



# CAMI Mathematics: Grade 11

## GRADE 11 Trigonometric equations

### 11.9 Trigonometric equations

1. Solve the angles if all the angles are acute angles.

(a)  $\cos 2\lambda = \sin 7\lambda$

(b)  $\cos 69^\circ = \sin 7\theta$

(c)  $\sin 76^\circ = \cos 2\alpha$

(d)  $\cos(\alpha + 63^\circ) = \sin(\alpha - 19^\circ)$

(e)  $\sin(\beta + 79^\circ) = \cos(\beta - 17^\circ)$

2. Solve the following trigonometric equations.

(a)  $\tan \delta - 1.54 = 0$  for  $\delta \in [0^\circ; 360^\circ]$

(b)  $\sin \alpha + 0.985 = 0$  for  $\alpha \in [0^\circ; 360^\circ]$

(c)  $\cos \beta = -0.358$  for  $\beta \in [0^\circ; 360^\circ]$

(d)  $6 \cos(2\alpha - 20^\circ) = 5.196$  for  $2\alpha - 20^\circ \in [0^\circ; 360^\circ]$

(e)  $\frac{1}{3} \cos(\alpha - 2^\circ) = -0.069$  for  $\alpha - 2^\circ \in [0^\circ; 360^\circ]$

3. Calculations with restrictions.

(a) Calculate  $\sin(2\delta - 69^\circ)$  if  $4 \tan \delta = 9.9$  and  $\sin \delta > 0$

(b) Calculate  $\cos(\theta - 41^\circ)$  if  $\frac{1}{5} \sin \theta = 0.164$  and  $\cos \theta > 0$



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## MEMO

1. Solve the angles if all the angles are acute angles. [7.6.2.3; 7.6.2.5]

(a)

$$\cos 2\lambda = \sin 7\lambda$$

$$\cos 2\lambda = \sin(90^\circ - 7\lambda)$$

$$\therefore 2\lambda = 90^\circ - 7\lambda$$

$$\therefore 9\lambda = 90^\circ$$

$$\therefore \lambda = 10^\circ$$

(b)

$$\cos 69^\circ = \sin 7\theta$$

$$\cos 69^\circ = \cos(90^\circ - 7\theta)$$

$$\therefore 69^\circ = 90^\circ - 7\theta$$

$$\therefore 7\theta = 21^\circ$$

$$\therefore \theta = 3^\circ$$

(c)

$$\sin 76^\circ = \cos 2\alpha$$

$$\sin 76^\circ = \sin(90^\circ - 2\alpha)$$

$$\therefore 76^\circ = 90^\circ - 2\alpha$$

$$\therefore 2\alpha = 14^\circ$$

$$\therefore \alpha = 7^\circ$$

(d)

$$\cos(\alpha + 63^\circ) = \sin(\alpha - 19^\circ)$$

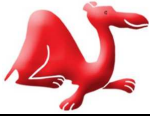
$$\cos(\alpha + 63^\circ) = \cos(90^\circ - (\alpha - 19^\circ))$$

$$\cos(\alpha + 63^\circ) = \cos(109^\circ - \alpha)$$

$$\therefore \alpha + 63^\circ = 109^\circ - \alpha$$

$$\therefore 2\alpha = 46^\circ$$

$$\therefore \alpha = 23^\circ$$



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(e)

$$\sin(\beta + 79^\circ) = \cos(\beta - 17^\circ)$$

$$\sin(\beta + 79^\circ) = \sin(90^\circ - (\beta - 17^\circ))$$

$$\therefore \beta + 79^\circ = 90^\circ - \beta + 17^\circ$$

$$\therefore 2\beta = 28^\circ$$

$$\therefore \beta = 14^\circ$$

**2. 2. Solve the following trigonometric equations. [7.6.6.1; 7.6.6.5]**

(a)

$$\tan \delta - 1.54 = 0 \text{ for } \delta \in [0^\circ; 360^\circ]$$

$$\tan \delta = 1.54$$

$$1st : \delta = 57^\circ$$

$$3rd : \delta = 180^\circ + 57^\circ = 237^\circ$$

(b)

$$\sin \alpha + 0.985 = 0 \text{ for } \alpha \in [0^\circ; 360^\circ]$$

$$\sin \alpha = -0.985$$

$$3rd : \alpha = 180^\circ + 80^\circ = 260^\circ$$

$$4th : \alpha = 360^\circ - 80^\circ = 280^\circ$$

(c)

$$\cos \beta = -0.358 \text{ for } \beta \in [0^\circ; 360^\circ]$$

$$2nd : \beta = 180^\circ - 69^\circ = 111^\circ$$

$$3rd : \beta = 180^\circ + 69^\circ = 249^\circ$$

(d)

$$6 \cos(2\alpha - 20^\circ) = 5.196 \text{ for } \alpha \in [0^\circ; 360^\circ]$$

$$\cos(2\alpha - 20^\circ) = 0.866$$

$$1st : 2\alpha - 20^\circ = 30^\circ$$

$$\therefore \alpha = 25^\circ$$

$$4th : 2\alpha - 20^\circ = 360^\circ - 30^\circ$$

$$\therefore \alpha = 175^\circ$$

(e)

$$\frac{1}{3} \cos(\alpha - 2^\circ) = -0.069 \text{ for } \alpha - 2^\circ \in [0^\circ; 360^\circ]$$

$$\cos(\alpha - 2^\circ) = -0.207$$

$$2nd : \alpha - 2^\circ = 180^\circ - 78^\circ$$

$$\therefore \alpha = 104^\circ$$

$$3rd : \alpha - 2^\circ = 180^\circ + 78^\circ$$

$$\therefore \alpha = 260^\circ$$



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## 3. Calculations with restrictions. [7.6.6.7]

- (a) Calculate  $\sin(2\delta - 69^\circ)$  if  $4 \tan \delta = 9.9$  and  $\sin \delta > 0$

$$4 \tan \delta = 9.9$$

$$\tan \delta = 2.475$$

*Quadrants : 1;3*

$$\sin \delta > 0$$

*Quadrants : 1;2*

Work in 1<sup>st</sup> quadrant:

$$\delta = 68^\circ$$

$$\sin(2(68^\circ) - 69^\circ) = 0.921$$

- (b) Calculate  $\cos(\theta - 41^\circ)$  if  $\frac{1}{5} \sin \theta = 0.164$  and  $\cos \theta > 0$

$$\frac{1}{5} \sin \theta = 0.164$$

$$\sin \theta = 0.82$$

*Quadrants : 1;2*

$$\cos \theta > 0$$

*Quadrants : 1;4*

Work in 1<sup>st</sup> quadrant:

$$\theta = 55^\circ$$

$$\cos(55^\circ - 41^\circ) = 0.97$$