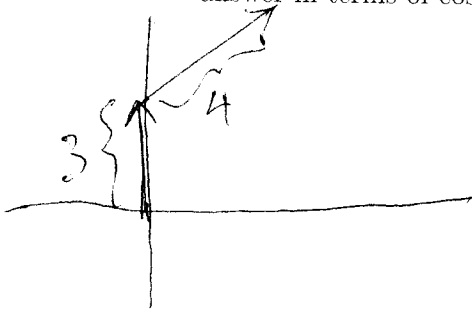


No notes or calculators. You can leave an answer as a numerical expression without computing the final value. For example, this is a perfectly acceptable answer :

$((250 - 63)/(1 - e^{(-6 \cdot 3.5)})) * \ln(27/168)$. Show your work clearly !!

1. (5pts) A ship starts at the origin and moves 3 units in the north direction. Then it moves 4 units in the North-East direction. What are the final coordinates of the ship ? (If you do not remember certain trigonometric function values, you can leave the answer in terms of cos and sin.)



First vector: $r = 3$
 $\alpha = 90^\circ$

$$\begin{bmatrix} 3 \cos 90 \\ 3 \sin 90 \end{bmatrix}$$

Second vector: $r = 4$
 $\alpha = 45^\circ$

$$\begin{bmatrix} 4 \cos 45 \\ 4 \sin 45 \end{bmatrix}$$

Final coordinates

$$\begin{bmatrix} 3 \cos 90 \\ 3 \sin 90 \end{bmatrix} + \begin{bmatrix} 4 \cos 45 \\ 4 \sin 45 \end{bmatrix} = \begin{bmatrix} 3 \cos 90 + 4 \cos 45 \\ 3 \sin 90 + 4 \sin 45 \end{bmatrix}$$

Final coordinates: $x = 3 \cos 90 + 4 \cos 45$, $y = 3 \sin 90 + 4 \sin 45$

2. (5 pts) Compute the eigenvalues and the corresponding eigenvectors of the matrix

$$A = \begin{bmatrix} -1 & 2 \\ 0 & -3 \end{bmatrix}$$

$$\begin{bmatrix} -1-\lambda & 2 \\ 0 & -3-\lambda \end{bmatrix}$$

$$\det = (-1-\lambda)(-3-\lambda) = 0$$

$$\lambda = -1, -3$$

Using $\lambda = -1$

$$\begin{bmatrix} -1 & 2 \\ 0 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = -1 \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

$$\begin{aligned} -x_1 + 2x_2 &= -x_1 \implies x_2 = 0 \\ -3x_2 &= -x_2 \end{aligned}$$

$$\begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

$$x_2 = 0, x_1 = 1$$

Using $\lambda = -3$

$$\begin{bmatrix} -1 & 2 \\ 0 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = -3 \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

$$\begin{aligned} -x_1 + 2x_2 &= -3x_1 \\ -3x_2 &= -3x_2 \\ -x_1 &= x_2 \end{aligned}$$

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

Choose $x_1 = 1$
 $x_2 = -1$