Name: Soln ID #:

As always you need to show your work. Fill in the appropriate blanks

**1.** A pair $(\lambda, v)$ is an eigen pair if $Av = \lambda v$ and $v \neq 0$

**2.** For $A = \begin{pmatrix} 1 & 2 \\ -2 & 1 \end{pmatrix}$. $(1-\lambda)^2 + 4 = 0$ $(\lambda-1)^2 = -4$ $\lambda - 1 = \pm 2i$

**2.1.** Compute the eigenvalues of A $1 \pm 2i$, $1-2i$

**2.2.** compute the eigenvectors of A $\begin{pmatrix} 1 \\ -i \end{pmatrix}$ and $\begin{pmatrix} 1 \\ i \end{pmatrix}$

$\lambda_1 = 1+2i$

$A - \lambda_1 I = \begin{bmatrix} -2i & 2 \\ -2 & -2i \end{bmatrix} \sim \begin{bmatrix} i & 1 \\ 0 & 0 \end{bmatrix}$ $x_1 i + x_2 = 0$ $x_2$ free $V_1 = \begin{pmatrix} 1 \\ -i \end{pmatrix}$

**3.** The matrix $A = \begin{pmatrix} a & -b \\ b & a \end{pmatrix}$ is a scaling by $r = \sqrt{a^2+b^2}$ and a rotation by $\arctan(b/c)$

**4.** A scaling by r and a rotation by angle $\phi$ has matrix $A = \begin{pmatrix} r & 0 \\ 0 & r \end{pmatrix} \begin{pmatrix} \cos\phi & -\sin\phi \\ \sin\phi & \cos\phi \end{pmatrix}$ i

**5.** The matrix $A = \begin{pmatrix} 1 & -2 \\ 2 & 1 \end{pmatrix}$ is a scaling by $\sqrt{1+4}$ and a rotation by $\arctan(2)$