GO COUGARS!

p 384 Homework Questions

In Exercises 1–6, find the exact value of each expression.

1. (a) $\cos(240° - 0°)$ (b) $\cos 240° - \cos 0°$
2. (a) $\sin(405° + 120°)$ (b) $\sin 405° + \sin 120°$
3. (a) $\cos\left(\frac{\pi}{4} + \frac{\pi}{3}\right)$ (b) $\cos\frac{\pi}{4} + \cos\frac{\pi}{3}$
4. (a) $\sin\left(\frac{2\pi}{3} + \frac{5\pi}{6}\right)$ (b) $\sin\frac{2\pi}{3} + \sin\frac{5\pi}{6}$
5. (a) $\sin(315° - 60°)$ (b) $\sin 315° - \sin 60°$
6. (a) $\sin\left(\frac{7\pi}{6} - \frac{\pi}{3}\right)$ (b) $\sin\frac{7\pi}{6} - \sin\frac{\pi}{3}$

In Exercises 7–22, find the exact values of the sine, cosine, and tangent of the angle.

7. $105° = 60° + 45°$
8. $165° = 135° + 30°$
9. $195° = 225° - 30°$
10. $255° = 300° - 45°$
11. $\frac{11\pi}{12} = \frac{3\pi}{4} + \frac{\pi}{6}$
12. $\frac{17\pi}{12} = \frac{7\pi}{6} + \frac{\pi}{4}$
13. $-\frac{\pi}{12} = \frac{\pi}{6} - \frac{\pi}{4}$
14. $-\frac{19\pi}{12} = \frac{2\pi}{3} - \frac{9\pi}{4}$
15. $75°$
16. $15°$
17. $-225°$
18. $-165°$
19. $\frac{13\pi}{12}$
20. $\frac{5\pi}{12}$
21. $-\frac{7\pi}{12}$
22. $-\frac{13\pi}{12}$

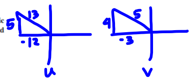
$$\frac{\sin\left(\frac{7\pi}{12}\right) = \frac{\sqrt{6}+\sqrt{2}}{\cancel{4}}}{\cos\left(-\frac{7\pi}{2}\right) = \frac{\sqrt{2}-\sqrt{6}}{\cancel{4}}} \quad \frac{\sqrt{6}+\sqrt{2}}{\sqrt{2}-\sqrt{6}}$$

In Exercises 23–30, write the expression as the sine, cosine, or tangent of an angle.

23. $\cos 60° \cos 20° - \sin 60° \sin 20°$
24. $\sin 110° \cos 80° + \cos 110° \sin 80°$
25. $\frac{\tan 325° - \tan 86°}{1 + \tan 325° \tan 86°}$
26. $\frac{\tan 154° - \tan 49°}{1 + \tan 154° \tan 49°}$
27. $\sin 3.5 \cos 1.2 - \cos 3.5 \sin 1.2$

29. $\cos\frac{\pi}{9}\cos\frac{\pi}{7} - \sin\frac{\pi}{9}\sin\frac{\pi}{7}$

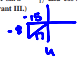
In Exercises 35–38, find the exact value of the trigonometric function given that $\sin u = \frac{5}{13}$ and $\cos v = -\frac{3}{5}$. (Both u and v are in Quadrant II.)



35. $\sin(u + v)$
36. $\cos(v - u)$
37. $\tan(u + v)$
38. $\sin(u - v)$

$$\sin(u+v) = \sin u \cos v + \cos u \sin v$$
$$\left(\frac{5}{13}\right)\left(-\frac{3}{5}\right) + \left(-\frac{12}{13}\right)\left(\frac{4}{5}\right)$$
$$-\frac{15}{65} - \frac{48}{65} = -\frac{63}{65}$$

In Exercises 39–42, find the exact value of the trigonometric function given that $\sin u = -\frac{8}{17}$ and $\cos v = -\frac{4}{5}$. (Both u and v are in Quadrant III.)



39. $\cos(u + v)$
40. $\tan(u + v)$
41. $\sin(v - u)$
42. $\cos(u - v)$

In Exercises 47–54, find the value of the expression without using a calculator.

47. $\sin(\sin^{-1} 1 + \cos^{-1} 1)$
48. $\cos[\sin^{-1}(-1) + \cos^{-1} 0]$
49. $\sin[\sin^{-1} 1 - \cos^{-1}(-1)]$
50. $\cos[\cos^{-1}(-1) - \cos^{-1} 1]$
51. $\sin\left(\sin^{-1}\frac{1}{2} - \cos^{-1}\frac{1}{2}\right)$
52. $\cos\left[\cos^{-1}\left(-\frac{1}{2}\right) + \sin^{-1} 1\right]$

$\sin\left(\frac{\pi}{2} + 0\right)$

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

$\cos\left(\frac{2\pi}{3} + \frac{\pi}{2}\right) = \cos\left(\frac{4\pi}{6} + \frac{3\pi}{6}\right) = \cos\frac{7\pi}{6} = -\frac{\sqrt{3}}{2}$

In Exercises 63–70, verify the identity.

