1997 Q2

Sit ①

$\vec{v}_r = u\vec{i}$.

$\vec{v}_{wr} = -2x\vec{i} - 3x\vec{j}$ [from $2\vec{i}+3\vec{j}$ dirn]

$\vec{v}_w = \vec{v}_{wr} + \vec{v}_r$

$= -2x\vec{i} - 3x\vec{j} + u\vec{i}$

$= (-2x+u)\vec{i} - 3x\vec{j}$

Sit ②

$\vec{v}_r = u\vec{j}$

$\vec{v}_{wr} = 2y\vec{i} - 3y\vec{j}$ [From $-2\vec{i}+3\vec{j}$ dirn]

$\vec{v}_w = \vec{v}_{wr} + \vec{v}_r$

$= 2y\vec{i} - 3y\vec{j} + u\vec{j}$

$= 2y\vec{i} + (u-3y)\vec{j}$.

$\vec{v}_w$ equal in both situations

$\vec{i} \Rightarrow u - 2x = 2y$

$\vec{j} \Rightarrow -3x = u - 3y$

$\Rightarrow$

$6x + 6y = 3u$

$-6x + 6y = 2u$

$12y = 5u$

$y = \frac{5u}{12}$,

$\Rightarrow x = \frac{u}{12}$.

$\Rightarrow \vec{v}_w = (-2x+u)\vec{i} - 3x\vec{j}$

$\vec{v}_w = \left(-\frac{u}{6}+u\right)\vec{i} - \frac{3u}{12}\vec{j}$

$\vec{v}_w = \frac{5u}{6}\vec{i} - \frac{u}{4}\vec{j}$.

(ii)

$\vec{v}_r = ?$

$\vec{v}_w = \frac{5u}{6}\vec{i} - \frac{u}{4}\vec{j}$.

$\vec{v}_{wr} = u\vec{i}$

$\Rightarrow \vec{v}_w - \vec{v}_{wr} = \vec{v}_r$

$\frac{5u}{6}\vec{i} - \frac{u}{4}\vec{j} - u\vec{i} = \vec{v}_r$

$-\frac{u}{6}\vec{i} - \frac{u}{4}\vec{j} = \vec{v}_r$

Mag^n $\therefore \sqrt{\left(\frac{u}{6}\right)^2 + \left(\frac{u}{4}\right)^2} = .3u$

Dir^n W 56.3° S

$\tan A = \frac{\frac{u}{4}}{\frac{u}{6}}$

$= \frac{6}{4}$.

$= \frac{3}{2}$.