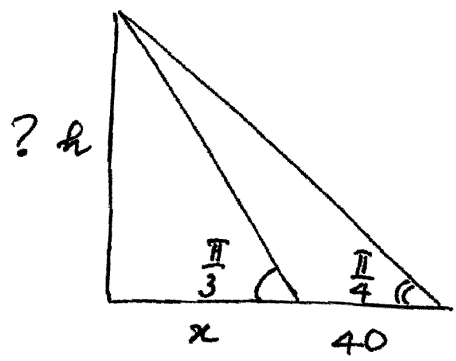


Problem 3

①

(a)



Label the sides and the angle as in the picture.

By definition of tan, we have:

$$\frac{h}{x} = \tan \frac{\pi}{3} = \sqrt{3} \quad (1)$$

$$\text{and } \frac{h}{x+40} = \tan \frac{\pi}{4} = 1 \quad (2)$$

From (1) and (2), $h = \sqrt{3} x = x + 40$.

Solving this equation for x we get:

$$\sqrt{3} x - x = 40$$

$$(\sqrt{3} - 1) x = 40$$

$$x = \frac{40}{\sqrt{3} - 1} \quad \text{feet}$$

$$\begin{aligned} &= \frac{40(\sqrt{3} + 1)}{3 - 1} \\ &= 20\sqrt{3} + 20 \quad \text{feet} \end{aligned}$$

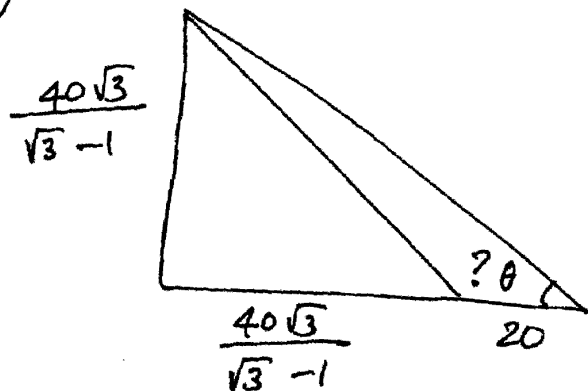
Optional

Using (1) again, ~~the~~ we get the height of the building:

$$h = \sqrt{3} x = \frac{40\sqrt{3}}{\sqrt{3} - 1} \text{ feet (or } 60 + 20\sqrt{3}\text{)}$$

$$\boxed{h = \frac{40\sqrt{3}}{\sqrt{3} - 1} \text{ feet}} \leftarrow \text{final answer}$$

(6)



We need to find θ . By tangent rule,

$$\tan \theta = \frac{\frac{40\sqrt{3}}{\sqrt{3}-1}}{\frac{40\sqrt{3}}{\sqrt{3}-1} + 20}$$

$$\tan \theta = \frac{\frac{40\sqrt{3}}{\sqrt{3}-1}}{\frac{60\sqrt{3}-20}{\sqrt{3}-1}}$$

$$\tan \theta = \frac{40\sqrt{3}}{60\sqrt{3}-20} \left[= \frac{2\sqrt{3}}{3\sqrt{3}-1} \right] \text{ optional}$$

So

$$\theta = \tan^{-1} \left(\frac{40\sqrt{3}}{60\sqrt{3}-20} \right) \leftarrow \text{final answer}$$

(2)