

The Scots College

HSC Mathematics Extension 2

Pre Trial Examination

April 2013

General Instructions

- Working time : 2 hours + 5 minutes reading time.
- Write using blue or black pen
- Board approved calculators may be used (Non Graphic)
- All necessary working should be shown in every question
- Standard Integrals Table attached
- Answer each question on a SEPARATE answer booklet

TOTAL MARKS: 75

SECTION I

7 marks

- Attempt Questions 1-7
- Answer on the Multiple Choice answer sheet provided.
- Allow about 10 minutes for this section.

SECTION II

68 marks

- o Attempt questions 8 11
- Answer on the booklets provided, unless otherwise instructed. Start a new booklet for each question.
- Allow about 1 hours & 50 minutes for this section

WEIGHTING: 30 %

Section I

7 marks

Attempt Questions 1-7

Allow about 10 minutes for this section

Use the multiple choice answer sheet for questions 1 - 7.

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample

2+4=? (A) 2 (B) 6 (C) 8 (D) 9



If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.



If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and drawing an arrow as follows:



- 1 Let $z^2 = \sqrt{3}i$, what is the value of z^{8n+4} ? A) -3^{2n+1} B) $(-3)^{8n+2}$ C) $(-3)^{6n+4}$ D) 3^{2n+1}
- 2 The point P represents the complex number ω where $\omega \overline{\omega} = 4$. Which of the points A, B, C, or D shown in the Argand diagram could represent the complex number $i\omega^{-1}$?



³ For the curve with equation $y = [f(x)]^n$:

- (A) The x intercept(s) of y = f(x) correspond to the stationary points of the curve.
- (B) The curve exhibits point symmetry about the origin.
- (C) The curve does not exist for values for which f(x) < 0.
- (D) More information is needed about the curve to determine further properties.

The roots of the equation $x^3 - 3x + 3 = 0$ are α , β and γ . What is the value of $\alpha^2 + \beta^2 + \gamma^2$. 4

A) -6 B) -3 C) 3 D) 6

5 The Cartesian equation of the locus of complex number z, such that |z+3| + |z-3| = 12, isj

(A)
$$\frac{x^2}{36} - \frac{y^2}{27} = 1$$

(B) $\frac{x^2}{36} + \frac{y^2}{27} = 1$
(C) $\frac{x^2}{27} - \frac{y^2}{36} = 1$
(D) $\frac{x^2}{27} + \frac{y^2}{36} = 1$

The foci of the ellipse $25 x^2 + 9 y^2 = 225$ have the coordinates 6

A) $(\pm 4, 0)$ B) $(\pm \sqrt{34}, 0)$ C) $(0, \pm 4)$ D) $(0, \pm \sqrt{34})$

7 The eccentricity of the hyperbola
$$x^2 - y^2 = 4$$
 is

A) 2 B)
$$\frac{1}{2}$$
 C) $\frac{1}{\sqrt{2}}$ D) $\sqrt{2}$

End of Section I

Section II

Total Marks (68) Attempt Questions 8 – 11. Allow about 1 hours & 50 minutes for this section.

Answer all questions, starting each question on a new answer booklet with your name and question number at the top of the page. All necessary working should be shown in every question.

Question 8 (Marks 17) Answer on a new booklet.

a) Evaluate
$$i^{2054}$$
 [1]

b) Let
$$z = \frac{9+2i}{2+i}$$
. [4]

- i) Simplify $(9+2i)(\overline{2+i})$
- ii) Express z in the form a + ib, where a and b are real numbers.
- iii) Hence, or otherwise, find |z| and arg (z).
- c) If $z = \cos \theta + i \sin \theta$ [2] Show that $1 + z = 2 \cos \frac{\theta}{2} \left(\cos \frac{\theta}{2} + i \sin \frac{\theta}{2} \right)$.
- d) Let $z = \cos \theta + i \sin \theta$. [4] Given that $z^n + \frac{1}{z^n} = 2 \cos n\theta$ and that $z^n - \frac{1}{z^n} = 2i \sin n\theta$ Show that $\sin^4 \theta + \cos^4 \theta = \frac{1}{4} (\cos 4\theta + 3)$
- e) Express (3 + 2i)(5 + 4i) and (3 2i)(5 4i) in the form [3] x + iy. Hence express $7^2 + 22^2$ as a product of prime factors.
- f) On an Argand diagram, shade in the region containing all points [3] representing the complex number z, such that $|z - (2 + 2i)| \le 2$ and $|z - (2 + 2i)| \le |z|$

Question 9 (Marks 17) Answer on a new booklet.

a) -3 1 3 2

[7]

[7]

The sketch above shows the parabola y = f(x) where $f(x) = \frac{1}{2}(x^2 + 2x - 3)$

 \hat{x}

Without the use of calculus, draw separate sketches of the following, showing all important features such as intercepts, asymptotes and turning points.

i)
$$y^2 = f(x)$$

ii)
$$y = e^{f(x)}$$

iii)
$$y = tan^{-1}f(x)$$

iv)
$$y = \frac{1}{2}(x+3)|x-1|$$

b) Consider the graph of the function $y = \frac{x^2}{x+2}$

i) Find the equations of the asymptotes for the graph.

