

$$|\vec{v}_A| = 16 \quad |\vec{v}_{AB}| = 16 \quad |\vec{v}_B| = v$$

$$\tan \theta = \frac{4}{3} \Rightarrow \sin \theta = \frac{4}{5}, \quad \cos \theta = \frac{3}{5}$$

Euler

$$\vec{v}_{AB} = \vec{v}_A - \vec{v}_B$$

OR

velocity triangle

$$\Rightarrow 16 \cos \alpha \hat{i} - 16 \sin \alpha \hat{j} = 16 \cos \theta \hat{i} - 16 \sin \theta \hat{j} - (v \hat{i})$$

$$16 \cos \alpha \hat{i} - 16 \sin \alpha \hat{j} = -9.6 \hat{i} - 12.8 \hat{j} + v \hat{i}$$

(i)  $16 \cos \alpha = -9.6 + v$

(ii)  $-16 \sin \alpha = -12.8$

$$\Rightarrow \sin \alpha = \frac{12.8}{16} = \frac{4}{5}$$

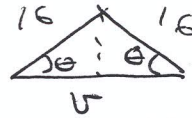
as  $|\alpha| < 90^\circ \Rightarrow \alpha = \theta$

(i)  $\Rightarrow \cos \alpha = \cos \theta = \frac{3}{5}$

$$\Rightarrow 16 \left(\frac{3}{5}\right) = -9.6 + v$$

$$\Rightarrow 9.6 = -9.6 + v$$

$$\Rightarrow v = 19.2 \text{ ms}^{-1}$$

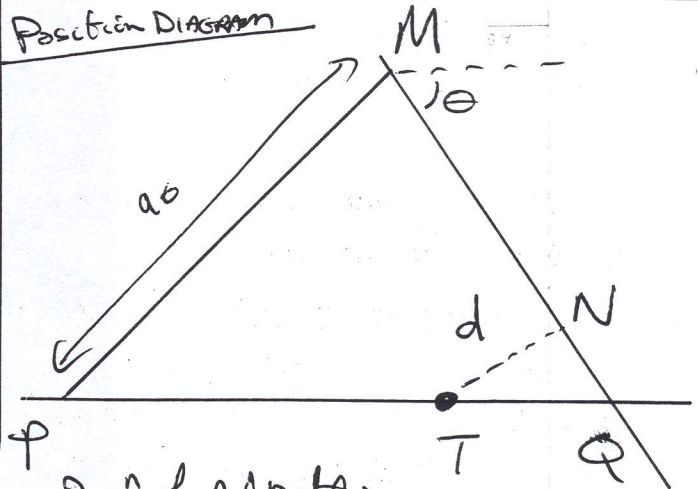


$$\Rightarrow \frac{v}{2} = 16 \cos \theta$$

$$\Rightarrow \frac{v}{2} = 32 \left(\frac{3}{5}\right)$$

$$\Rightarrow v = 19.2 \text{ ms}^{-1}$$

Position Diagram



Dir<sup>n</sup> of Rel path:

$$\vec{v}_{AB} = 16 \cos \theta \hat{i} - 16 \sin \theta \hat{j}, \quad \text{EoS, } \tan \theta = \frac{4}{3}$$

SHORTEST DISTANCE  $|TN| = d$

$$d = |PQ| \sin \theta$$

Find  $|PQ|$ :  $|PQ| = \frac{96}{\sin \theta}$

$$\sin(80-20) = \sin 2\theta = 2 \sin \theta \cos \theta$$

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$$= 2 \left(\frac{4}{5}\right) \left(\frac{3}{5}\right)$$

$$= \frac{24}{25} \quad \text{|||}$$

$$|PQ| = \frac{25}{24} \cdot \frac{96}{\frac{4}{5}} = \frac{25 \cdot 96 \cdot 5}{24 \cdot 4}$$

$$= 115.2 \text{ metres}$$

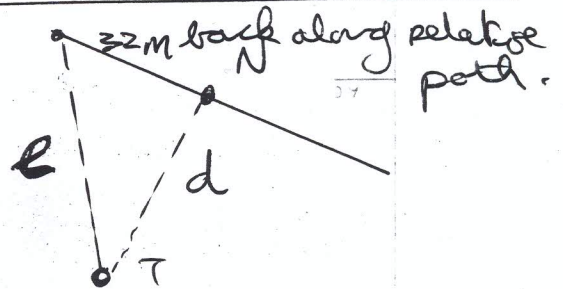
$$|TQ| = 115.2 - 38.4$$

$$= 76.8 \text{ metres}$$

$$\Rightarrow d = (76.8) \left(\frac{4}{5}\right) = 61.44$$

shortest distance = 61.44

Find distance 2 seconds before the shortest distances.



2 secs  $\Rightarrow 2(16)$  m back along.

$\therefore$  Pythagoras  $\Rightarrow$

$$l^2 = d^2 + 32^2$$

$$l^2 = (61.44)^2 + 32^2$$

$$l^2 = 3775 + 1024$$

$$l^2 = 4799$$

$$l = 69.3 \text{ m}$$

$$\Rightarrow l = 69 \text{ m to nearest metre}$$