Math 331 **Problems** **Part 1**

1. a) Compute $\rho_{O,\frac{\pi}{2}}\rho_{\left[\begin{smallmatrix}2\\0\end{smallmatrix}\right],\pi}$ explicitly.
   b) Compute $\rho_{\left[\begin{smallmatrix}2\\0\end{smallmatrix}\right],\pi}\rho_{O,\frac{\pi}{2}}$ explicitly.
2. Let m be the line $y = 3x$. Find $\sigma_m(\left[\begin{smallmatrix}1\\1\end{smallmatrix}\right])$.
3. Let ℓ be the line $x = 2$, m the line $y = 3$ and n the line $y = 5$. Compute the following explicitly:
   a) $\sigma_m\sigma_\ell$
   b) $\sigma_m\sigma_n$
   c) $\sigma_n\sigma_m$
   d) $\sigma_m\sigma_\ell\sigma_m$
   e) $\sigma_m\sigma_\ell\sigma_n$
   f) $\sigma_m\sigma_n\sigma_m$.
4. Let ℓ be the line $y = x$, m the line $y = \sqrt{3}\,x$, n the line $y = 0$ (the x-axis), and p the line $y = 2$. Compute the following explicitly:
   a) $\sigma_m\sigma_\ell\sigma_n$
   b) $\sigma_m\sigma_\ell\sigma_m$
   c) $\sigma_p\sigma_\ell\sigma_n$
   d) $\sigma_\ell\sigma_p\sigma_\ell$
5. Explicitly calculate $\tau_{O,\left[\begin{smallmatrix}2\\2\end{smallmatrix}\right]}\rho_{\left[\begin{smallmatrix}3\\1\end{smallmatrix}\right],\frac{\pi}{6}}$.
6. Let $P = \left[\begin{smallmatrix}1\\5\end{smallmatrix}\right]$, $Q = \left[\begin{smallmatrix}2\\2\end{smallmatrix}\right]$ and $R = \left[\begin{smallmatrix}3\\6\end{smallmatrix}\right]$. Find S such that
$$\sigma_S\sigma_R = \sigma_Q\sigma_P.$$
7. Let ℓ be the line $y = 3x + 2$, m the line $y = 3x - 4$, and n the line $y = -\frac{1}{3}x$. Calculate the following explicitly:
   a) $\sigma_n\sigma_\ell$
   b) $\sigma_n\sigma_m$
   c) $\sigma_m\sigma_\ell$.