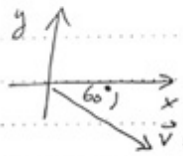
ANSWER QUESTION 1 ONLY

(a)(i) For $t \leq 3$ hours



$v_x = 60 \cos 60^\circ$ km hr^{-1}

$= 60 \times \frac{1}{2} = 30$ km hr^{-1}

$v_y = -60 \sin 60^\circ$ km hr^{-1}

$= -60 \frac{\sqrt{3}}{2} = -30\sqrt{3}$ km hr^{-1}

$\therefore$ Position at $t = 3$ hr: $x_1 = v_x t = 30 \times 3 = 90$ km

$y_1 = v_y t = -30\sqrt{3} \times 3 = -90\sqrt{3}$ km

For $3 \leq t \leq 5$ hour car is stationary

For $5 \leq t \leq 6\frac{1}{2}$ hours $v_x = 0$ $v_y = 90$ km hr^{-1}

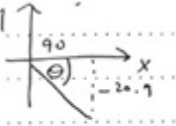
During this time car moves a distance $x_2 = 0$ $y_2 = v_y t = 90 \times 1.5 = 135$ km

$\therefore$ Total displacement $x^{tot} = x_1 + x_2 = 90$ km $y^{tot} = y_1 + y_2 = -90\sqrt{3} + 135$ km

$= -20.9$ km

(ii) Magnitude of $\vec{r}^{tot}$: $r^{tot} = \sqrt{(x^{tot})^2 + (y^{tot})^2} = \sqrt{90^2 + (-20.9)^2} = 92.4$ km

Direction of $\vec{r}^{tot}$:



$\tan\theta = 20.9/90$

$\Rightarrow \theta = 13^\circ$ south of East

(iii) Average velocity = $\frac{\text{total displacement}}{\text{total time}} = \frac{\vec{r}^{tot}}{(3+2+1.5)}$

Magnitude $\bar{v} = \frac{92.4}{6.5} = 14.2$ km hr^{-1}

Direction of $\vec{v}$ is same as direction of $\vec{r}^{tot}$

13° south of East