

7. 13.13, $17^\circ 27'$, $23^\circ 35'$, $138^\circ 58'$.
 8. 108.25. 9. 52.5. 10. $\frac{1}{2} \sqrt{2c^2 + 2a^2 - b^2}$.
 11. $\sin \varphi = 4\Delta / b \sqrt{2c^2 + 2a^2 - b^2}$; etc.
 17. 1168.5 yds. 18. 18.3 ft. 19. 23 m. 1379.8 ft.

EXERCISE XII.

1. 26.31; $25^\circ 42'$ with the greater force.
 2. 100. 3. $\theta = 75^\circ 31'$; $\varphi = 28^\circ 57'$.
 4. 0.8962 f ; 0.4436 f , where f is force along the string.
 5. 0.9316.

EXERCISE XIII.

1. $w \tan \theta$; $w \sec. \theta$. 2. $\frac{w \sin \theta}{\sin (45^\circ - \theta)}$; $\frac{w \sin 45^\circ}{\sin (45^\circ - \theta)}$
 3. (a) 100.38 lbs.; 8.75 lbs. (b) 99.62 lbs.; 8.72 lbs.
 4. 75.59 lbs.; 56.69 lbs. 5. $10 \tan \theta$.

EXERCISE XIV.

5. $\frac{\sqrt{3}-1}{2\sqrt{2}}$, $\frac{\sqrt{3}+1}{2\sqrt{2}}$. 6. $\frac{1}{6}(2\sqrt{2}+\sqrt{3})$, $\frac{1}{6}(2\sqrt{6}-1)$.
 9. 174.1 ft. 11. $\frac{\sqrt{3}-1}{\sqrt{3}+1}$, $\frac{\sqrt{3}+1}{\sqrt{3}-1}$.
 12. $\frac{3 \tan \theta - \tan^3 \theta}{1 - 3 \tan^2 \theta}$.
 13. $\frac{\tan A + \tan B + \tan C - \tan A \tan B \tan C}{1 - \tan A \tan B - \tan B \tan C - \tan C \tan A}$.

EXERCISE XV.

1. 0.0738; 0.0740.
 3. (i) 60° . (ii) $\frac{1}{2} r^2 \tan \theta (1 + \cos \theta)$.