PCA HW

	X	Y	$x = x' + \bar{x}$ (mean already 0)	X'	Y'
m_1	.2	-.3		.2	-.2
m_2	-1.1	2	$y' = Y_{mi} - \bar{Y}$	-1.1	2.1
m_3	1	-2.2		1	-2.1
m_4	.5	-1		.5	-.9
m_5	-.6	1		-.6	1.1
mean	0 ($\bar{x}$)	-.1 ($\bar{y}$)			

Covariance Matrix = $\begin{bmatrix} cov(x,x) & cov(x,y) \\ cov(y,x) & cov(y,y) \end{bmatrix}$

Cov matrix = $\begin{bmatrix} .715 & -1.39 \\ -1.39 & 2.72 \end{bmatrix}$

Eigenvalues = .00370122 (λ_2) & 3.43129878 (λ_1)

Eigenvectors $\begin{bmatrix} -.89021285 \\ .45554483 \end{bmatrix}$, $\begin{bmatrix} -.45554483 \\ -.89021285 \end{bmatrix}$

Reduce to 1 feature (only using λ_1)

$$\text{VarExpl}(1) = \frac{\lambda_1}{\lambda_1 + \lambda_2} = \frac{3.43129878}{3.43129878 + .0037012} = \boxed{.999}$$

$1 \times 2 \quad \times 2 \times 5$

Row Feature = $[-.45554483, -.89021285]$ only 1 feature

Row Data = $\begin{bmatrix} .2 & -1.1 & 1 & .5 & -.6 \\ -.2 & 2.1 & -2.1 & -.9 & 1.1 \end{bmatrix}$

Transformed Data = Row Feature $\times$ Row Data

Transformed = $[.0869336, -1.36834767, 1.41390215, .5734915, -.70590723]$
1st principle component

.999 Explainability $\rightarrow$ 99.9%