1.18

Monday, January 18, 2021 7:54 PM

Welcome to the TUT0105B
We will start at 8:10.
I am going to answer your questions, so please come with questions prepared.

An Old Question:

A man on the earth moves toward south 10km, then east 10km, then north 10km. Finally he moves back to the start position. Where is this start position on the earth?

$\boxed{\dfrac{3x^2}{x^3-1}}$

1. first we consider x^3-1

$x=1$ as a root.

therefore, $x^3-1 = (x-1)(x^2+x+1)$

$= \dfrac{3x^2}{(x-1)(x^2+x+1)}$

$f(x) = x^2+x+1$ has two roots.

$x = \dfrac{-b \pm \sqrt{b^2-4ac}}{2a}$ for ax^2+bx+c

$x_1 = \dfrac{-1+\sqrt{1-4}}{2} = \dfrac{-1+\sqrt{3}i}{2}$ $\quad i = \sqrt{-1}$

$x_2 = \dfrac{-1-\sqrt{3}i}{2}$

$\dfrac{3\sqrt{x}}{(x^3+2x+3)^{1/2}}$

Q2. $I = \displaystyle\int \frac{2x}{(x^2+2x+4)^2}\,dx =$

$2x\,dx \Rightarrow dx^2$

$\dfrac{(\ N\ )}{(\ D\ )}$

x^2+1 $\quad x^2 \cdot 1$ $\quad \sqrt{x^2 \cdot 1}$ $\quad \sqrt{x^2+1}$

$u = x^2+2x+4 \qquad du = (2x+2)\,dx$

$I = \displaystyle\int \frac{2x+2}{(\underbrace{x^2+2x+4}_{u})^2}\,dx - \int \frac{2}{(x^2+2x+4)^2}\,dx$ $\qquad$ arcsin sin

$= \displaystyle\int \frac{du}{u^2} - \int \frac{2}{(x^2+2x+4)^2}\,dx$ $\qquad x^2+2x+4 \rightarrow c(s^2+1)$

$= -\dfrac{1}{u} - 2I_2$

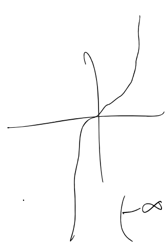
$I_2 = \displaystyle\int \frac{1}{(x^2+2x+4)^2}\,dx = \int \frac{1}{((x+1)^2+3)^2}\,dx$

let

$t = (x+1)$

$I_2 = \displaystyle\int \frac{1}{(t^2+3)^2}\,dt$

$t = \sqrt{3}\cdot\tan(s)$



$(-\infty, \infty)$

$I_2 = \displaystyle\int \frac{\sqrt{3}\cdot\frac{1}{\cos^2 s}}{(3\tan^2 s+3)^2}\,ds$ $\qquad \dfrac{dt}{ds} = \dfrac{\sqrt{3}}{\cos^2 s}$

$= \dfrac{\sqrt{3}}{9}\displaystyle\int \frac{1}{\cos^2 s\,(\tan^2 s+1)^2}\,ds$

$= \dfrac{\sqrt{3}}{9}\displaystyle\int \cos^2 s\,ds$ $\qquad \tan^2 s+1 = \dfrac{\sin^2 s+\cos^2 s}{\cos^2 s} = \dfrac{1}{\cos^2 s}$

$= \dfrac{\sqrt{3}}{9}\displaystyle\int \frac{\cos 2s+1}{2}\,ds$ $\qquad \cos^2+\sin^2=1$ $\qquad \dfrac{d\tan}{dx}$

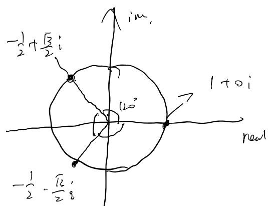
$\cos 2x = \cos^2-\sin^2$

$= \dfrac{\sqrt{3}}{18}\displaystyle\int \cos 2s+1\,ds$ $\qquad \cos^2 = \dfrac{\cos 2x+1}{2}$

Q3. $\frac{3x^2}{x^3-1} =$ $\quad f(x)=x^3-1$

$x^3=1 \Rightarrow f(x)=x^3-1 \; ; \; f(x)=0$

$\boxed{e^{ix}=\cos x+i\sin x}$ euler equation.