- ii) Find the stationary points and state their nature
- iii) Draw a neat sketch of the graph, showing all important features.
- iv) Hence, or otherwise, sketch the graph of $y = \frac{|x+2|}{x^2}$
- c) Find the coordinates of the stationary points and determine their [3] nature, for the curve

 $x^2 + xy - 2y^2 + 9 = 0$

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Question 10 (Marks 17) Answer on a new booklet.

a) Consider the hyperbola
$$\frac{x^2}{16} - \frac{y^2}{9} = 1$$
. Find
i. its eccentricity [7]

- ii. the coordinates of the foci
- iii. equation of the directrices
- iv. equation of the asymptotes
- v. the length of the latus rectum
- vi. draw a neat sketch of the hyperbola, showing all the important features.
- b) The point $P\left(4p, \frac{4}{p}\right)$, lies on the hyperbola xy = 16 and is in the first [6] quadrant. The normal to the hyperbola at P meets the hyperbola again at the point $Q\left(4q, \frac{4}{q}\right)$.
 - i. Find the equation of the normal at *P*.
 - ii. Show that $q = -\frac{1}{p^3}$
 - iii. Hence show that there is only one value of p for which the normal at P is also a normal to the hyperbola at Q. Find the coordinates of P and Q for this normal.
- c) Let $C_1 = x^2 + 4y^2 2$ and $C_2 = 3x^2 + y^2 1$, and let k be a real [4] number.
 - i. Show that $C_1 + k C_2 = 0$ is the equation of the curve passing through the point of intersection of the ellipses $C_1 = 0$ and $C_2 = 0$.
 - ii. Find the value of k such that $C_1 + k C_2 = 0$ is the equation of an ellipse.

Question 11 (Marks 17) Answer on a new booklet.

(ii) Hence express
$$x^6 - x^3 + 1$$
 as a product of three real quadratic factors.

 $x^6 - x^3 + 1 = 0$

(iii) Hence show that

$$\cos\frac{\pi}{9} + \cos\frac{7\pi}{9} + \cos\frac{13\pi}{9} = 0 \text{ , and}$$

$$\cos\frac{\pi}{9} \times \cos\frac{7\pi}{9} \times \cos\frac{13\pi}{9} = \frac{1}{8}$$

End of Assessment

c)

Standard Integrals

$\int x^n dx$	$=\frac{1}{n+1}x^{n+1}, \ n\neq -1; x\neq 0, \text{if } n<0$
$\int \frac{1}{x} dx$	$= \ln x, x > 0$
$\int e^{ax} dx$	$=\frac{1}{a}e^{ax}, a \neq 0$
$\int \cos ax dx$	$=\frac{1}{a}\sin ax, \ a\neq 0$
$\int \sin ax dx$	$= -\frac{1}{a}\cos ax, \ a \neq 0$
$\int \sec^2 ax dx$	$=\frac{1}{a}\tan ax, \ a\neq 0$
$\int \sec ax \tan ax dx$	$=\frac{1}{a}\sec ax, \ a\neq 0$
$\int \frac{1}{a^2 + x^2} dx$	$=\frac{1}{a}\tan^{-1}\frac{x}{a}, \ a\neq 0$
$\int \frac{1}{\sqrt{a^2 - x^2}} dx$	$=\sin^{-1}\frac{x}{a}, a > 0, -a < x < a$
$\int \frac{1}{\sqrt{x^2 - a^2}} dx$	$=\ln\left(x+\sqrt{x^2-a^2}\right), x>a>0$
$\int \frac{1}{\sqrt{x^2 + a^2}} dx$	$=\ln\left(x+\sqrt{x^2+a^2}\right)$

NOTE : $\ln x = \log_e x$, x > 0

Pre-Trial HSC Examination 2013 Mathematics Extension 2

Multiple Choice Answer Sheet

Name_____

Completely fill the response oval representing the most correct answer.

1.	АO	ВO	СО	DO
2.	АO	ВO	СО	DO
3.	АO	ВO	СО	DO
4.	АO	ВO	СО	DO
5.	АO	ВO	СО	DO
6.	АO	ВO	СО	DO
7.	$A \bigcirc$	ВO	СО	DO

Pre-Trial HSC Examination 2013 Mathematics Extension 2

	Μι	ultiple	Choice	Answ	ver Sheet
	Nam	e	Sc	LUTI	ONS.
Com	pletely fill	the respon	ise oval re	presenting	the most correct answer.
1.	A 🜑	вO	сO	DO	
2.	АO	вO	сO	D 🌑	
3.	A 👁	вО	сO	D 👁	Both Answers acceptable
4.	АO	вО	сO	D 📀	
5.	A' O	B 🜑	сO	DO	
б.	АO	вO	C 🜑	DO	
7.	АO	вO	0.0	D 👁	

Question			Name:		
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(b) (i) $(9+2i)(\overline{2+i})$	<u>)</u>	•••••
= (9+2i)(2-i)	)	· · · · · · · · · · · · · · · · · · ·
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(11)  7 = 9+21		
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- <u>20-5</u> 5	$2\dot{c} = 4 - \dot{c}$	
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$(11)^{\prime}$ $ Z  = \sqrt{16+1}$	= 177	·····
arg (2) = tan	5. ( /4).	• • • • • • • • • • • • • • • • • • • •

