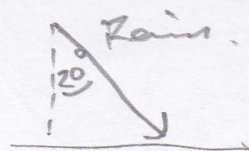
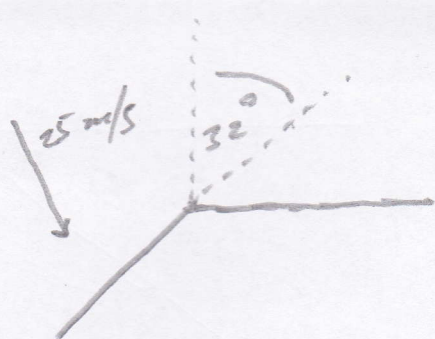


2012 Q2.

(a)



$$\vec{V}_r = 25 \sin 20^\circ \vec{i} - 25 \cos 20^\circ \vec{j}$$

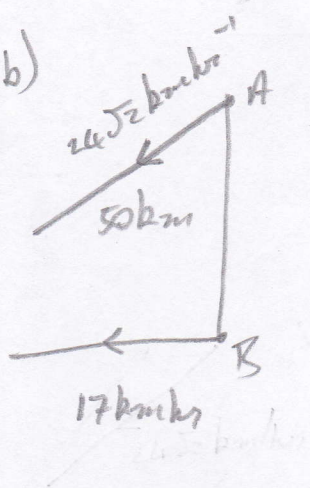
$$\vec{V}_c = -20 \vec{i}$$

$$\vec{V}_{rc} = \vec{V}_r - \vec{V}_c = (25 \sin 20^\circ + 20) \vec{i} + 25 \cos 20^\circ \vec{j}$$

$$\alpha = \tan^{-1} \left(\frac{25 \sin 20^\circ + 20}{25 \cos 20^\circ} \right) + 32$$

$$= 82.55^\circ$$

(b)



$$\begin{aligned} \vec{V}_A &= -24\sqrt{2} \cos 45^\circ \vec{i} - 24\sqrt{2} \sin 45^\circ \vec{j} \\ &= -24 \vec{i} - 24 \vec{j} \end{aligned}$$

$$\vec{V}_B = -17 \vec{i}$$

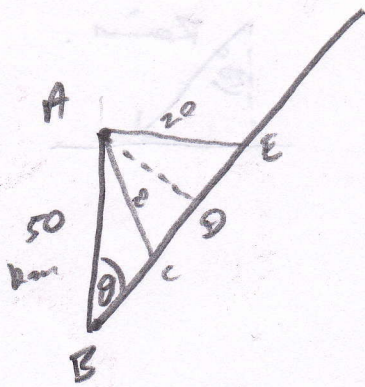
$$\vec{V}_{BA} = \vec{V}_B - \vec{V}_A$$

$$= (-17 + 24) \vec{i} + 24 \vec{j}$$

$$= 7 \vec{i} + 24 \vec{j}$$

$$|\vec{V}_{BA}| = \sqrt{7^2 + 24^2} = 25 \text{ km/hr}^{-1}$$

$$\tan^{-1} \left(\frac{7}{24} \right) = \theta \text{ see Over.}$$



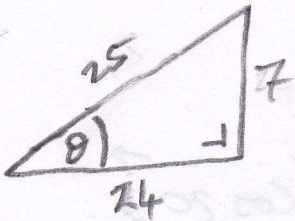
$$|AD| = 50 \sin \theta$$

$$= 50 \left(\frac{7}{25} \right)$$

$$= 14 \text{ km}$$

$$\Rightarrow |CD| = \sqrt{20^2 - 14^2}$$

$$= 14.2829 \text{ km}$$



$$|BC| = |BD| - |CD|$$

$$= 50 \cos \theta - 14.2829$$

$$= 50 \left(\frac{24}{25} \right) - 14.2829$$

$$= 33.7171 \text{ km}$$

$$s = \frac{D}{T}$$

$$\text{Time} = \frac{\text{Dist}}{\text{Speed}} = \frac{33.7171}{25} = 1.3487$$

\Rightarrow Time they can start signalling = 13 hrs 21 min.
or 1:21 PM.

$$(ii) |CE| = 2|CD| = 28.5658 \text{ km}$$

$$\text{Time} = \frac{\text{Dist}}{\text{Speed}} = \frac{28.5658}{25}$$

$$= 1.1426$$

$$= 1 \text{ hr } 9 \text{ min}$$