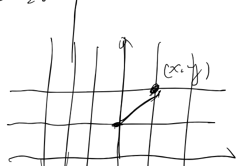
$x^3=1$

$(x-1)(x^2+x+1)$

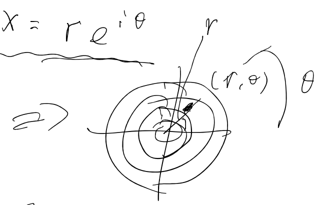
$$\begin{cases} x_1=1 & \sin 0 \\ x_2=-\frac{1}{2}+\frac{\sqrt{3}}{2}i & \cos 3\cdot 0 \\ x_3=-\frac{1}{2}-\frac{\sqrt{3}}{2}i \end{cases}$$

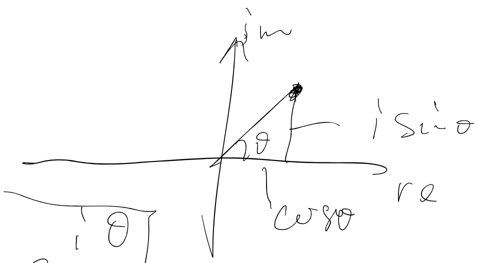
$x^3-1=0$

$x=re^{i\theta}$



$\Rightarrow$





$\boxed{e^{i\theta}}=\cos\theta+i\sin\theta$

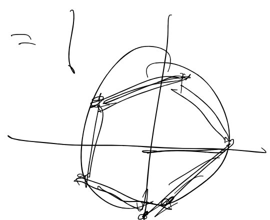
$(re^{i\theta})^3-1=0$

$(re^{i\theta})^3=1 \qquad r\neq 0$

$\boxed{r^3}e^{i3\theta}=1 \qquad r^3=1 \Rightarrow r=1$

$e^{i3\theta}=1 \Rightarrow \theta=\frac{2\pi}{3}, \frac{4\pi}{3}, \frac{6\pi}{3}$

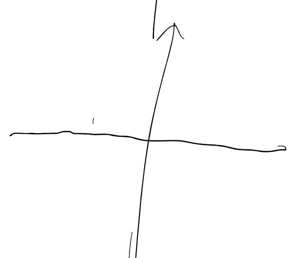
$e^{i\theta}=1$

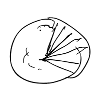


$x^5=1 \qquad x^5=1$

$\boxed{x^5-2x=1}$

$x(x^4-2)=1$





17 equally

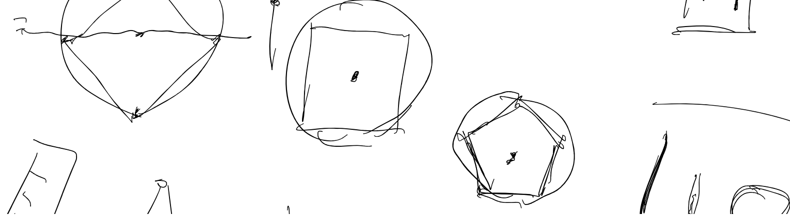
17-polygon

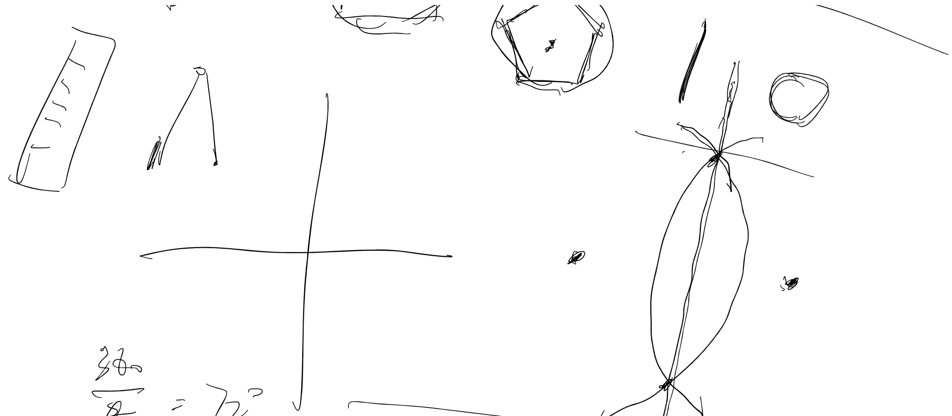
$\boxed{x^{17}=1}$

$\boxed{17}$- polygon

Gauss

$\frac{360}{17}=$





$$\frac{360}{5} = 72^\circ$$

$$\boxed{\cos 72^\circ + i \sin 72^\circ}$$