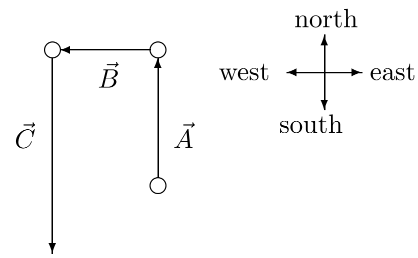
12. We label the displacement vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ (and denote the result of their vector sum as $\vec{r}$). We choose *east* as the $\hat{\text{i}}$ direction ($+x$ direction) and *north* as the $\hat{\text{j}}$ direction ($+y$ direction). All distances are understood to be in kilometers. Therefore,



$$
\begin{aligned}
\vec{A} &= 3.1\ \hat{\text{j}} \\
\vec{B} &= -2.4\ \hat{\text{i}} \\
\vec{C} &= -5.2\ \hat{\text{j}} \\
\vec{r} = \vec{A} + \vec{B} + \vec{C} &= -2.1\ \hat{\text{i}} - 2.4\ \hat{\text{j}}
\end{aligned}
$$

which means that its magnitude is

$$|\vec{r}| = \sqrt{(-2.1)^2 + (-2.4)^2} \approx 3.2 \text{ km} \ .$$

and the two possibilities for its angle are

$$\tan^{-1}\left(\frac{-2.4}{-2.1}\right) = 41^\circ, \quad \text{or} \quad 221^\circ \ .$$

We choose the latter possibility since $\vec{r}$ is in the third quadrant. It should be noted that many graphical calculators have polar $\leftrightarrow$ rectangular "shortcuts" that automatically produce the correct answer for angle (measured counterclockwise from the $+x$ axis). We may phrase the angle, then, as 221° counterclockwise from East (a phrasing that sounds peculiar, at best) or as 41° south from west or 49° west from south. The resultant $\vec{r}$ is not shown in our sketch; it would be an arrow directed from the "tail" of $\vec{A}$ to the "head" of $\vec{C}$.