56. The vector sum of the displacements $\vec{d}_{\text{storm}}$ and $\vec{d}_{\text{new}}$ must give the same result as its originally intended displacement $\vec{d}_{\text{o}} = 120\,\hat{\text{j}}$ where east is $\hat{\text{i}}$, north is $\hat{\text{j}}$, and the assumed length unit is km. Thus, we write

$$\vec{d}_{\text{storm}} = 100\,\hat{\text{i}} \quad \text{and} \quad \vec{d}_{\text{new}} = A\,\hat{\text{i}} + B\,\hat{\text{j}} \ .$$

(a) The equation $\vec{d}_{\text{storm}} + \vec{d}_{\text{new}} = \vec{d}_{\text{o}}$ readily yields $A = -100$ km and $B = 120$ km. The magnitude of $\vec{d}_{\text{new}}$ is therefore $\sqrt{A^2 + B^2} = 156$ km.

(b) And its direction is $\tan^{-1}(B/A) = -50.2^\circ$ or $180^\circ + (-50.2^\circ) = 129.8^\circ$. We choose the latter value since it indicates a vector pointing in the second quadrant, which is what we expect here. The answer can be phrased several equivalent ways: 129.8° counterclockwise from east, or 39.8° west from north, or 50.2° north from west.