Q	Parts		Elements of answer		Notes
I	1)		$\lim_{x\to-\infty}\frac{-x}{x-\sqrt{1+x^2}}=\lim_{x\to-\infty}\frac{-x}{x-\sqrt{x^2\left(\frac{1}{x^2}+1\right)}}$ $=\lim_{x\to-\infty}\frac{-x}{x-\|x\|}$ & $x<0$	$=\lim_{x\to-\infty}\frac{-x}{2x}$ $=\frac{-1}{2}$ thus, A	
	2)		To determine the axis of symmetry of a polynomial function We find $f'(x)=0$ But, $f(x)=x^2+4x$ Then, $f'(x)=2x+4$ Thus, $x=\frac{-4}{2}=-2$ is an axis of symmetry of given curve. B		`
	3)		Since, $g(x)=f(x+2)$ Thus, curve of g is the image of that of f by the vector $\vec{V}(-2;0)$ C		
II	1		(E) admits two real distinct roots *iff* $\Delta>0$ $\Delta=b^2-4ac$ $=(m-2)^2-4(m+1)(1-m)$ $=5m^2-4m$ but a >0 so, $5m^2-4m>0$ for all $m\in]-\infty;0[\cup]\frac{4}{5};+\infty[$ Thus, (E) admits two real distinct roots for all $m\in]-\infty;0[\cup]\frac{4}{5};+\infty[$		
	2	a.	(F) admits a double root *iff* $\Delta=0$ $\Delta'=b'^2-ac$ $0=\sin^2 a-\cos a(\cos a)$ $0=\sin^2 a-\cos^2 a$ Thus, $0=\cos 2a$		
		b.	$S=\frac{-b}{a}=\frac{2\sin a}{\cos a}=2\tan a$ & $P=\frac{c}{a}=\frac{\cos a}{\cos a}=1$ *And*, $\tan 2a=\frac{2\tan a}{1-\tan^2 a}$	*Thus*, $\tan 2a=\frac{2S}{2P-S^2}$	

III	1		$f(x)$ is of the form, $\frac{r}{n}$ so, $\left(\frac{r}{n}\right)' = \frac{r'n - n'r}{r^2}$ Where, $r = ax^n, so, r' = nax^{n-1}$ and, $n = \sqrt{v}, so, n' = \frac{v'}{2\sqrt{v}}$	Thus, $f'(x) = \frac{-4x\sqrt{5x+2} - \frac{5(-2x^2)}{2\sqrt{5x+2}}}{\left(\sqrt{5x+2}\right)^2}$ $g(x)$ is of the form, u^n so, $(u^n)' = nu^{n-1}u'$ thus, $g'(x) = 3(\cos 5x - \sin x)^2(-5\sin 5x) - \cos x$	
	2		f is continuous at $x = 0$ *iff*, $\lim_{x\to 0} f(x) = f(0)$ $\lim_{x\to 0} a\frac{\sin 2x}{x} = \frac{1}{2}$ Then, $\lim_{x\to 0} a\frac{2\sin 2x}{2x} = \frac{1}{2}$ Thus, $a = \frac{1}{4}$		
	3	a.	Take L.H.S: $\tan\left(\frac{\pi}{4} - x\right) = \frac{\tan\left(\frac{\pi}{4}\right) - \tan x}{1 + \tan\frac{\pi}{4}\tan x}$ $= \frac{1 - \tan x}{1 + \tan x}$	$= \frac{1 - \frac{\sin x}{\cos x}}{1 + \frac{\sin x}{\cos x}}$ Thus, $\tan\left(\frac{\pi}{4} - x\right) = \frac{\cos x - \sin x}{\cos x + \sin x}$	
		b.	$\tan\left(\frac{\pi}{4} - x\right) = \frac{\cos x - \sin x}{\cos x + \sin x}$ (proved) $\frac{\cos x - \sin x}{\cos x + \sin x} \times \frac{\cos x + \sin x}{\cos x + \sin x}$	$\frac{\cos^2 x - \sin^2 x}{(\cos x + \sin x)^2}$ $\frac{\cos 2x}{\cos^2 x + \sin^2 x + 2\sin x\cos x}$ Thus, $\tan\left(\frac{\pi}{4} - x\right) = \frac{\cos 2x}{1 + \sin 2x}$	
IV	1		$(C): x^2 + y^2 - 2x - 2 = 0$ is of the form $x^2 + y^2 - 2ax - 2by + c = 0$ So $a = 1, b = 0$ & $c = -2$ Thus, $W(a;b) \equiv (1;0)$ and $R = \sqrt{a^2 + b^2 - c} = \sqrt{3}u.o.l$		
	2		$A \in (C)$ if coordinate of A satisfy the equation of (C) $(2)^2 + \left(\sqrt{2}\right)^2 - 2(2) - 2 \stackrel{?}{=} 0$ $0 = 0$ Thus, $A \in (C)$		