Question Name: Teacher: (C) Z 2 Cro 0 + i Sm 0 1+Z = 1+Gs0+UImiQ = 2 Cos 2/2 + 2i Smi 0/2 Cos 0/2 - 2 cos 0/2 ( cos 0/2 + i Smi 0/2)  $(d) \quad Z^{h} + \frac{1}{2} = 2 \cos n \theta$  $Z^{n} - \frac{1}{2n} = 2USmn \Theta$  $\frac{|e_{F} n_{Z}|}{(2U SmO)^{4}} = (\frac{Z}{Z} - \frac{1}{Z})^{4}$  $\frac{16 \sin^4 \theta}{22 z^4} = \frac{2}{4 z^2} + \frac{1}{6} = \frac{4}{z^2} + \frac{1}{z^4} = 0$  $(2 \cos \Theta)^4 = (Z + \frac{1}{Z})^4$  $\frac{16 \cos^{4} \Theta = Z^{4} + 4 Z^{2} + 6 + 4 + 1}{Z^{2} + 2}$  $16(Sm'0+Cos'0) = 2Z' + 12 + \frac{2}{24}$  $2(2\cos 40) + 12$ = 4 (Cos 40+3) : Sn' 0 + Cos' 0 = f(Cos 40 - 73)

Question _ Name: Teacher: (e) (3+2i)(5+4i) = 15-8+12i+10i7+220 (3-21) (5-41) = 15-80 - 121-101 - 7-221 (3+2i)(5+4i)(3-2i)(5-4i) = (7+22i)(7-22i) $(9+4)(23+16) = 7^2 + 22^2$  $ar 7^2 + 22^2 = 13 \times 41$  $\left| \overline{Z} - (2+2i) \right| = 2$ 17 - (2 + 2i) = 12

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Question _____

Teacher: _____

9(6)  $N = \frac{\chi^2}{\chi_{\pm 2}}$ i)  $y = x^2 - 4 + 4$  $\chi + 2$  $= 2 - 2 + \frac{4}{2 + 2}$ Oblique asymptoté al y= 2-2 Vertical asymptote X=-2 (ii)  $\frac{dy}{dx} = \frac{(x+2)(2x) - x^2(1)}{(x+2)^2}$  $\frac{d^2y}{dn^2} = \frac{4}{(2(+2)^2)}$ d²y 1.2  $\frac{2x^2+42-x^2}{(2+2)^2}$ (7(+2)³ x^L+4x (x+2)² for alationary points dy/dx = 0  $1 = \frac{4}{(x+2)^2} = 4$  When x = 0,  $x+2 = \pm 2$ . : (0,0) ... Muh pL  $\chi = -4, \quad \frac{d^2 y}{ds^2} < 0.$  $(-4, -8) \quad 6 \quad n0$  $\chi = 0 \alpha - 4$  $\gamma = 0 \quad \alpha = 8$ is max.pl





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Question Name: Teacher:  $\chi^{2} + \chi_{y} - 2\chi^{2} + 9 = 0$ Differentiating w-r-t. 2  $2x + y + x y' - 4y \cdot y' = 0$  $2x + y = (4y - x) y^{\dagger}$  $y' = \frac{2^{2}+y}{4^{2}y^{-2}} \qquad y' = (4y-x)(2+y') - (2x+y)(4y'-1)$  $(4y-x)^{2} \qquad (4y-x)^{2}$ For st points y'= 0 when x=1, y=-2, y'=0 $\frac{22+y=0}{y=-2x}$   $\frac{y'=-2x}{(-8-1)(2+0)=0}$   $\frac{(-8-1)^2}{(-8-1)^2}$ Sub into  $2^2+2y-2y^2+9=0$  <0  $\frac{(1-2)}{(-2)}$   $\frac{(1-2)}{(-2)}$   $\frac{(1-2)}{(-2)}$   $\frac{(1-2)}{(-2)}$ = 0 When x = -1, y = 2, y'=0  $-9x^2+9=0$  $y'' = \frac{(8+1)(2+0) - 0}{(8+1)^2}$  $\chi^2 = \phi$  $\chi = 1$ ,  $\alpha \chi = -1$ 7.0 .:. (-1,2) is a min.  $\gamma = -2$  or  $\gamma = 2$ 