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

$\sin\frac{\pi}{2}\cos x + \cos\frac{\pi}{2}\sin x = \cos x$

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

$\cos x = \cos x$

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5.5 Double Angle Formulas and Power Reducing Formulas

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Double Angle Formulas

$$\sin 2x = 2\sin x \cos x$$

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

$\sin(x+x) =$
$\sin x\cos x + \cos x \sin x$
$2\sin x \cos x$

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

$$\tan 2x = \frac{\sin 2x}{\cos 2x} \qquad \tan 2x = \frac{2\tan x}{1-\tan^2 x}$$

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Double Angle Formulas are used to solve.

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

$2\sin x\cos x + \cos x = 0$
$\cos x(2\sin x + 1) = 0$

$\cos x = 0$	$\sin x = -\frac{1}{2}$
$x = \frac{\pi}{2}, \frac{3\pi}{2}$	$x = \frac{7\pi}{6}, \frac{11\pi}{6}$

$$\cos 2x + \cos x = 0$$

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

$\cos x = \frac{1}{2}$	$\cos x = -1$
$x = \frac{\pi}{3}, \frac{5\pi}{3}$	$x = \pi$

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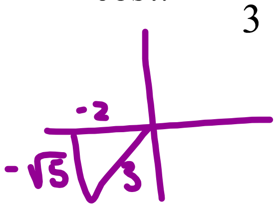
Double Angle Formulas are used to find exact values.

If $\cos x = -\frac{2}{3}$ in QIII, find $\sin 2x, \quad \cos 2x, \quad \tan 2x$



$\sin 2x = 2\sin x \cos x$

$= 2\left(-\frac{\sqrt{5}}{3}\right)\left(-\frac{2}{3}\right)$

$= \frac{4\sqrt{5}}{9}$

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

$= \left(-\frac{2}{3}\right)^2 - \left(-\frac{\sqrt{5}}{3}\right)^2$

$\frac{4}{9} - \frac{5}{9}$

$-\frac{1}{9}$

$\tan 2x = \frac{\sin 2x}{\cos 2x}$

$\frac{\frac{4\sqrt{5}}{\cancel{9}}}{-\frac{1}{\cancel{9}}}$

$-4\sqrt{5}$

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Power Reducing Formulas

reducing a trig function to a power of 1

$$\sin^2 x = \frac{1-\cos 2x}{2} \qquad \cos^2 x = \frac{1+\cos 2x}{2} \qquad \tan^2 x = \frac{1-\cos 2x}{1+\cos 2x}$$

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$$\sin^4 x = (\sin^2 x)(\sin^2 x)$$
$$= \left(\frac{1-\cos 2x}{2}\right)\left(\frac{1-\cos 2x}{2}\right)$$
$$= \frac{1-\cos 2x-\cos 2x+\cos^2 2x}{4}$$
$$= \frac{1-2\cos 2x+\boxed{\cos^2 2x}}{4}$$
$$= \frac{1-2\cos 2x+\left(\frac{1+\cos 4x}{2}\right)}{4}$$
$$= \frac{\frac{2}{2}-\frac{4\cos 2x}{2}+\left(\frac{1+\cos 4x}{2}\right)}{4} \div 4 \quad \frac{1}{4}$$
$$\frac{3-4\cos 2x+\cos 4x}{8}$$
$$\frac{1}{8}(3-4\cos 2x+\cos 4x)$$

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$$\cos^4 \frac{x}{2} = \left(\cos^2 \frac{x}{2}\right)\cos^2 \frac{x}{2}$$
$$= \left(\frac{1+\cos 2\left(\frac{x}{2}\right)}{2}\right)\left(\frac{1+\cos 2\left(\frac{x}{2}\right)}{2}\right)$$
$$= \left(\frac{1+\cos x}{2}\right)\left(\frac{1+\cos x}{2}\right)$$
$$= \frac{1+2\cos x+\cos^2 x}{4}$$
$$= \frac{\left(1+2\cos x+\left(\frac{1+\cos 2x}{\cancel{2}}\right)\right)\cancel{2}}{4\cdot 2}$$
$$\frac{2+4\cos x+1+\cos 2x}{8}$$
$$\frac{1}{8}(3+4\cos x+\cos 2x)$$

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HOMEWORK

p 394 1, 3 (no calc), 7, 11-19 odd,

25, 29, 31, 35

Suggested review:

WB p 115, 116 evens, 120

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