Q. 10. $\overrightarrow{v_{PW}} = 100\vec{i}$

$\overrightarrow{v_W} = -10\vec{j}$

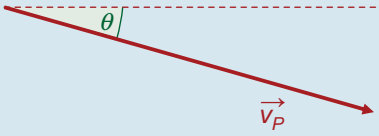
$\Rightarrow \overrightarrow{v_P} = 100\vec{i} - 10\vec{j}$

Speed $= |\overrightarrow{v_P}|$

$= \sqrt{100^2 + (-10)^2}$

$= 10\sqrt{101}$

$= 100.5$ m/s



$\tan\theta = \frac{10}{100}$

$= \frac{1}{10}$

$\Rightarrow \theta = 5.71°$

$= 5°43'$

$\Rightarrow 5°43'$ S of E

Q. 11. Upstream:

$\overrightarrow{v_C} = \overrightarrow{v_{CR}} + \overrightarrow{v_R}$

$= -5\vec{i} + (3\vec{i})$

$= -2\vec{i}$

Time $= \frac{80}{2}$

$= 40$ s

Downstream:

$\overrightarrow{v_C} = 5\vec{i} + 3\vec{i}$

$= 8\vec{i}$

Time $= \frac{80}{8}$

$= 10$ s

Total time $= 40 + 10 = 50$ s

Lake: Total time $= \frac{80}{5} + \frac{80}{5}$

$= 32$ s

which is 18 seconds less

Q. 12. Still water: Time $= \frac{\text{distance}}{\text{speed}}$

$= \frac{960}{8} = 120$ s

Current: A to B: Time $= \frac{\text{distance}}{\text{speed}}$

$= \frac{480}{10}$

$= 48$ s

Current: B to A: Time $= \frac{\text{distance}}{\text{speed}}$

$= \frac{480}{6}$

$= 80$ s

Total time $= 48 + 80$

$= 128$ s

$\Rightarrow$ It takes 8 seconds longer when there is a current of 2 m/s from A to B.

Q. 13. (i) $\overrightarrow{v_R} = 12\vec{i}$

$\overrightarrow{v_{BR}} = 5\vec{j}$

$\overrightarrow{v_B} = \overrightarrow{v_{BR}} + \overrightarrow{v_R}$

$= 12\vec{i} + 5\vec{j}$ m/s

Magnitude: $|\overrightarrow{v_B}| = \sqrt{12^2 + 5^2}$

$= 13$ m/s

(ii) Time $= \frac{\text{distance}}{\text{speed}}$

$= \frac{240}{5}$

$= 48$ s

Distance downstream:

speed downstream $\times$ time

$= 12 \times 48$

$= 576$ m

Q. 14. $v = \sqrt{15^2 + 8^2}$

$= 17$ m/s

Q. 15. (i) $\overrightarrow{v_R} = 7\vec{i}$

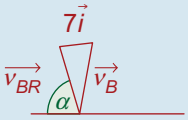
$\overrightarrow{v_{BR}} = -25\cos\alpha\vec{i} + 25\sin\alpha\vec{j}$

$\therefore \overrightarrow{v_B} = (7 - 25\cos\alpha)\vec{i} + 25\sin\alpha\vec{j}$

$7 - 25\cos\alpha = 0$

$\Rightarrow \cos\alpha = \frac{7}{25}$

$\Rightarrow \sin\alpha = \frac{24}{25}$



Since $\cos\alpha = \frac{7}{25}$

$= 0.28$

$\alpha = 73°44'$

(ii) $v_B = 0\vec{i} + 25\left|\frac{24}{25}\right|\vec{j}$

$= 24\vec{j}$

Time $= \frac{120}{24}$

$= 5$ s