

MATHEMATICS.

Solutions to Papers in June Number.

TRIGONOMETRY.

$$\begin{aligned} 1. \text{ Log. } 175 &= \log. \frac{700}{4} = \log. 700 - \log. 4 \\ &= \log. 700 - 2 \log. 2 = 2.8451 - .60206 \\ &= 2.24304 \\ \text{Log. } 6860 &= 3.83632. \end{aligned}$$

$$\begin{aligned} 2. \text{ Log. of the square root of } \frac{\sqrt[3]{3} \sqrt[3]{577}}{49 \sqrt{686}} \\ &= \frac{1}{2} \log. \frac{\sqrt[3]{3} \sqrt[3]{577}}{49 \sqrt{686}} \\ &= \frac{1}{2} \log. \sqrt[3]{3} + \frac{1}{2} \log. \sqrt[3]{577} - \frac{1}{2} \log. 49 \\ &\quad - \frac{1}{2} \log. \sqrt{686} \\ &= \frac{1}{2} \log. 3 + \frac{1}{6} \log. 577 - \log. 7 - \frac{1}{2} \log. 686 \\ &= \frac{1}{2} \text{ of } .47712 + \frac{1}{6} \text{ of } 2.76118 - .8451 - \frac{1}{2} \text{ of } 2.83632 \\ &= 1.025296 \end{aligned}$$

$$\begin{aligned} \text{Log. } \frac{\sqrt{.002}}{\sqrt[3]{.07}} &= \frac{1}{2} \log. .002 - \frac{1}{3} \log. .07 \\ &= \frac{1}{2} \text{ of } 3.30103 - \frac{1}{3} \text{ of } 2.8451 \\ &= 2.650515 - 1.61503 \\ &= 1.035485. \end{aligned}$$

$$\begin{aligned} 7. \text{ Cos } e &= \cos \frac{2e}{2} - \sin \frac{2e}{2} \\ &= \left\{ 1 - \tan^2 \frac{e}{2} \right\} \cos \frac{e}{2} \\ &= \frac{1 - \tan^2 \frac{e}{2}}{\sec^2 \frac{e}{2}} \\ &= \frac{1 - \tan^2 \frac{e}{2}}{1 + \tan^2 \frac{e}{2}} \\ &= \frac{\sin 45 + a \sin 45 - a}{\sin 45 + a \sin 45 - a} \end{aligned}$$

$$\begin{aligned} &= \sin^2 45 - \sin^2 a \\ &= \frac{1}{2} - \sin^2 a \\ &= \frac{1}{2} (1 - 2 \sin^2 a) \\ &= \frac{1}{2} \cos 2a \\ &= \sin^2 e - \sin^2 a \\ &= \sin^2 e - \sin^2 e \sin^2 a \\ &\quad + \sin^2 e \sin^2 a - \sin^2 a \\ &= \sin^2 e (1 - \sin^2 a) \\ &\quad + \sin^2 a (1 - \sin^2 e) \\ &= \sin^2 e \cos^2 a - \sin^2 a \cos^2 e \\ &= (\sin e \cos a + \cos e \sin a) \\ &\quad \times (\sin e \cos a - \cos e \sin a) \\ &= \sin (e + a) \sin (e - a) \\ &= \frac{\sin a + \sin 3a}{\cos a + \cos 3a} \\ &= \frac{\sin a + 3 \sin a - 4 \sin^3 a}{\cos a - 3 \cos a + 4 \cos^3 a} \\ &= \frac{\sin a}{\cos a} \frac{2 - 2 \sin^2 a}{2 \cos^2 a - 1} \\ &= \frac{\sin a}{\cos a} \frac{2 \cos^2 a}{\cos 2a} \\ &= \frac{2 \sin a \cos a}{\cos 2a} = \tan 2a \\ &= \tan 67^\circ 30' = \tan \frac{135}{2} \\ &= \frac{\sin 135}{1 + \cos 135} = 1 + \sqrt{2} \end{aligned}$$