$Teacher: \ 10 (A) \chi^{2} - \chi^{2} = 1a^{2} = 16 b^{2} = 9g = 16 (e^{2} - 1)e^{2} - 1 = \frac{9}{16}e^{2} = 1 + \frac{9}{16} = \frac{25}{14}(i) e = 5.4(ii) foci : ae = \frac{14}{5} \times \frac{5}{4}(iii) foci : ae = \frac{14}{5} \times \frac{5}{4}(iii) foci : ae = \frac{14}{5} \times \frac{5}{4}(iii) foci : ae = \frac{14}{5} \times \frac{5}{4}(iv) agniphts\chi = \pm \frac{9}{6}\chi = \pm \frac{16}{5}(iv) agniphts\chi = \pm \frac{5}{4}\chi = \pm \frac{16}{5}$	<u>_</u>	
$\frac{10}{(a)} \frac{\chi^{2}}{16} - \frac{\chi^{2}}{16} = 1$ $\frac{a^{2} = 16}{16} \frac{b^{2} = 9}{9}$ $\frac{9 = 16 (e^{2} - 1)}{e^{2} - 1} = \frac{9}{16}$ $e^{2} = 1 + \frac{9}{16} = \frac{25}{16}$ $(1) e = 5.4$ $(1) e $		Teacher:
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		
$(A)  \frac{\chi^{2}}{16} = \frac{\chi^{2}}{16} = \frac{1}{16}$ $A^{2} = 16,  b^{2} = 9$ $9 = 16 (e^{2} - 1)$ $e^{2} - 1 = \frac{9}{6}$ $e^{2} = 1 + \frac{9}{6} = \frac{25}{6}$ $(1)  e = \frac{5}{4}$ $(1)  e = \frac{5}{4}$ $(1)  e = \frac{5}{4}$ $(1)  e = \frac{14 \times 5}{9}$ $= 5$ $(1)  focd : ae = \frac{14 \times 5}{9}$ $= 5$ $(1)  focd : ae = \frac{14 \times 5}{9}$ $(1)  e^{2} = \frac{16}{6}$	10	
$ \frac{16}{2} = 16,  b^{2} = 9 $ $ \frac{9}{2} = 16,  (e^{2} - 1) $ $ \frac{e^{2} - 1}{2} = \frac{9}{16} $ $ e^{2} = 1 + \frac{9}{16} = \frac{25}{14} $ $ \frac{10}{2} = \frac{5}{4} $ $ \frac{10}{2} = \frac{5}{4} $ $ \frac{10}{2} = \frac{5}{4} $ $ \frac{10}{2} = \frac{14}{5} \times \frac{5}{2} $ $ \frac{10}{2} = \frac{14}{5} \times \frac{5}{2} $ $ \frac{10}{2} = \frac{16}{5} $ $ \frac{10}{5} = \frac{16}{5} $	( <i>D</i> )	$\chi^2 - \chi^2$
$a^{2} = 16, b^{2} = 9$ $9 = 16 (e^{2} - 1)$ $e^{2} - 1 = 9/6$ $e^{2} = 1 + 9/6 = 25/6$ $(i) e = 5/4$ $(i) foci : ae = 4x \cdot 5/4$ $= 5$ $(ii) foci : (\pm 5, 0)$ $(iii) foci : (\pm 5, 0)$ $(iii) foci : (\pm 5, 0)$ $(iii) foci : (\pm 5, 0)$ $y = \pm 9/6$ $y = \pm 16/6$ $y = \pm 16/6$ $y = \pm 16/6$		16 09 1
9. = 16 $(e^{2}-1)$ $e^{2}-1 = \frac{9}{16}$ $e^{2} = 1+ \frac{9}{16} = \frac{25}{16}$ ( $\dot{U}$ $e = 5.4$ ( $\ddot{U}$ $e = 5.4$ ( $\ddot{U}$ $e = 5.4$ = 5 $f_{0,ci}$ $(\pm 5, 0)$ ( $\dot{I}II$ ) Equation of directices: $\chi = \pm \frac{9}{2}$ $\chi = \pm \frac{16}{5}$ ( $\dot{I}II$ ) Regnation of directices: $\chi = \pm \frac{9}{2}$ $\chi = \pm \frac{16}{5}$ ( $\dot{I}II$ ) Regnation of $\chi = \pm \frac{16}{5}$ ( $\dot{I}II$ ) Regnation of $\chi = \pm \frac{16}{5}$	a	$\frac{2}{2} = 16$ $b^2 = 9$
$e^{2} = 1 = \frac{9}{16}$ $e^{2} = 1 + \frac{9}{16} = \frac{25}{14}$ (1) $e = 5/4$ (1) $e = 5/4$ (1) $e = \frac{5}{4}$ $\frac{(10)}{10} = \frac{6}{10} = \frac{14 \times 5}{9}$ $\frac{(10)}{10} = \frac{6}{10} = \frac{14 \times 5}{9}$ $\frac{(10)}{10} = \frac{6}{10} = \frac{14 \times 5}{9}$ $\frac{(10)}{10} = \frac{6}{10} = \frac{6}{10}$	C	$l = 16 (e^2 - 1)$
$e^{2} = 1 + 9/4 = \frac{25/4}{4}$ (1) $e = 5/4$ (1) $e = 5/4$ (1) $e = 5/4$ (1) $e = 14 \times 5/4$ $= 5$ (1) $f_{0,c_{1}} = (\pm 5, 0)$ (1) $e_{g_{1,c_{1}}} = (\pm 5, 0)$ (1)	e	$2^{2}-1 = \frac{9}{16}$
(i) $e = 5/4$ (ii) face $ae = 4x \cdot 5y$ = 5 Foce: $(\pm 5, 0)$ (iii) Equation of directions $x = \pm 9/e$ $y = \pm 16/s$ (i) $asymptote5$ $y = \pm \frac{5x}{4}$ $y = \pm \frac{3x}{4}$	••••••	$\rho^2 = 1 + \frac{9}{4} = \frac{25}{4}$
(ii) foci $ae = 4x \cdot 5/4$ = 5 Foci $(\pm 5, 0)$ (iii) Equation of diricchices $x = \pm \frac{a}{6}$ $y = \pm \frac{16}{5}$ (iv) Asymptotes $y = \pm \frac{bx}{a}$ $y = \pm \frac{3x}{4}$	o (1)	$\rho = 5/\mu$
(ii) faci : $ae = 45 \times 574$ = 5 $\therefore$ Foci : $(\pm 5, 0)$ (iii) Equation of diriectnces: $\chi = \pm \frac{9}{6}$ $\chi = \pm \frac{16}{5}$ (iv) $asymptote5$ $\gamma = \pm \frac{5\chi}{4}$	·····	
$= 5$ Foc: $(\pm 5, 0)$ (ii) Equation of division $x = \pm \frac{9}{6}$ $y = \pm \frac{16}{5}$ (ii) Desymptotes $y = \pm \frac{5\pi}{4}$ $y = \pm \frac{3\pi}{4}$	(°°)	$foci \cdot ae = 45 \times 57_{4}$
Foci: $(\pm 5, 0)$ (iii) Equation of directices: $\chi = \pm \frac{9}{6}$ $\chi = \pm \frac{16}{5}$ (i) asymptotes $\gamma = \pm \frac{5\pi}{4}$ $\gamma = \pm \frac{3\pi}{4}$		= 5
(iii) Equation of directices: $\chi = \pm \frac{a}{c}$ $\chi = \pm \frac{1b}{5}$ (iv) asymptotes $\gamma = \pm \frac{bx}{a}$ $\gamma = \pm \frac{3x}{4}$	, , 	$f_{0}(1, 5, 0)$
(iii) Equation of directices: $\chi = \pm \frac{9}{6}$ $\chi = \pm \frac{16}{5}$ (iii) Asymptotes $\gamma = \pm \frac{5\pi}{4}$ $\gamma = \pm \frac{3\pi}{4}$		
$y = \frac{1}{2} \frac{16}{5}$ (19) $Asymptotes$ $y = \frac{bx}{a}$ $y = \frac{bx}{4}$ $y = \frac{3x}{4}$	( īii)	Conation of disconces: X = + a/o
(i) $Asymptoteb$ $M = \pm \frac{bx}{a}$ $Y = \pm \frac{3x}{4}$		t 1/2
(i) $Asymptotes$ $y = \pm \frac{bx}{a}$ $y = \pm \frac{3x}{4}$		A = 10/5
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$y = \pm \frac{3\lambda}{4}$		our by
$Y = \pm \frac{3\lambda}{4}$		$\int \frac{1}{2} $
$7 - \frac{1}{4}$		$N = \pm 3\lambda$
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10(6)		
$\chi_{y} = 16$		
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$(1)  f = \frac{10}{2}$	· · · · · · · · · · · · · · · · · · ·	•••••••••••••••••••••••••••••••••••••••
dy 16/	2	
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$ur P, M_t = -$	$\frac{10}{16}p^2 = -p^2$	
MN = pL	·····	
guation of horme	21 is	·····
$N = 4/ = n^2/m$	40)	
$\frac{1}{p} = \frac{p}{p} \frac{p}{q}$	(- 4p)	•••••••••••••••••••••••••••••••••••••••
$\dots p_{\gamma} = 4 \cdot z \cdot p^{-1} (X)$	<u>-4p)</u>	•••••••••••••••••••••••••••••••••••••••
$\alpha p^3 \alpha - p \gamma - \gamma$	1.4 4	
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(ii) Sub (49. 4/9	) with the en	ation of the room
p ³ /40) - 4p	4 n ⁴ - 4	
γ	····· <i>p</i> ·······	
$4p^{3}q^{2} - 4p = 4p^{4}c^{4}$	9, - 49,	•••••••••••••••••••••••••••••••••••••••
$p^{3}q^{2} - b^{4}a = b$	y	······
p30 (0 p);	$p \rightarrow Q \rightarrow p^3 q$	- 1 - 0 1

