

STEP II, 2002, Q1

1 Show that

$$\int_{\pi/6}^{\pi/4} \frac{1}{1 - \cos 2\theta} d\theta = \frac{\sqrt{3}}{2} - \frac{1}{2}.$$

By using the substitution $x = \sin 2\theta$, or otherwise, show that

$$\int_{\sqrt{3}/2}^1 \frac{1}{1 - \sqrt{(1-x^2)}} dx = \sqrt{3} - 1 - \frac{\pi}{6}.$$

Hence evaluate the integral

$$\int_1^{2/\sqrt{3}} \frac{1}{y(y - \sqrt{(y^2 - 1^2)})} dy.$$



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