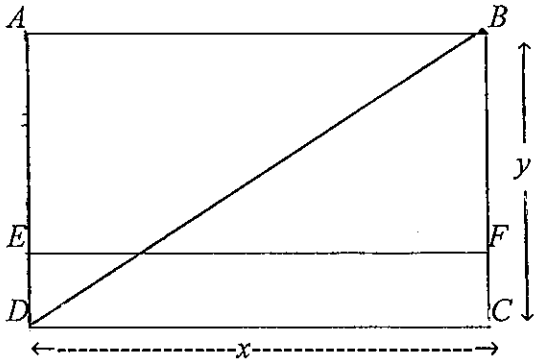
(ii) The normal at P and Q meet at the point N. 2
Find the coordinates of the point N.

(iii) Find the coordinates R and T which correspond to the endpoints of the focal chord parallel to the x axis. 1

(iv) Prove that the equation of the circle that touches the parabola at R and T is : 2

$$x^2+y^2-6ay+a^2=0.$$

(c) A rectangle $ABCD$ with sides x metres and y metres has an area of 9 m^2.
Two metal construction strips, one a diagonal BD and the other EF parallel to sides AB and CD of length x are required to strengthen the rectangle as shown.



2

(i) Show that the total length L metres of both strips is given by :

$$L = x + \frac{\sqrt{x^4+81}}{x}$$

(ii) Find the dimensions of the rectangle which will minimize the total length L of the strips. 4

End of Exam