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(iii) M, of Q.	$= 9^2 = M_{\odot}$	of D	•••••
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p ² = 1 or -	1 (rej)		• • • • • • • • • • •
p = 1  or  -1	(rej as P is	n' 1st gradian	л)
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; . P (4,4)	9 (-4, -4)	)	
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Question Name: Teacher: (C)  $C_{1} \equiv \chi^{2} + 4\chi^{2} - 2$   $C_{2} \equiv 3\chi^{2} + \chi^{2} - 1$ (i) The pt of intersection of G and G must sohsfy C1= D and G2D  $\frac{1}{C_1 + k C_2 = 0}$ C, + k C2 20 is the required equation (ii)  $\chi^{2} + 4\chi^{2} - 2 + k(3\chi^{2} + \chi^{2} - 1) = 0$ ar  $(1 + 3k)\chi^{2} + (4 + k)\chi^{2} - 2 - k = 0$  $\frac{\alpha x^2}{(2+\mu)/1+3\mu} + \frac{\gamma^2}{\frac{2+\mu}{4+\mu}} = \infty$ ......... For an ellipse  $\frac{\partial t_k}{\partial t_k} = 0$ ,  $\frac{\partial t_k}{\partial t_k} = 0$  and  $\frac{\partial t_k}{\partial t_k} = \frac{\partial t_k}{\partial t_k}$  $\frac{\partial t_k}{\partial t_k} = 0$   $\frac{\partial t_k}{\partial t_k} = 0$   $\frac{\partial t_k}{\partial t_k} = 0$ 2+k (183k) 70 (2+k) (4+h) 70 (+3k = 4+k) k<-2 ar k>-1/3 k7-2 ar k<-4  $2k \neq 3$ k = 3/2  $k_{7} - \frac{1}{3}$   $k_{8} < -4$   $k_{7} = \frac{3}{2}$ 

Question _ Name: Teacher: ····  $\frac{(3+\sqrt{5})^{n} + (3-\sqrt{5})^{n}}{2^{n}}$  is a positive integer prove true for n=1 and n=2 $\frac{1+(3-\sqrt{5})^{1}}{2}$   $\frac{6}{5}=3$  $\frac{(3+15)^2+(3-15)^2}{2^2}, 9+5+65+9+5-65}{4}$ = 2874 n=1 and n=2Lep 2 Assume true for n=k and n=k+1  $(3+.5)^{k}+(3-.5)^{k}=p$  and  $(3+.5)^{k+1}+(3-.5)^{k+1}=q$   $2^{k+1}=q$ Where p and q are positive integers

