L4 - Solving with Identities

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10:28 AM

Quest 11 • 1 hour
• 20 marks
• Non-Calc

Unit 11: Trigonometric Identities
Lesson 4 Solving Equations with Identities

- We have solved trigonometric equations before (~~Chapter 4~~ Unit 9). Sometimes, for more complex equations we will need to use identities to simplify an equation to only one trigonometric function.
- We can verify answers on our calculator, or by substitution.
- We are again solving over a specified domain, or asked for a general solution. eg. $0 \le x < 2\pi$ or $x \in R$
- Always check for npv's (or check by substitution).
  - State npv's first!

Ex. 1: Solve each equation algebraically over the domain $0 \le x < 2\pi$.

a) $\cos 2x + 1 - \cos x = 0$ *no npv's

$2\cos^2 x - 1 + 1 - \cos x = 0$

$2\cos^2 x - \cos x = 0$

$\cos x(2\cos x - 1) = 0$

$\cos x = 0$ or $\cos x = \frac{1}{2}$ (adj, 1, hyp, 2, $\theta_R = \frac{\pi}{3}$)

$x = \frac{\pi}{2}, \frac{3\pi}{2}$ $x = \frac{\pi}{3}, \frac{5\pi}{3}$

b) $1 - \cos^2 x = 3\sin x - 2$ *no npv's

$\sin^2 x = 3\sin x - 2$

$\sin^2 x - 3\sin x + 2 = 0$ let $a = \sin x$

$a^2 - 3a + 2 = 0$

$(a-2)(a-1) = 0$

$\sin x = 2$ (opp, 2, hyp, 1) → No Solution $\quad \sin x = 1$

$x = \frac{\pi}{2}$

Ex. 2: Solve the equation $\cos^2 x = \cot x \sin x$ algebraically in the domain $0° \le x \le 360°$. Verify your answer.

* npv's: $\sin x \neq 0$ → $x \neq 0, 180°, 360°$

$\cos^2 x = \frac{\cos x}{\sin x} \cdot \sin x$

$\cos^2 x = \cos x$

$\cos^2 x - \cos x = 0$

$\cos x(\cos x - 1) = 0$

$\cos x = 0$ or $\cos x = 1$

npv! (extraneous)

$x = 0°, 90°, 270°$ $\quad x = 90°, 270°$

Ex. 3: Solve the equation $\sin 2x = \sqrt{2}\cos x$ algebraically. Give the general solution expressed in radians.

$2\sin x\cos x = \sqrt{2}\cos x$ * no npv's

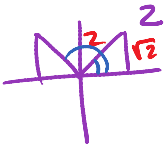
$2\sin x\cos x - \sqrt{2}\cos x = 0$

$\cos x(2\sin x - \sqrt{2}) = 0$

$\cos x = 0$

$x = \frac{\pi}{2}, \frac{3\pi}{2}$

$\sin x = \frac{\sqrt{2}}{2}$ opp / hyp



$\theta_R = \pi/4$

$x = \frac{\pi}{4}, \frac{3\pi}{4}$

General:

$x = \frac{\pi}{2} + \pi n, n \in \mathbb{Z}$

$x = \frac{\pi}{4} + 2\pi n, n \in \mathbb{Z}$

$x = \frac{3\pi}{4} + 2\pi n, n \in \mathbb{Z}$

Ex. 4: Algebraically solve $2\sin x = 7 - 3\csc x$. Give general solutions expressed in radians.

$2\sin x = 7 - 3 \cdot \frac{1}{\sin x}$ $\sin x$

* npv's: $\sin x \neq 0$

$x = 0, \pi, 2\pi, \ldots$

$2\sin^2 x = 7\sin x - 3$

$2\sin^2 x - 7\sin x + 3 = 0$

let $a = \sin x$

$2a^2 - 7a + 3 = 0$

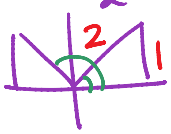
$(2a - 6)(2a - 1) = 0$

$(a - 3)(2a - 1) = 0$

$\sin x = 3$ opp / 1 hyp

→ No Solution

$\sin x = \frac{1}{2}$



$\theta_R = \pi/6$

not npv's...

$x = \frac{\pi}{6}, \frac{5\pi}{6}$

General:

$x = \frac{\pi}{6} + 2\pi n, n \in \mathbb{Z}$

$x = \frac{5\pi}{6} + 2\pi n, n \in \mathbb{Z}$

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Unit 11: Trigonometric Identities
Lesson 4 Solving Equations with Identities

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Ex. 2: Solve the equation $\cos^2 x = \cot x \sin x$ algebraically in the domain $0° \le x < 360°$. Verify your answer.

Ex. 3: Solve the equation $\sin 2x = \sqrt{2}\cos x$ algebraically. Give the general solution expressed in radians.

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Ex. 1: Solve each equation algebraically over the domain $0 \le x < 2\pi$.

a) $\cos 2x + 1 - \cos x = 0$

b) $1 - \cos^2 x = 3\sin x - 2$

Ex. 2: Solve the equation $\cos^2 x = \cot x \sin x$ algebraically in the domain $0° \le x < 360°$. Verify your answer.

Ex. 3: Solve the equation $\sin 2x = \sqrt{2}\cos x$ algebraically. Give the general solution expressed in radians.

Ex. 4: Algebraically solve $2\sin x = 7 - 3\csc x$. Give general solutions expressed in radians.

L4 Worksheet