Math Review

Note Title

① $a = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ $b = \begin{bmatrix} 1 \\ -1 \\ 4 \end{bmatrix}$

compute $a \cdot b$

$1 \cdot 1 + 2 \cdot -1 + 3 \cdot 4$

$= 11$

compute $a^T b$

$\begin{bmatrix} 1 & 2 & 3 \end{bmatrix} \begin{bmatrix} 1 \\ -1 \\ 4 \end{bmatrix}$

$= 11$

② compute $a \times b$

$\begin{matrix} i & j & k \\ 1 & 2 & 3 \\ 1 & -1 & 4 \end{matrix}$

$i: 2 \cdot 4 - (-1) 3 = 11$

$j: -[1 \cdot 4 - 1 \cdot 3] = -1$

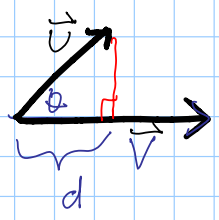
$k: 1 \cdot (-1) - 1 \cdot 2 = -3$

$\begin{bmatrix} 11 \\ -1 \\ -3 \end{bmatrix}$

compute $b \times a$

$b \times a = - a \times b$

③



Determine an expression for d

$|v \cdot V| = |v||V| \cos\theta$

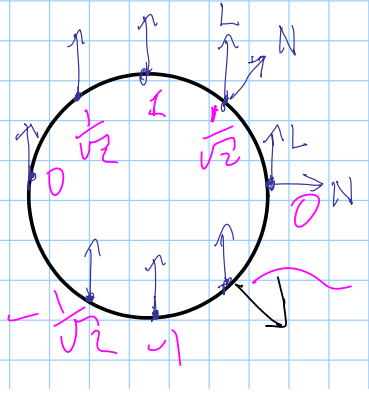
$d = |v| \cos\theta$

$= \frac{|v \cdot V|}{|V|}$

④ $|\vec{v} \times \vec{V}| = ?$

$= |v||V| \sin\theta$

⑤



Compute $\vec{N} \cdot \vec{L}$ at all the points shown on the cylinder where N is a unit surface normal and L is a unit vector pointing up as drawn

⑥ Compute $C = A * B$

$$\begin{bmatrix} 1 & 0 & 4 \\ 2 & 0 & 2 \\ 3 & -1 & 2 \end{bmatrix} \begin{bmatrix} 3 & 1 & 6 \\ 2 & 2 & 1 \\ 1 & 3 & 1 \end{bmatrix} = \begin{bmatrix} 7 & 13 & 10 \\ 8 & 8 & 14 \\ 9 & 7 & 19 \end{bmatrix}$$

Does $AB = BA$?

⑦ $P \rightarrow [B] \rightarrow P' \rightarrow [A] \rightarrow P''$

Compute P'' where $P = \begin{bmatrix} 2 \\ 0 \\ 1 \end{bmatrix}$

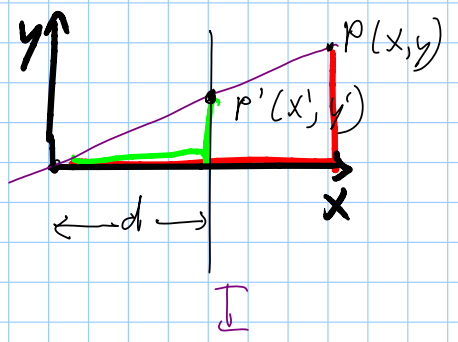
$P' = B \cdot P$

$P'' = A \cdot P'$

$P'' = (A \cdot B) P$

$$\begin{bmatrix} 24 \\ 30 \\ 37 \end{bmatrix} = \begin{bmatrix} \quad \end{bmatrix} \begin{bmatrix} 2 \\ 0 \\ 1 \end{bmatrix}$$

⑧

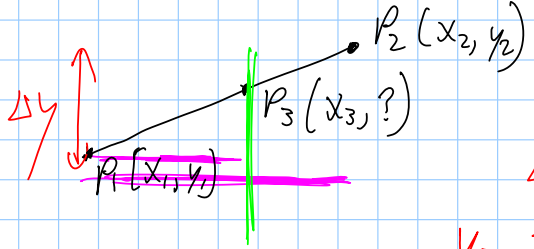


Given P, compute P'

$x' = d$ $\quad y' = d \cdot y$

$\frac{y}{x} = \frac{y'}{d}$

⑨



Compute y_3

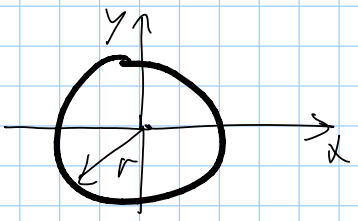
$\Delta y = y_2 - y_1$

$y_3 = y_1 + f \Delta y$

$f = \frac{x_3 - x_1}{x_2 - x_1}$

$$y_3 = y_1 + \left(\frac{x_3 - x_1}{x_2 - x_1}\right)(y_2 - y_1)$$

(10)



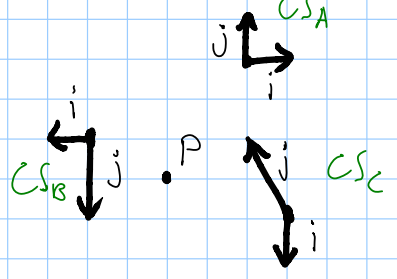
Create a function $f(x,y)$ such that

$f(x,y) > 0$ inside circle
$f(x,y) = 0$ on circle
$f(x,y) < 0$ outside circle

$x^2 + y^2 = r^2$

$0 = r^2 - x^2 - y^2 = f(x,y)$

(11)



$\vec{P} = O + x\vec{i} + y\vec{j}$

origin

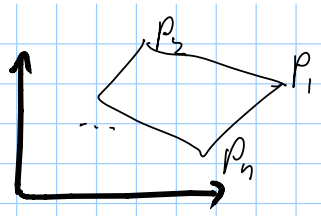
Locate P in each of the 3 coordinate systems

$P_A = (-2,-3)$

$P_B = (-2, \frac{1}{2})$

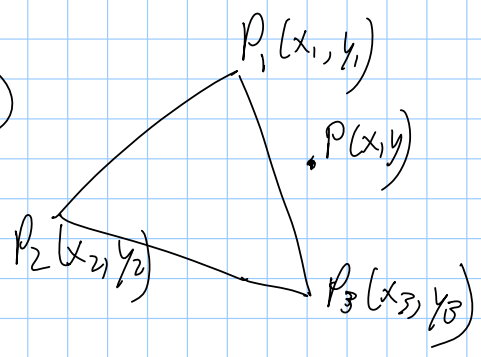
$P_C = (5,3)$

(12)



How would one compute the area of an arbitrary polygon in the xy plane?

(13)



Given an arbitrary point $P(x,y)$ how can you determine if it is inside a given triangle?