Exercise 3

Paper 2 style · Graphic display calculator

3 7 marks AHL 3.9 ●●○ Typical

Consider the equation $3\cot^2 x + 2\operatorname{cosec} x = 5$, for $0 < x < 2\pi$, $x \neq \pi$.

(a) Show that the equation can be written as $3\operatorname{cosec}^2 x + 2\operatorname{cosec} x - 8 = 0$. **[2]**

(b) Hence solve the equation. **[5]**

The markscheme is on the next page: try the question first. Written and verified by a practising IB mathematics teacher, produced with AI assistance; solved twice and recomputed by software. Not affiliated with or endorsed by the International Baccalaureate Organization.
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MARKSCHEME (a)

$3\left(\operatorname{cosec}^2 x - 1\right) + 2\operatorname{cosec} x = 5$ **M1**

$3\operatorname{cosec}^2 x + 2\operatorname{cosec} x - 8 = 0$ **A1**

Total 2 marks

Note Using $\cot^2 x = \operatorname{cosec}^2 x - 1$.

Note AG.

MARKSCHEME (b)

$\operatorname{cosec} x = \frac{4}{3}$ or $\operatorname{cosec} x = -2$ **(M1)A1**

$\sin x = \frac{3}{4}$ or $\sin x = -\frac{1}{2}$ **M1**

$x = 0.848,\ x = 2.29$ **A1**

$x = 3.67,\ x = 5.76$ **A1**

Total 5 marks

Note $(3\operatorname{cosec} x - 4)(\operatorname{cosec} x + 2) = 0$.

Note Exact values $\frac{7\pi}{6}$ and $\frac{11\pi}{6}$ also accepted.