Question _ Name: Teacher: for h = k + d+  $(3 - 5)^{k+2}$  is an integer trove ) ((3+15)^{k+1} - (3-15)^{k+1}) let 2 (3-15) K+2 3-15  $2^{k+2}$ (9+'5)(p.2^k) gkt2 2k+2 . 3^{k+2} - p-2^{k+2} is an integer integers. integers. posi Hence for n=k+2 t : Therefore by the principle of matternatical return the statement is true for all position Step indi integers n

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(b) $x^{5} - 5x + 1$	= 7
Tor P(x) - X	5-52+1
$P'(x) \leq x'$	4-5 =7
$f(x) = \frac{1}{2}$	· · · ·
<i>N X ' - /</i>	······
$\chi = 1, -1, \dots$	$c'_{j} - c$
$P(1) = 1 - 5 + 1 \neq 7$	<u>D</u>
P(-1) = -1+5+1 = 70	)
P(i) = i - Si + 1	<i>≠</i> 0
P(-i) = -i + 5i + 1	'≠D
-'. NO root of P	"(x) = 0 is a root of P(x) = 0
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$Teacher: _$ $C) \qquad 8x^{4} - 14x^{3} - 69x^{2} - 14x + 8 = 0$ $= x^{2}$ $8x^{2} - 14x - 69 - \frac{14}{2} + \frac{8}{2x^{2}} = 0$ $ex = (x^{2} + \frac{1}{x^{2}}) = 14 (x + \frac{1}{x}) = 69 = 0$ $(ex = t = x^{2} + \frac{1}{x^{2}}) = t + 2 = x^{2} + \frac{1}{x^{2}}$ $\frac{1}{2} = x^{2} + 2 + \frac{1}{x^{2}} = t + 2 = x^{2} + \frac{1}{x^{2}}$ $\frac{1}{2} = x^{2} + 2 + \frac{1}{x^{2}} = t + 2 = x^{2} + \frac{1}{x^{2}}$ $\frac{1}{2} = x^{2} + 2 + \frac{1}{x^{2}} = 0 \qquad 8x + 85$ $\frac{8t^{2} - 14t - 85 = 0}{8t^{2} - 34t + 20t - 85 = 0} \qquad 8x + 85$ $\frac{8t^{2} - 34t + 20t - 85 = 0}{8t^{2} - 34t + 20t - 85 = 0} = 4x + 2x + 17x + 5$ $\frac{8t^{2} - 34t + 20t - 85 = 0}{2t + 5(4t - 17) = 0} = \frac{3t}{2}, 20$ $ex = (2t + 5)(4t - 17) = 0$ $\therefore t = -57x \qquad 4x^{2} + 4 = 17x$ $ex = 3x^{2} + 3x + 2 = 0 \qquad 4x^{2} - 17x + 4 = 0$ $(2x + 1)(x + 2) = 0 \qquad (4x - 1)(x - 4) = 0$	Question	Name:
C) $8x^4 - 14x^3 - 69x^2 - 14x + 8 = 0$ $= x^2$ $8x^2 - 14x - 69 - \frac{14}{2} + \frac{8}{32} = 0$ $ar = 8 \cdot (x^2 + \frac{1}{x^2}) = -14 \cdot (x + \frac{1}{x}) = -69 = 0$ $(ar + t = x^2 + \frac{1}{x^2}) = t - 2 = x^2 + \frac{1}{22}$ $\frac{1}{2} = x^2 + 2 + \frac{1}{2} = 2$ $x + 2 + \frac{1}{2} = \frac{17}{2}$ $x + \frac{1}{2} = \frac{17}{2}$ $x + \frac{1}{2} = \frac{17}{2}$ $x + \frac{1}{2} = -5x$ $4x^2 + 4 = \frac{17x}{2}$ $x + \frac{1}{2} = \frac{17}{2}$ $x + \frac{1}{2} = 0$ (2x + 1)(x + 2) = 0 (4x - 1)(x - 4) = 0		Teacher:
$\frac{1}{2} \cdot \frac{\pi^{2}}{2} = \pi^$	(c) $8x^4 - 14x^3 - 6$	$(9)^{2} - 14 \times + 8 = 7$
$8\pi^{2} - 14\pi - 69 - \frac{14}{\pi} + \frac{8}{\pi^{2}} = 0$ $a = 8 \cdot \left(\pi^{2} + \frac{1}{\pi^{2}}\right) - 14 \cdot \left(\pi + \frac{1}{\pi}\right) - 69 = 0$ $let t = \pi^{2} + \frac{1}{\pi^{2}} = t + 2 + \frac{1}{\pi^{2}} = t + 2 = \pi^{2} + \frac{1}{\pi^{2}}$ $\frac{t^{2}}{8(t^{2} - 2)} - 14(t) - 69 = 0$ $a = 8t^{2} - 14t - 85 = 0$ $gt^{2} - 17t + 20t - 85 = 0$ $gt^{2} + 3t + 3t + 4t = 17\pi$ $gt^{2} + 3t + 5t + 220$ $gt^{2} + 3t + 4t = 17\pi$ $gt^{2} + 3t + 4t = 17\pi$ $gt^{2} - 17x + 4t = 0$ $gt^{2} + 3t + 5t + 220$ $gt^{2} + 3t + 5t + 20$ $gt^{2} + 3t + 5t + 20$ $gt^{2} + 3t + 5t + 20$ $gt^{2} + 3t + 20$	- a ²	
$g_{1} = \frac{1}{2} + \frac{1}{2} = 0$ $g_{2} = \frac{1}{2} + \frac{1}{2} \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = \frac{1}{2} + \frac{1}$	$8x^2 - 14x - 69 - 14$	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