	3	a.	$NW^2=(x_w-x_N)^2+(y_W-y_N)^2=(1-x)^2+\left(0-\sqrt{2}\right)^2=x^2-2x+3$ Thus, $NW^2-R^2=x^2-2x+3-\sqrt{3}^2=x^2-2x$		
	3	b.	To determine relative positions of N w.r.t (C) we find the sign NW^2-R^2 If $x^2-2x=x(x-2)>0$ then N is exterior to (C) for $x\in]-\infty;0[\cup]2;+\infty[$ If $x^2-2x=x(x-2)<0$ then N is interior to (C) for $x\in]0;2[$ If $x^2-2x=x(x-2)=0$ then N is on (C) for $x\in\{0,2\}$		
	4.		$\frac{x-1}{-x^2-2x-1}=\frac{x-1}{-(x+1)^2}\geq 0$ So, $\frac{-x+1}{(x+1)^2}\geq 0$ Roots and excluded values: $x=1$ and $x_1\neq -1$	$S_1=]-\infty;-1[\cup]-1;+1]$ But, $x^2-2x=x(x-2)>0$ Roots: $x=0$ & $x=2$ and $a=1>0$ $S_2=]-\infty;0[\cup]2;+\infty[$ Thus, $S=S_1\cap S_2$ $=]-\infty;-1[\cup]-1;0[\cup]0;1]$	
V	1		For $n=0, U_1=\frac{2U_0+1}{U_0+2}=\frac{1}{2}$ For $n=1, U_2=\frac{2U_1+1}{U_1+2}=\frac{4}{5}$ For $n=2, U_3=\frac{2U_2+1}{U_2+2}=\frac{13}{14}$		
V	2	a.	$V_1=\frac{U_1-1}{U_1+1}=-\frac{1}{3}$ $V_2=\frac{U_2-1}{U_2+1}=-\frac{1}{9}$ $V_3=\frac{U_3-1}{U_3+1}=-\frac{1}{27}$	$So, \frac{V_2}{V_1}=\frac{V_3}{V_2}=\frac{1}{3}$ Thus, (V_n) is a geometric sequence of common ratio $r=\frac{1}{3}$ & $V_1=\frac{1}{3}$	
V	2	b.	(V_n) is a G. S, where $r=\frac{1}{3}$ & $V_1=\frac{1}{3}$ So, $V_n=V_1\cdot r^{n+1}$ Thus, $V_n=\frac{1}{3}\times\left(\frac{1}{3}\right)^{n+1}=\frac{1}{3^{n+2}}$	But, $V_n=\frac{U_n-1}{U_n+1}$ So, $U_n=\frac{V_n+1}{1-V_n}$ Thus, $U_n=\frac{1+3^{n+2}}{3^{n+2}-1}$	
V	2	c.	$\sum_{i=0}^{n}V_n=V_0\left(\frac{1-r^{n+1}}{1-r}\right)=\frac{1}{3^2}\left(\frac{1-\frac{1}{3^{n+1}}}{1-\frac{1}{3}}\right)$		

VI

A 1.

$A(1;1)$ is a maximum of (C)

So, $f'(1)=0$ and $f(1)=1$

$f'(x)=4ax^3+2bx$

Then, $4a(1)^3+2b(1)=0$

So, $4a+2b=0....(i)$

$f(1)=a(1)^4+b(1)^2=1$

So, $a+b=1.....(ii)$

Using equations (i) & (ii) we get

$a=-1$ & $b=2$

B a.

$f(x)=-x^4+2x^2$ So, $f'(x)=-4x^3+4x$

For, $f'(x)=0$ So, $-4x(x^2-1)=0$

Table of variations:

Values of x	$-\infty$		-1		0		1		$+\infty$
Sign of $f'(x)$		+	0	-	0	+	0	-	
Variation of f	$-\infty$	↗	1	↘	0	↗	1	↘	$-\infty$

b.

$-x^4+2x^2=0$

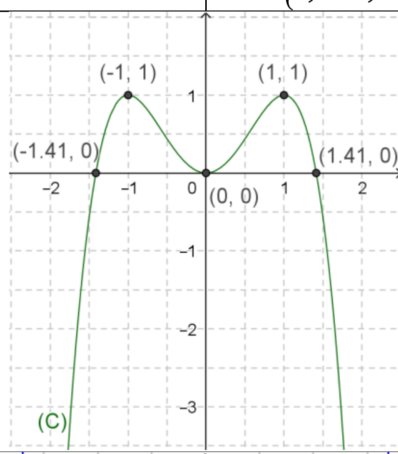
$-x^2\left(x^2-\sqrt{2}^2\right)=0$

$-x^2\left(x-\sqrt{2}\right)\left(x+\sqrt{2}\right)=0$

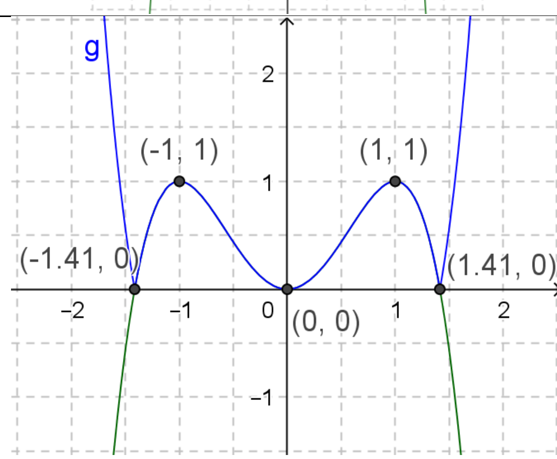
Which has three distinct roots:

$x=\{0,\sqrt{2},-\sqrt{2}\}$

c.



2b



2c

Since, at $x=\sqrt{2}$ the graph of (g) admits a corner point, that is two semi tangents of opposite directions, thus (g) is not differentiable at point of abscissa $x=\sqrt{2}$.