1a $-\pi/5$

1b Undefined.

1c $\sqrt{5}/2$

1d We have

$$\theta = \cos^{-1}\left(\sin\tfrac{7\pi}{6}\right) \;\Rightarrow\; \cos\theta = \sin\tfrac{7\pi}{6} = \cos\left(\tfrac{\pi}{2} - \tfrac{7\pi}{6}\right) = \cos\tfrac{2\pi}{3} \;\Rightarrow\; \theta = \tfrac{2\pi}{3}.$$

2a We have $\sin\theta = \pm\tfrac{1}{\sqrt{2}}$, and so $\theta = \tfrac{\pi}{4}, \tfrac{3\pi}{4}, \tfrac{5\pi}{4}, \tfrac{7\pi}{4}$.

2b So $\tan\theta = -1$, giving $\theta = \tfrac{3\pi}{4}, \tfrac{7\pi}{4}$.

2c Write $4 + 4\sin\theta = 1 - \sin^2\theta$, so $(\sin\theta + 3)(\sin\theta + 1) = 0$, which implies $\sin\theta = -1$, or $\theta = \tfrac{3\pi}{2}$.

3a We have

$$1 - \frac{\sin^2\theta}{1 - \cos\theta} = 1 - \frac{1 - \cos^2\theta}{1 - \cos\theta} = 1 - \frac{(1 - \cos\theta)(1 + \cos\theta)}{1 - \cos\theta} = 1 - (1 + \cos\theta) = -\cos\theta.$$

3b We have

$$\sin\theta\tan\theta = \frac{\sin^2\theta}{\cos\theta} = \frac{1 - \cos^2\theta}{\cos\theta} = \frac{1}{\cos\theta} - \frac{\cos^2\theta}{\cos\theta} = \sec\theta - \cos\theta.$$

4 The expression becomes $\cos\left(\tfrac{5\pi}{12} + \tfrac{7\pi}{12}\right) = \cos\pi = -1$.

5 With a half-angle identity,

$$\cos 22.5° = \sqrt{\frac{1 + \cos 45°}{2}} = \sqrt{\frac{1 + 1/\sqrt{2}}{2}} = \frac{\sqrt{2 + \sqrt{2}}}{2}.$$

6 $\cos^4\theta - \sin^4\theta = (\cos^2\theta - \sin^2\theta)(\cos^2\theta + \sin^2\theta) = \cos^2\theta - \sin^2\theta = \cos(2\theta).$

7 This sets up a right triangle with legs of length 12 and 3, and so if the angle of depression is θ, we have

$$\tan\theta = -\frac{3}{12} \quad\Rightarrow\quad \theta = \tan^{-1}(-0.25) = -14.0°.$$

8 Let h be the height of the monument. Then

$$\tan 35.1° = \frac{h}{789} \quad\Rightarrow\quad h = 789\tan 35.1° \approx 554.5 \text{ ft}$$

9a $B = 110°$ is immediate, and with the Law of Sines we find that $b = 3.68$ and $c = 1.34$.

9b Use the Law of Sines again to get one triangle with $a = 6.21$, $A = 86.5°$, $C = 53.5°$, and another triangle with $a = 1.45$, $A = 13.5°$, $C = 126.5°$.

9c Use Law of Cosines twice to get $A = 33.6°$, $B = 62.2°$, $C = 84.3°$.

10 Use the Law of Cosines to find that the guy wires should be 520.1 ft and 499.5 ft.