$s_{1} = \frac{8}{2} \left( \frac{1}{2} + \frac{1}{2} \right) = \frac{14}{2} \left( \frac{1}{2} + \frac{1}{2} \right) = \frac{59}{2} = 0$ $let  t = \frac{1}{2} + \frac{1}{2} \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = \frac{1}{2} + $		$\mathcal{T}_{\mathcal{T}_{\mathcal{T}}}$
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\cdots \circ r \cdots \otimes \left( \cdot \lambda^{-} t \cdot \frac{1}{\chi^{2}} \right) \cdots \cdot \left[ \cdot 4 \cdot \left( \cdot \right)^{-} \right]$	$\left(\frac{1}{2}, \frac{1}{2}\right) = \frac{6.9}{2} = 0$
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	, , <i>k</i> 1	· · · · · · · · · · · · · · · · · · ·
$\frac{t^{2}}{8(t^{2}-2)} = -\frac{t}{2} = \frac{t}{2} = \frac{t}{2} + \frac{t}{2}$ $\frac{t^{2}}{8(t^{2}-2)} = -\frac{14(t)}{-14(t)} - \frac{69}{69} = 0$ $\frac{t^{2}}{8(t^{2}-2)} = -\frac{14(t)}{-12} = 0$ $\frac{t^{2}}{2} = -\frac{14(t)}{-12} = 0$	$let t = \chi^2 + \frac{1}{\chi^2}$	
$ \frac{1}{8(t^2 - 2)} - 14(t) - 69 = 0 $ $ \frac{1}{8(t^2 - 2)} - 14(t - 85 = 0) \qquad g_{X 85} $ $ \frac{1}{8t^2 - 34t + 20t - 85 = 0} = 4 \times 2 \times 17 \times 5 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 = 34, 20 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 17) + 5(4t - 17) = 0 $ $ \frac{1}{8t} (4t - 1) (x - 4) = 0 $	$t^{2} = \pi^{2} + 2 + \frac{1}{2} = 3$	$t-2 = x^2 + \frac{1}{x^2}$
$8(t^{2}-2) - 14(t) - 69 = 0$ $a  8t^{2} - 14t - 85 = 0 \qquad 8x 85$ $8t^{2} - 34t + 20t - 85 = 0 \qquad = 4 \times 2 \times 17 \times 5$ $8t  (4t - 17) + 5  (4t - 17) = 0 \qquad = 34, 20$ a  (2t + 5)  (4t - 17) = 0 a  (2t + 5)  (4t - 1)  (x - 4) = 0		
$c  8t^{2} - 14t - 85 = 0 \qquad 8x 85$ $8t^{2} - 34t + 20t - 85 = 0 \qquad = 4 \times 2 \times 17 \times 5$ $gt (4t - 17) + 5 (4t - 17) = 0 \qquad = 34, 20$ $c  (2t + 5) (4t - 17) = 0$ $d  (2t + 5) (4t - 17) = 0$ $d  (2t + 5) (4t - 17) = 0$ $d  (2t + 5) (4t - 17) = 0$ $d  (2t + 5) (4t - 17) = 0$ $d  (2t + 5) (4t - 17) = 0$ $d  (2t + 5) (4t - 17) = 0$ $d  (2t + 5) (4t - 17) = 0$ $d  (2t + 5) (4t - 17) = 0$ $d  (2t + 5) (4t - 17) = 0$ $d  (2t + 5) (4t - 17) = 0$ $d  (2t + 5) (4t - 17) = 0$ $d  (2t + 5) (4t - 17) = 0$ $d  (2t + 5) (4t - 17) = 0$ $d  (2t + 5) (4t - 17) = 0$ $d  (2t + 5) (4t - 17) = 0$ $d  (2t + 5) (4t - 17) = 0$ $d  (2t + 5) (4t - 17) = 0$ $d  (2t + 5) (4t - 17) = 0$ $d  (2t + 5) (4t - 17) = 0$	8(t-2) -14 (+)	-69 = 0
$8t^{2} - 34t + 20t - 85 = 0 = 4 \times 2 \times 17 \times 5$ $9t (4t - 17) + 5 (4t - 17) = 0 = 34, 20$ $\sim (2t + 5) (4t - 17) = 0$ $\therefore t = -57_{2}  cx  17/4$ $(x + 1) = -5  x + \frac{1}{2} = \frac{17}{2}$ $9x^{2} + 2 = -5x  4x^{2} + 4 = 17x$ $r = 2x^{2} + 5x + 2 = 0  4x^{2} - 17x + 4 = 0$ $(2x + 1)(x + 2) = 0  (4x - 1)(x - 4) = 0$	Gr 8t ² -14t-85=	O &x &5
$\frac{\partial t}{\partial t} (4t - 17) + 5 (4t - 17) = 0 = -34, 20$ $\approx (2t + 5) (4t - 17) = 0$ $\frac{2t + 5}{2} (4t - 17) = 0$ $\frac{17}{4}$ $\frac{1}{3} = -57, \qquad 17/4$ $\frac{1}{3} = -57, \qquad 4\pi^2 + 4 = -17\pi$ $\frac{1}{3} = -5\pi, \qquad 4\pi^2 + 4 = -17\pi$ $\frac{1}{3} = -5\pi, \qquad 4\pi^2 - 17\pi + 4 = 0$ $(2\pi + 1) (\pi + 2) = 0 \qquad (4\pi - 1) (\pi - 4) = 0$	812-34++ 20+-05-7	$= 4 \times 2 \times 17 \times 5$
