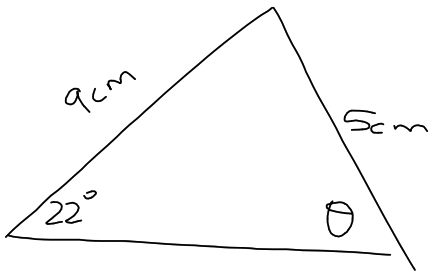
4

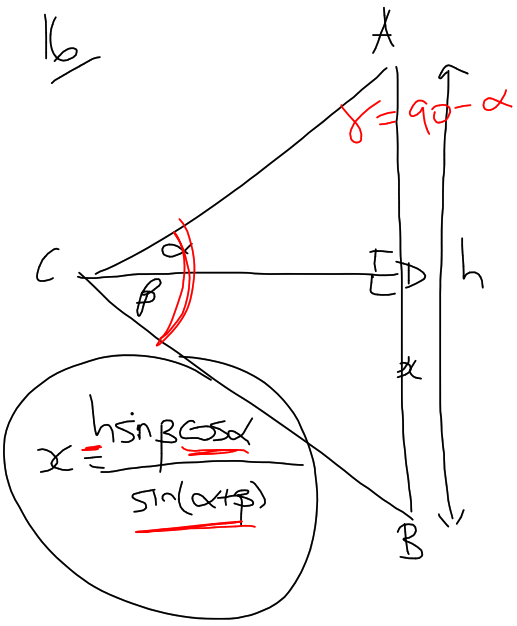


$$\frac{\sin\theta}{9} = \frac{\sin 22}{5}$$

$$\sin\theta = \frac{9\sin 22}{5}$$

$$\theta = 42^\circ \text{ or } 138^\circ$$

16.



$$x = \frac{h \sin\beta \cos\alpha}{\sin(\alpha+\beta)}$$

$$\frac{x}{BC} = \sin\beta$$

$$x = BC \sin\beta$$

$$x = \frac{h \cos\alpha \sin\beta}{\sin(\alpha+\beta)}$$

$$BC = \frac{h\cos\alpha}{\sin(\alpha+\beta)}$$

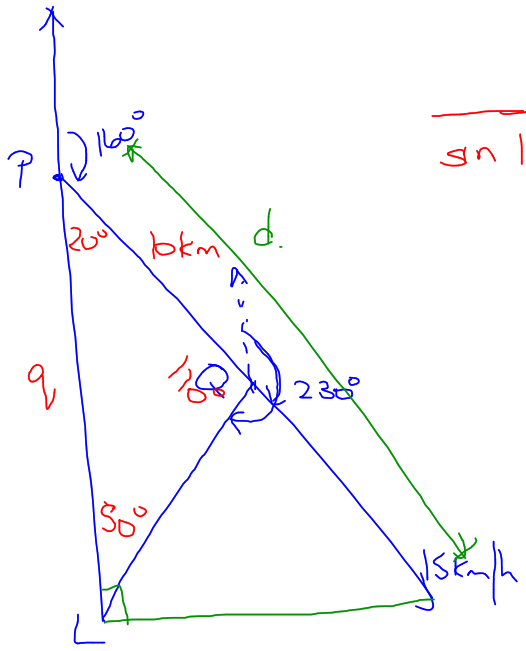
$$\frac{BC}{\sin\gamma} = \frac{h}{\sin(\alpha+\beta)}$$

