1. find $\det(A^TA)$

(a) $\begin{pmatrix} 1 & 3 & 2 \end{pmatrix}$.

(b) $\begin{pmatrix} 1 & 1 & 1 \\ 1 & 3 & 2 \\ 1 & 3 & 2 \end{pmatrix}$

(c) $\begin{pmatrix} \cos u & -r\sin u & 0 \\ \sin u & r\cos u & 0 \\ 0 & 0 & 1 \end{pmatrix}$

2. $A_{m\times n} = Q_{m\times n} R_{n\times n}$

A is $m\times n$ matrix, with rank $A = n$

Q is orthogonal, R is upper triangle

find R for $A = \begin{pmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix}$

3. Proof for $f(x, y, z)$.

volume element is $\sqrt{1+f_x^2+f_y^2+f_z^2}\,dx\,dy\,dz$

Hence find the volume of $\frac{x^2}{4}+\frac{y^2}{9} \le z \le a^2$

4. $\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} (R + r\cos u)\cos v \\ (R + r\cos u)\sin v \\ r\sin u \end{pmatrix}$ $u, v \in [0, 2\pi]$

find the volume

5. $f(z) = z^2$ $z = x + iy$. $|z| \le 1$

find the surface area of $f(z)$

(hint: use 4 coordinates)

6. $f(z) = \cos(z)$ $z = x + iy$

find the area $x \in [-\pi, \pi]$, $y \in [-1, 1]$