$ \begin{array}{c} \alpha c \left[ 4c - 1/\right] + 5 \left( 4c - 1/\right) = 0 \\ \alpha \left( 2t + 5 \right) \left( 4t - 17 \right) = 0 \\ \vdots t = -57_{2}  \alpha  17/\epsilon \\ \gamma + \frac{1}{2} = -57_{2} \\ 3x^{2} + 2 = -5\pi \\ \gamma + \frac{1}{2} = -5\pi \\ \gamma + \frac{1}{2} = -5\pi \\ \gamma + \frac{1}{2} = -7\pi \\ \gamma + \frac{1}{2} =$	91 (45 17) 5 - 111	(7) = 34 20
$ \begin{array}{c} \sim (2t+5)(4t-17)=0 \\ \vdots t = -57_{2}  \alpha  17/4 \\ \qquad \qquad$	$\alpha \tau [4 (-1/) + 5 (4 t - 1/) + 5 (4$	11) - 0 ,
$\frac{1}{2} \cdot t = -\frac{5}{72}  cr  \frac{17}{4}$ $\frac{7}{3} \cdot \frac{1}{2} = -\frac{5}{2} \qquad \frac{7}{4} \cdot \frac{1}{3} = \frac{17}{3}$ $\frac{2x^{2} + 2 = -5x}{2x^{2} + 5x + 2 \cdot 20} \qquad \frac{4x^{2} + 4 = 17x}{4x^{2} - 17x + 4 = 0}$ $\frac{2x^{2} + 5x + 2 \cdot 20}{(2x + 1)(x + 2) = 0} \qquad \frac{4x^{2} - 17x + 4 = 0}{(4x - 1)(x - 4) = 0}$	~ (2t+5) (4t-17) =0	) 
$\begin{array}{rcl} \chi + \frac{1}{2} &= -5 \\ \chi + \frac{1}{2} &= \frac{17}{2} \\ 2\chi^{2} + 2 &= -5\chi \\ \varphi &= -5\chi \\ \gamma &= 4\chi^{2} + 4 &= 17\chi \\ \varphi &= 17\chi \\ \gamma &= 2\chi^{2} + 5\chi + 2 &= 0 \\ (2\chi + 1)(\chi + 2) &= 0 \\ (4\chi - 1)(\chi - 4) &= 0 \end{array}$	t = -5/2 or	1 <del>7/</del> ¢
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	x+1=-5	$x + \frac{1}{2} = 17$
$\begin{aligned} &2x^{2} + 2 = -5x & 4x^{2} + 4 = 17x \\ &r & 2x^{2} + 5x + 2 = 0 \\ & (2x + 1)(x + 2) = 0 & (4x - 1)(x - 4) = 0 \end{aligned}$	· · · · · · · · · · · · · · · · · · ·	/' ¥
$\begin{array}{ccc} & & & & & & \\ & & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & &$	$\partial x^2 + \partial = -5x$	$4x^2 + 4 = 17x$
$(2\chi +1)(\chi +2) = 0$ $(4\chi -1)(\chi -4) = 0$	$\alpha  2x^2 + 5x + 2z0$	$4x^2 - 17x + 4 = 0$
	(20, +1)(x+1) = 0	(4x-1)(x-4)=0
$\chi = -\frac{1}{2} \alpha - L \qquad \chi = \frac{1}{4} \alpha 4$	$\chi = -\frac{1}{2} qr - L$	$\chi = \lambda_{4} \propto 4$
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	Teacher:
$(d) \chi^{6} - \chi^{3} + 1 = 0$	
$\chi^3 = \frac{1 \pm \sqrt{1 - 4}}{2}$	······································
$\frac{-1\pm\sqrt{3}i}{2}$	$a^{3} - 1 - \sqrt{3} c'$
$\frac{17.032}{2}$ = $\frac{17.032}{2}$ = Cis $\frac{7}{3}$	$z c\hat{\omega} - \frac{1}{3}$
$\chi_{\kappa} = Cis \frac{\mathcal{Q}k\pi + \frac{1}{3}}{3} k^{\frac{1}{2}}$	0,1,2 x ³ = Cis -24(K-1/3), k= 1
79, = cis 179	$x_4 = c_{10} - \frac{17}{9}$
N2 = Cis 7779	X5= cis - 7179
\$13 Cro 13 179	$\gamma_{c} = c_{is}^{*} - \frac{13\pi}{2}$
	•••••••••••••••••••••••••••••••••••••••

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Ouestion Name: Teacher: (ii)  $\chi + \beta = 2\cos 79$   $\chi \beta = 1$ r+8: 26,777g r521 l+f= 2 cn 13 1/g ef=1  $= \chi^{6} - \chi^{3} + I = (\chi^{2} - 2\chi C_{v} \sqrt{7} + I) (\chi^{2} - 2\chi C_{v} \sqrt{7} + I) (\chi^{2} - 2\chi C_{v} \sqrt{7} + I) (\chi^{2} - 2\chi C_{v} \sqrt{7} + I)$ (111) Genaling Coeff of x ★ 0 = -2x Co 7g - 2x Co 77g - 2x Co 1317g - Cos 1/g + Cos 1/7/g + Cos 13/7/g = 0 Guatury coeff of 2³ -1 = -2.C, 17g - 2 C, ⁷7g - 2 C, ¹³7g - 8 g C, 17g C, ¹³7g C, ¹³7g -1= 0-8 co 79 co 779 co 13 79 - Cos 1/2 Cos 1/72 Cos 13 1/2 = 1/2