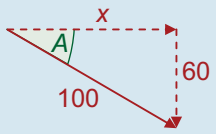
Q. 16. $\overrightarrow{v_W} = 60\vec{j}$

$\Rightarrow$ Plane must head at an angle A as shown in order to counteract the wind.



$x^2 + 60^2 = 100^2$

$\Rightarrow x = 80$

$\Rightarrow$ Plane actually flies at 80 m/s due East.

$$\text{Time} = \frac{\text{distance}}{\text{speed}}$$

$$= \frac{189}{80}$$

$$= 2.3625 \text{ h}$$

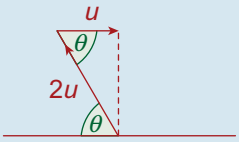
$$= 2 \text{ h } 21 \text{ m } 45 \text{ s}$$

The time taken for the return journey is the same because the wind is blowing directly from the south. This means that the wind will have no effect on the $\vec{i}$-velocity of the plane. The plane will still fly at 80 km/h but in the opposite direction.

Q. 17. $\cos\theta = \frac{u}{2u}$

$$= \frac{1}{2}$$

$\Rightarrow \theta = 60°$



Q. 18. $\overrightarrow{v_c} = -\vec{j}$

$\overrightarrow{v_s} = 2\cos 45°\vec{i} - 2\sin 45°\vec{j}$

$= 1.414\vec{i} - 1.414\vec{j}$

$\overrightarrow{v_{sc}} = \overrightarrow{v_s} - \overrightarrow{v_c} = 1.414\vec{i} - 0.414\vec{j}$

$v_{sc} = \sqrt{(1.414)^2 + (-0.414)^2}$

$= 1.47$ m/s

Q. 19. $\overrightarrow{v_A} = -100\vec{i}$

$\overrightarrow{v_W} = -20\cos 30\vec{i} + 20\sin 30\vec{j}$

$= -17.32\vec{i} + 10\vec{j}$

$\overrightarrow{v_{AW}} = \overrightarrow{v_A} - \overrightarrow{v_W}$

$= -100\vec{i} - (17.32\vec{i} + 10\vec{j})$

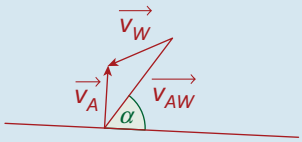
$= -82.68\vec{i} - 10\vec{j}$

$|\overrightarrow{v_{AW}}| = \sqrt{(-82.68)^2 + (-10)^2}$

$= 83.28$ km/h

Q. 20. $\overrightarrow{v_w} = -50\cos 45°\vec{i} - 50\sin 45°\vec{j}$

$= -35.355\vec{i} - 35.355\vec{j}$



$\overrightarrow{v_{Aw}} = 200\cos\alpha\vec{i} + 200\sin\alpha\vec{j}$

$\overrightarrow{v_A} = (200\cos\alpha - 35.355)\vec{i} + (200\sin\alpha - 35.355)\vec{j}$

But $200\cos\alpha - 35.355 = 0$

$\Rightarrow \cos\alpha = \frac{35.355}{200} = 0.1768$

$\Rightarrow \alpha = 79° 49'$

$\therefore \overrightarrow{v_A} = 0\vec{i} + (200(0.9843) - 35.355)\vec{j}$

$= 161.505\vec{j}$

$= 161.5$ km/h