$$BC = \frac{h\sin\gamma}{\sin(\alpha+\beta)}$$

$$= \frac{h\sin(90-\alpha)}{\sin(\alpha+\beta)}$$

$$= \frac{h\cos\alpha}{\sin(\alpha+\beta)}$$

18



$$\frac{q}{\sin 110^\circ} = \frac{10}{\sin 50^\circ}$$

$$q = \frac{10 \sin 110^\circ}{\sin 50^\circ}$$

$$= 12.266815969905678\ldots$$

$$= 12 \text{ km}$$

$$\frac{q}{d} = \cos 20^\circ$$

$$d = \frac{q}{\cos 20^\circ}$$

$$= \frac{10 \sin 110^\circ}{\sin 50^\circ \cos 20^\circ}$$

$$= 13.054072\ldots$$

$s = \frac{d}{t}$

$t = \frac{d}{s}$

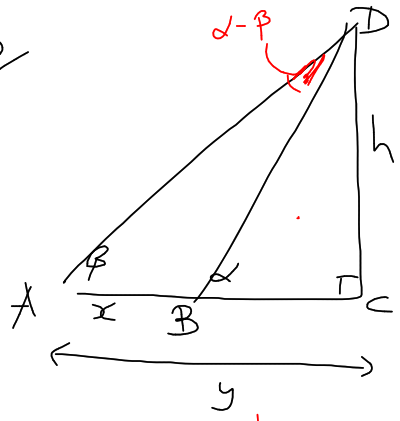
$= \frac{d}{15}$

$= 0.8702\ldots \text{ hrs}$

$= 52.21\ldots$

$\therefore$ at 9:52

2/



$$h = \frac{x \sin\alpha \sin\beta}{\sin(\alpha-\beta)}$$

$$\frac{BD}{\sin\beta} = \frac{x}{\sin(\alpha-\beta)}$$

$$BD = \frac{x\sin\beta}{\sin(\alpha-\beta)}$$

$$\frac{h}{BD} = \sin\alpha$$

$$h = BD\sin\alpha$$

$$h = \frac{x\sin\beta\sin\alpha}{\sin(\alpha-\beta)}$$

20b)

$$\tan\alpha = \frac{h}{y-x} \qquad \tan\beta = \frac{h}{y} \Rightarrow y = \frac{h}{\tan\beta}$$

show $h = \dfrac{x\tan\alpha\tan\beta}{\tan\alpha - \tan\beta}$

$$\tan\alpha = \frac{h}{\frac{h}{\tan\beta} - x}$$

$$= \frac{h\tan\beta}{h - x\tan\beta}$$

$$h\tan\alpha - x\tan\alpha\tan\beta = h\tan\beta$$

$$h\tan\alpha - h\tan\beta = x\tan\alpha\tan\beta$$

$$h(\tan\alpha - \tan\beta) = x\tan\alpha\tan\beta$$

$$h = \frac{x\tan\alpha\tan\beta}{\tan\alpha - \tan\beta}$$

c) $h = \dfrac{x\sin\alpha\sin\beta}{\sin(\alpha-\beta)}$ $\qquad h = \dfrac{x\tan\alpha\tan\beta}{\tan\alpha-\tan\beta}$

$$\frac{x\sin\alpha\sin\beta}{\sin(\alpha-\beta)} = \frac{x\tan\alpha\tan\beta}{\tan\alpha-\tan\beta}$$

$$\sin(\alpha-\beta) = \frac{(\tan\alpha-\tan\beta)\sin\alpha\sin\beta}{\tan\alpha\tan\beta}$$

$$= \frac{\sin\alpha}{\tan\beta}\times\sin\beta - \frac{\sin\alpha}{\tan\alpha}\times\sin\beta$$

$$= \frac{\sin\alpha\cos\beta}{\sin\beta}\times\sin\beta - \frac{\sin\alpha\cos\alpha}{\sin\alpha}\times\sin\beta$$

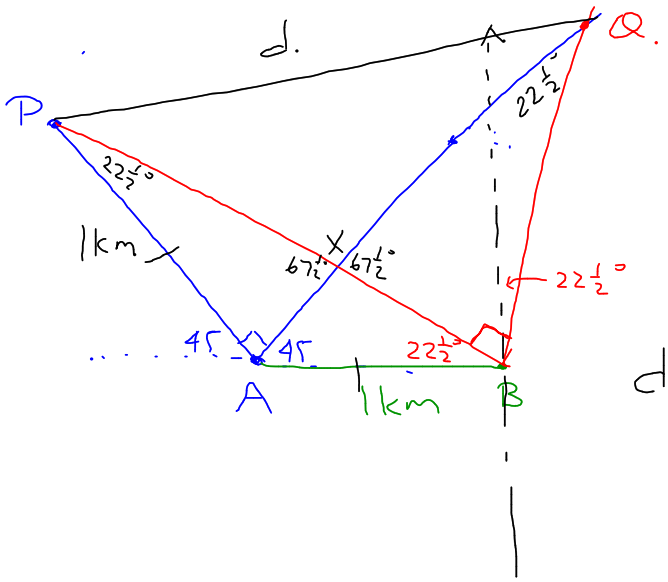
$$= \sin\alpha\cos\beta - \cos\alpha\sin\beta$$

$$\sin(60 - 45) = \sin 60 \cos 45 - \cos 60 \sin 45$$

$$\sin 15^\circ = \frac{\sqrt{3}}{2} \times \frac{1}{\sqrt{2}} - \frac{1}{2} \times \frac{1}{\sqrt{2}}$$

$$= \frac{\sqrt{3} - 1}{2\sqrt{2}}$$

22



$$\frac{AQ}{\sin 112\frac{1}{2}} = \frac{1}{\sin 22\frac{1}{2}°}$$

$$AQ = \frac{\sin 112\frac{1}{2}°}{\sin 22\frac{1}{2}°}$$

$$d^2 = 1^2 + AQ^2$$

$$= 1 + \left(\frac{\sin 112\frac{1}{2}}{\sin 22\frac{1}{2}}\right)^2$$

$$d = 2.61 \text{ km}$$