CHIDI MILESTONE MIRACLE
18/EN G01/005
CHEMICAL ENGINEERING

By plotting the curves given in equation (i) and (ii) to show the angles between them at their points of intersections with the aid of MathCAD. find the magnitude of the angle for which x and y are positive.

$5x^2+y^2=5$ —— (i)

$x^2+y^2=4$ —— (ii)

from equ ii

$x^2+y^2=4$

$y^2=4-x^2$ —— iii

Sub; equ iii in equ iii

$5x^2+y^2=5$

$5x^2+(4-x^2)=5$

$5x^2+4-x^2=5$

$5x^2-x^2+4=5$

$4x^2=5-4$

$4x^2=1$

$x^2=1/4$; $x=\pm\sqrt{1/4}$

$x=+1/2$ or $-1/2$.

from equ iii

$y^2=4-x^2$

$y^2=4-(1/2)^2$

$y^2=15/4$

$y^2=\sqrt{\frac{15}{4}}$, $y=\frac{\sqrt{15}}{4}$ $\therefore (x,y)=(\frac{1}{2},\frac{\sqrt{15}}{2})$

From equ i, $5x^2+y^2=5$

$10x+2y\,dy/dx=0$

$2y\,dy/dx=-10x$

$\frac{dy}{dx}=\frac{-10x}{2y}=\frac{-5x}{y}$

Recall that $dy/dx=\tan\theta$

$\frac{-5x}{y}=\tan\theta$

$\frac{-5(1/2)}{\sqrt{15}/2}=\tan\theta$

$\theta=\tan^{-1}\left(\frac{\sqrt{15}}{3}\right)$

$\theta_1=-52.24$

From equ ii, $x^2+y^2=4$

$2y+2y\frac{dy}{dx}=0$

$2y\frac{dy}{dx}=-2x$

$\frac{dy}{dx}=\frac{-2x}{2y}=\frac{-x}{y}$

Recall that $\frac{dy}{dx}=\tan\theta$

$\frac{-x}{y}=\tan\theta$

$\frac{-1/2}{\sqrt{15}/2}=\tan\theta$

$\frac{-\sqrt{15}}{15}=\tan\theta$

$\theta=\tan^{-1}\frac{\sqrt{15}}{15}$

$\theta=-14.48$

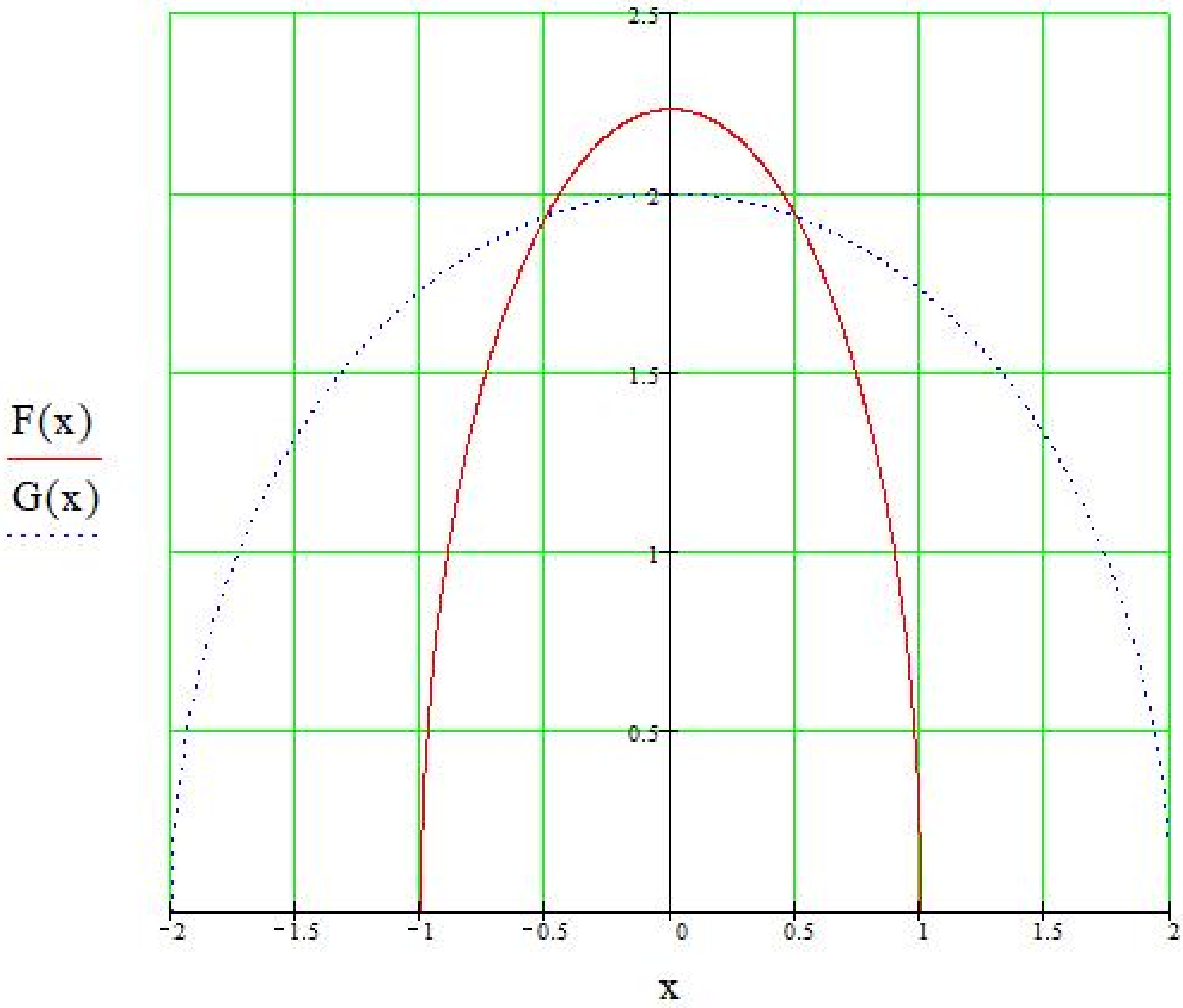
Since magnitude $=\theta_2-\theta_1$

$\therefore -14.48-(-52.24)$

$=37.76°$

$$G(x) := \sqrt{\left(4 - x^2\right)}$$

$$F(x) := \sqrt{\left(5 - 5x^2\right)}$$



2.5
2
1.5
1
0.5
F(x)
G(x)
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
x