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p 387 Homework Questions

In Exercises 1–38, verify the identity.

1. $\sin t \csc t = 1$
3. $(1 + \sin \alpha)(1 - \sin \alpha) = \cos^2 \alpha$
5. $\cos^2 \beta - \sin^2 \beta = 1 - 2\sin^2 \beta$
7. $\sin^2 \alpha - \sin^4 \alpha = \cos^2 \alpha - \cos^4 \alpha$
9. $\dfrac{\csc^2 \theta}{\cot \theta} = \csc \theta \sec \theta$
11. $\dfrac{\cot^2 t}{\csc t} = \csc t - \sin t$
13. $\sin^{1/2} x \cos x - \sin^{5/2} x \cos x = \cos^3 x \sqrt{\sin x}$
15. $\dfrac{1}{\sec x \tan x} = \csc x - \sin x$
17. $\csc x - \sin x = \cos x \cot x$
19. $\dfrac{1}{\tan x} + \dfrac{1}{\cot x} = \tan x + \cot x$
21. $\dfrac{\cos \theta \cot \theta}{1 - \sin \theta} - 1 = \csc \theta$
23. $\dfrac{1}{\sin x + 1} + \dfrac{1}{\csc x + 1} = 1$
25. $\tan\left(\dfrac{\pi}{2} - \theta\right) \tan \theta = 1$
27. $\dfrac{\csc(-x)}{\sec(-x)} = -\cot x$
29. $\dfrac{\tan x \cot x}{\cos x} = \sec x$
31. $\dfrac{\tan x + \cot y}{\tan x \cot y} = \tan y + \cot x$
33. $\sqrt{\dfrac{1 + \sin \theta}{1 - \sin \theta}} = \dfrac{1 + \sin \theta}{|\cos \theta|}$
35. $\cos^2 \beta + \cos^2\left(\dfrac{\pi}{2} - \beta\right) = 1$
37. $\sin t \csc\left(\dfrac{\pi}{2} - t\right) = \tan t$

In Exercises 39–46, (a) use a graphing utility to graph each side of the equation to determine whether the equation is an identity, (b) use the *table* feature of a graphing utility to determine whether the equation is an identity, and (c) confirm the results of parts (a) and (b) algebraically.

39. $2\sec^2 x - 2\sec^2 x \sin^2 x - \sin^2 x - \cos^2 x = 1$
43. $\csc^4 x - 2\csc^2 x + 1 = \cot^4 x$

In Exercises 51–54, use the cofunction identities to evaluate the expression without the aid of a calculator.

51. $\sin^2 25° + \sin^2 65°$
53. $\cos^2 20° + \cos^2 52° + \cos^2 38° + \cos^2 70°$

$\sin^2 25 + \cos^2 25 = 1$

$\sin^2 a(1 - \sin^2 a)$

$\sin^2 a(\cos^2 a)$

$(1-\cos^2 a)(\cos^2 a)$

$\cot^2 x \sin x$

$(\csc^2 x - 1)(\sin x)$

$\csc x - \sin x$

$$\frac{\csc x + 1 + \sin x + 1}{(\sin x + 1)(\csc x + 1)}$$

$$\frac{\csc x + 1 + \sin x + 1}{1 + \sin x + \csc x + 1}$$

1

$$\frac{\cos\theta\cot\theta}{1-\sin\theta} - \frac{(1-\sin\theta)}{1-\sin\theta} = \csc\theta$$

$$\frac{\cos\theta \cdot \frac{\cos\theta}{\sin\theta} - 1 + \sin\theta}{1 - \sin\theta}$$

$$\frac{\frac{\cos^2\theta}{\sin\theta} - 1 + \sin\theta}{1-\sin\theta}$$

$$\frac{\frac{\cos^2\theta - \sin\theta + \sin^2\theta}{\sin\theta}}{1-\sin\theta}$$

$$\frac{1-\sin\theta}{\sin\theta} \cdot \frac{1}{1-\sin\theta}$$

$$\frac{1}{\sin\theta}$$

$\csc\theta$

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In Exercises 1–6, verify that the *x*-values are solutions of the equation.

5. $2\sin^2 x - \sin x - 1 = 0$

   (a) $x = \dfrac{\pi}{2}$ (b) $x = \dfrac{7\pi}{6}$

In Exercises 7–20, solve the equation.

7. $2\cos x + 1 = 0$
9. $\sqrt{3} \csc x - 2 = 0$
11. $3\sec^2 x - 4 = 0$
13. $\sin x(\sin x + 1) = 0$
15. $4\cos^2 x - 1 = 0$
17. $2\sin^2 2x = 1$
19. $\tan 3x(\tan x - 1) = 0$

In Exercises 21–34, find all solutions of the equation in the interval $[0, 2\pi)$.

21. $\cos^3 x = \cos x$
23. $3\tan^3 x = \tan x$
25. $\sec^2 x - \sec x = 2$
27. $2\sin x + \csc x = 0$
29. $2\cos^2 x + \cos x - 1 = 0$
31. $2\sec^2 x + \tan^2 x - 3 = 0$
33. $\csc x + \cot x = 1$

In Exercises 35–40, solve the multiple-angle equation.

35. $\cos 2x = \dfrac{1}{2}$
37. $\tan 3x = 1$
39. $\cos \dfrac{x}{2} = \dfrac{\sqrt{2}}{2}$

In Exercises 45–54, use a graphing utility to approximate the solutions (to three decimal places) of the equation in the interval $[0, 2\pi)$.

47. $\dfrac{1 + \sin x}{\cos x} + \dfrac{\cos x}{1 + \sin x} = 4$

In Exercises 55–58, use the Quadratic Formula to solve the equation in the interval $[0, 2\pi)$. Then use a graphing utility to approximate the angle *x*.

