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A LEVEL MATHS

# (31) Equations and Identities using sec $x$, cosec $x$ & cot $x$

## WORKING AT D/E

(1) Write each of the following in terms of $\sec\theta$.

(a) $\frac{1}{\cos^2\theta}$ (b) $\frac{4}{\cos 3\theta}$

Write each of the following in terms of $\operatorname{cosec}\theta$.

(c) $\frac{1}{\sin^2\theta}$ (d) $\frac{5}{\sin 2\theta}$

Write each of the following in terms of $\cot\theta$.

(e) $\frac{3}{\tan^2\theta}$ (f) $\frac{\cos 4\theta}{\sin 4\theta}$

(2) (a) Simplify $\cos x \operatorname{cosec}\sec x$

(b) Hence, find the 2 solutions for
$\cos x \operatorname{cosec}\sec x = 1, \quad 0 < x < 360$

(3) Show that there are 4 solutions to the equation
$\sec^2 x = 4, \quad 0 < x < 360$

## WORKING AT B/C

(1) (a) Show that $\operatorname{cosec} 2\theta \tan 2\theta \equiv \sec 2\theta$

(b) Hence, solve the equation

$$\operatorname{cosec} 2\theta \tan 2\theta = \sqrt{2}, \quad 0 \le \theta \le 2\pi,$$

giving your answers as multiples of $\pi$

(2) Show that

$$\frac{(\cos x + \sin x)^2}{\cos x} \equiv \sec x + 2\sin x$$

(3) (a) Show that, if $\cot^2\theta - 2\cot\theta - 8 = 0$, then $\tan\theta = 0.25$ or $\tan\theta = -0.5$.

(b) Hence, solve the equation

$$\cot^2\theta - 2\cot\theta - 8 = 0\ , \quad 0 < \theta < 360$$

Give your answers to 3SF.

## WORKING AT A*/A

(1) Show that there are no solutions to the equation
$20\operatorname{cosec}^2\theta + 7\operatorname{cosec}\theta = 6, \quad 0 \le \theta \le 2\pi$

(2) Given that $\cot p = \frac{4}{3}$ where $p$ is a reflex angle measure in radians, find the value of:

(a) $\cos^2 p$

(b) $\operatorname{cosec}^2 p$

(c) $\sin p$

(d) $\sin\left(\frac{\pi}{2} - p\right)$

(3) (a) Show that

$$(\cot x + \tan x)^2 \equiv \operatorname{cosec}^2 x \sec^2 x$$

(b) Hence, or otherwise, show that there are no solutions to the equation $(\cot x + \tan x)^2 = 0$, $0 \le x \le 360$