

# Standard Deviation

Jack Maguire

## Question 1

*i*

$$\begin{aligned}p(2i + 6j) + q(2i - 4j) &= 6i - 7j \\2pi + 6pj + 2qi - 4qj &= 6i - 7j\end{aligned}$$

$$\begin{aligned}2p + 2q &= 6 & 6p - 4q &= -7 \\4p + 4q &= 12 & 6p - 4q &= -7\end{aligned}$$

## Question 2

*i*

*a*

$$= 2i + j$$

*b*

$$\begin{aligned}\text{dir}(OA) &= \arctan \frac{-2}{1} = -63.4^\circ \\ \text{dir}(OB) &= 26.6^\circ, -153^\circ\end{aligned}$$

ii

C points form a circle around A, radius 2. You need to find the unit vector of A, then scale it by 2. Then, either add/subtract that from A to get the max/min.

$$\begin{aligned}|OA| &= \sqrt{1^2 + 2^2} = \sqrt{5} \\ OA_{\text{Unit}} &= \frac{OA}{\sqrt{5}} \\ &= \frac{1}{\sqrt{5}}i - \frac{2}{\sqrt{5}}j \\ &= \frac{\sqrt{5}}{5}i - \frac{2\sqrt{5}}{5}j \\ |AC| &= \frac{2\sqrt{5}}{5}i - \frac{4\sqrt{5}}{5}j\end{aligned}$$

$$\begin{aligned}\text{Max} &= i - 2j + \frac{2\sqrt{5}}{5}i - \frac{4\sqrt{5}}{5}j \\ \text{Min} &= i - 2j - \frac{2\sqrt{5}}{5}i + \frac{4\sqrt{5}}{5}j\end{aligned}$$