57. $\tan^2 x + 3\tan x + 1 = 0$

$a=1$

$b=3$

$c=1$

$2\sin x + \dfrac{1}{\sin x} = 0$

$\dfrac{2\sin^2 x + 1}{\sin x} = 0$

$2\sin^2 x + 1 = 0$

$\dfrac{1}{\sin x} + \dfrac{\cos x}{\sin x} = 1$

$1 + \cos x = \sin x$

$\dfrac{3x}{3} = \dfrac{\pi}{4} \quad \dfrac{5\pi}{4} \quad \dfrac{9\pi}{4} \quad \dfrac{13\pi}{4} \quad \dfrac{17\pi}{4} \quad \dfrac{21\pi}{4}$

$x = \dfrac{\pi}{12} \; . \; . \; . \; . \; . \; . \; \dfrac{21\pi}{12}$

$(1)^2 = (\sin x - \cos x)^2$

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

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

$\sin x = 0 \quad \cos x = 0$

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5.4 Sum & Difference Formulas

$$\sin(u+v) = \sin u \cos v + \cos u \sin v$$
$$\sin(u-v) = \sin u \cos v - \cos u \sin v$$
$$\cos(u+v) = \cos u \cos v - \sin u \sin v$$
$$\cos(u-v) = \cos u \cos v + \sin u \sin v$$
$$\tan(u+v) = \frac{\sin(u+v)}{\cos(u+v)} = \frac{\tan u + \tan v}{1 - \tan u \tan v}$$
$$\tan(u-v) = \frac{\sin(u-v)}{\cos(u-v)} = \frac{\tan u - \tan v}{1 + \tan u \tan v}$$

$\sin(30+60) = \sin 90 = 1$

$\neq \sin 30 + \sin 60$

$\frac{1}{2} + \frac{\sqrt{3}}{2} \neq$

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$\sin 75° = \sin(45+30)$

$= \sin 45 \cos 30 + \cos 45 \sin 30$

$\left(\frac{1}{\sqrt{2}}\right)\left(\frac{\sqrt{3}}{2}\right) + \left(\frac{1}{\sqrt{2}}\right)\left(\frac{1}{2}\right)$

$\frac{\sqrt{3}+1}{2\sqrt{2}}$ $\left(\frac{\sqrt{6}+\sqrt{2}}{4} \text{ rationalized}\right)$

$\cos(\frac{\pi}{12}) = \cos\left(\frac{\pi}{4} - \frac{\pi}{6}\right)$

$\frac{\pi}{4}$ $\frac{\pi}{6}$

$\frac{3\pi}{12} - \frac{2\pi}{12}$

$= \cos\frac{\pi}{4}\cos\frac{\pi}{6} + \sin\frac{\pi}{4}\sin\frac{\pi}{6}$

$\left(\frac{1}{\sqrt{2}}\right)\left(\frac{\sqrt{3}}{3}\right) + \left(\frac{1}{\sqrt{2}}\right)\left(\frac{1}{2}\right)$

$\frac{\sqrt{3}+1}{2\sqrt{2}}$

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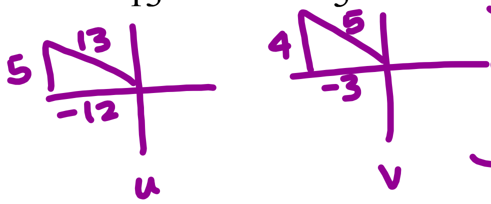
To find exact values:

Find $\cos(u-v)$ given $\sin u = \frac{5}{13}$, $\cos v = -\frac{3}{5}$, in QII

angles



ratios

$\boxed{\cos u}\cos v + \sin u \sin v$

$\left(\frac{-12}{13}\right)\left(-\frac{3}{5}\right) + \left(\frac{5}{13}\right)\left(\frac{4}{5}\right)$

$\frac{36}{65} + \frac{20}{65}$

$\frac{56}{65}$

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$\cos 25° \cos 20° - \sin 25° \sin 20°$

$\cos(25 + 20)$

$\cos 45$

$\frac{1}{\sqrt{2}}$

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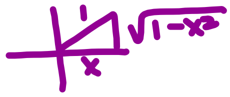
$\sin(\arctan 1 + \arccos x)$

$\sin(\frac{\pi}{4} + \arccos x)$

$\sin\frac{\pi}{4}\cos(\arccos x) + \cos\frac{\pi}{4}\sin(\arccos x)$



$\frac{1}{\sqrt{2}}x + \frac{1}{\sqrt{2}}(\sqrt{1-x^2})$

$\frac{x}{\sqrt{2}} + \frac{\sqrt{1-x^2}}{\sqrt{2}}$

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Proving Cofunction Identity:

$$\sin(x - \frac{\pi}{2}) = -\cos x$$

$\sin x \cos\frac{\pi}{2} - \cos x \sin\frac{\pi}{2}$

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

$0 - \cos x$

$-\cos x$ ✓

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Solve:

$$\sin(x+\frac{\pi}{2})+\sin(x-\frac{3\pi}{2})=1 \qquad [0,2\pi)$$

$$\left(\sin x\cos\frac{\pi}{2}+\cos x\sin\frac{\pi}{2}\right)+\left(\sin x\cos\frac{3\pi}{2}-\cos x\sin\frac{3\pi}{2}\right)=1$$

$$0 + \cos x + 0 + \cos x = 1$$

$$2\cos x = 1$$

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

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

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HOMEWORK

p 404 3, 9, 17, 19, 23, 25, 31, 33, 37, 43, 47, 51-55 odd, 59, 61, 65, 71

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