

C3 Counter Example & Trig Questions

Specimen

5. Showing all your working, find the values of θ between 0° and 360° satisfying

$$\cot^2 \theta = 7 - 2 \operatorname{cosec} \theta. \quad [7]$$

2005 Summer

3. (a) Show, by counter-example, that the statement

$$\cot^2 \theta \equiv 1 + \operatorname{cosec}^2 \theta \quad [2]$$

is false.

- (b) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$10 \sec^2 \theta = 11 \tan \theta + 16. \quad [6]$$

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2006 Winter

2. (a) Show, by counter-example, that the statement

$$\tan 2\theta \equiv 2 \tan \theta$$

is false. [2]

- (b) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$4 \cot^2 \theta = 11 - 4 \operatorname{cosec} \theta. \quad [6]$$

2006 Summer

2. (a) Show, by counter-example, that the statement

$$\cos(a + b) \equiv \cos a + \cos b$$

is false.

[2]

- (b) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$7 - \sec^2\theta = \tan^2\theta + \tan\theta.$$

[6]

2007 Winter

2. (a) Show, by counter-example, that the statement

$$\cos 3\theta \equiv 3 \cos^3\theta - 4 \cos\theta$$

is false.

[2]

- (b) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$\tan^2\theta + 2 \sec\theta = 7.$$

[6]

2007 Summer

2. (a) Show, by counter-example, that the statement

$$\cos 2\theta \equiv 1 - 2 \cos^2\theta$$

is false.

[2]

- (b) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$\cot^2\theta = 7 - 2 \operatorname{cosec}\theta.$$

[6]

2008 Winter

2. (a) Show, by counter-example, that the statement

$$\sin 3\theta \equiv 4 \sin\theta - 3 \sin^3\theta$$

is false.

[2]

- (b) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$\sec\theta = 1 - 2 \tan^2\theta.$$

[6]

2008 Summer

2. (a) Show, by counter-example, that the statement

$$\tan 2\theta \equiv \frac{2 \tan \theta}{1 + \tan^2 \theta}$$

is false.

[2]

- (b) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$2\sec^2\theta = 8 - \tan\theta.$$

[6]

2009 Winter

2. (a) Show, by counter-example, that the statement

$$\cos 2\theta \equiv 2\cos^2\theta - \sin^2\theta$$

is false.

[2]

- (b) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$3\tan^2\theta = 7 + \sec\theta.$$

[6]

2009 Summer

2. (a) Show, by counter-example, that the statement

$$\cos\theta + \cos 3\theta \equiv 2\cos 2\theta \cos 4\theta$$

is false.

[2]

- (b) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$\cot^2\theta - 9 = \operatorname{cosec}\theta - \operatorname{cosec}^2\theta.$$

[6]

2010 Winter

2. (a) Show, by counter-example, that the statement

$$\sin 4\theta \equiv 4 \sin^3 \theta - 3 \sin \theta$$

is false.

[2]

- (b) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$3 \sec^2 \theta = 7 - 11 \tan \theta.$$

Give your answers correct to one decimal place.

[6]

2010 Summer

2. (a) Show, by counter-example, that the statement

$$\cos \theta + \cos 4\theta \equiv \cos 2\theta + \cos 3\theta$$

is false.

[2]

- (b) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$2 \tan^2 \theta = \sec \theta + 8.$$

[6]

2011 Winter

2. (a) Show, by counter-example, that the statement

$$\sec^2 \theta \equiv 1 - \operatorname{cosec}^2 \theta$$

is false.

[2]

- (b) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$3 \operatorname{cosec}^2 \theta = 11 - 2 \cot \theta.$$

[6]

2011 Summer

2. Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$2\operatorname{cosec}^2\theta + 3\cot^2\theta + 4\operatorname{cosec}\theta = 9. \quad [6]$$

2012 Winter

2. (a) Show, by counter-example, that the statement

$$\sin(\theta + \phi) \equiv \sin\theta + \sin\phi$$

is false.

[2]

- (b) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$\sec^2\theta + 8 = 4\tan^2\theta + 5\sec\theta. \quad [6]$$

2012 Summer

2. (a) Show, by counter-example, that the statement

$$\text{'If } \cos\theta = \cos\phi \text{ then } \sin\theta = \sin\phi \text{'}$$

is false.

[2]

- (b) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$13\tan^2\theta = 5\sec^2\theta + 6\tan\theta. \quad [6]$$

2013 Winter

2. (a) (i) Show, by counter-example, that the statement

$$\cos^3\theta \equiv 1 - \sin^3\theta$$

is false.

- (ii) **Write down** a value of θ which does satisfy the equation

$$\cos^3\theta = 1 - \sin^3\theta. \quad [3]$$

- (b) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$4\operatorname{cosec}^2\theta = 9 - 8\cot\theta. \quad [6]$$

2013 Summer

2. (a) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$4\cot^2\theta - 8 = 2\operatorname{cosec}^2\theta - 5\operatorname{cosec}\theta \quad [6]$$

- (b) Find all values of ϕ in the range $0^\circ \leq \phi \leq 360^\circ$ satisfying

$$\sec\phi + 2\tan\phi = 0. \quad [3]$$

2014 Winter

2. (a) Show, by counter-example, that the statement

'If x is an acute angle then $\sin(x + 30^\circ) > \sin x$ '

is false. [2]

- (b) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$15\operatorname{cosec}^2\theta + 2\cot\theta = 23. \quad [6]$$

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2014 Summer

2. Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$8\tan^2\theta - 5\sec^2\theta = 7 + 4\sec\theta \quad [6]$$

2015

2. (a) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$7\operatorname{cosec}^2\theta - 4\cot^2\theta = 16 + 5\operatorname{cosec}\theta \quad [6]$$

- (b) Without carrying out any calculations, explain why there are no values of ϕ in the range $0^\circ \leq \phi \leq 90^\circ$ which satisfy the equation

$$4\sec\phi + 3\operatorname{cosec}\phi = 6. \quad [1]$$

2016

2. (a) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$3 \operatorname{cosec} \theta (\operatorname{cosec} \theta - 1) = 5 \cot^2 \theta - 9. \quad [6]$$

- (b) Find all values of ϕ in the range $0^\circ \leq \phi \leq 360^\circ$ satisfying

$$2 \operatorname{cosec} \phi + 3 \sec \phi = 0. \quad [3]$$

2017

2. (a) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$6 \tan^2 \theta - 6 = 4 \sec^2 \theta + 5 \sec \theta. \quad [6]$$

- (b) Find all values of ϕ in the range $0^\circ \leq \phi \leq 360^\circ$ satisfying

$$3 \sec \phi + 5 \tan \phi = 0. \quad [3]$$

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