# I3 WITH RCOS QUESTIONS

**1** **(i)** Express $\cos\theta + (\sqrt{3})\sin\theta$ in the form $R\cos(\theta - \alpha)$, where $R > 0$ and $0 < \alpha < \frac{1}{2}\pi$, giving the exact values of $R$ and $\alpha$. [3]

**(ii)** Hence show that $\displaystyle\int_0^{\frac{1}{2}\pi} \frac{1}{\left(\cos\theta + (\sqrt{3})\sin\theta\right)^2}\,\mathrm{d}\theta = \frac{1}{\sqrt{3}}$. [4]

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**2** **(i)** Express $4\cos\theta + 3\sin\theta$ in the form $R\cos(\theta - \alpha)$, where $R > 0$ and $0 < \alpha < \frac{1}{2}\pi$. Give the value of $\alpha$ correct to 4 decimal places. [3]

**(ii)** Hence

**(a)** solve the equation $4\cos\theta + 3\sin\theta = 2$ for $0 < \theta < 2\pi$, [4]

**(b)** find $\displaystyle\int \frac{50}{(4\cos\theta + 3\sin\theta)^2}\,\mathrm{d}\theta$. [3]

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3 **(i)** Express $(\sqrt{3})\cos\boldsymbol{x} + \sin\boldsymbol{x}$ in the form $\boldsymbol{R}\cos(\boldsymbol{x} - \alpha)$, where $\boldsymbol{R} > 0$ and $0 < \alpha < \frac{1}{2}\pi$, giving the exact values of $\boldsymbol{R}$ and $\alpha$. [3]

**(ii)** Hence show that

$$\int_{\frac{1}{6}\pi}^{\frac{1}{2}\pi} \frac{1}{\left((\sqrt{3})\cos\boldsymbol{x} + \sin\boldsymbol{x}\right)^2}\,\mathrm{d}\boldsymbol{x} = \tfrac{1}{4}\sqrt{3}.$$ [4]

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4 **Throughout this question the use of a calculator is not permitted.**

**(i)** Express $\cos\theta + 2\sin\theta$ in the form $R\cos(\theta - \alpha)$, where $R > 0$ and $0 < \alpha < \frac{1}{2}\pi$. Give the exact values of $R$ and $\tan\alpha$. [3]

**(ii)** Hence, showing all necessary working, show that $\displaystyle\int_0^{\frac{1}{4}\pi} \frac{15}{(\cos\theta + 2\sin\theta)^2}\,\mathrm{d}\theta = 5$. [5]

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