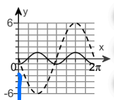
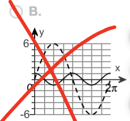
Period 4, Jan 31, 20250182

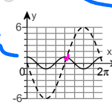
Graph f(x) = **cos** 2x and g(x) = − 6 **sin** x in the same rectangular coordinate system for $0 \le x \le 2\pi$. Then solve a trigonometric equation to determine points of intersection and identify these points on the graph.

The graphs of f(x) and g(x) are plotted together. The graph of f(x) is the solid line and the graph of g(x) is the dashed line. Which of the following plots represent these two functions?

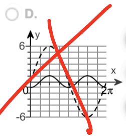
A.


$-\cos 2x$

B.


C.


$+\cos 2x$

D.


Period For $\cos 2x$

$2x = 2\pi$

$x = \pi$ new period

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

$1 - 2\sin^2 x$

$2\cos^2 x - 1$

$-6\sin x = \cos 2x$

$-6\sin x = 1 - 2\sin^2 x$

$2\sin^2 x - 6\sin x - 1 = 0$

$a = 2 \quad b = -6 \quad c = -1$

$\sin x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$\sin x = \dfrac{-(-6) \pm \sqrt{(-6)^2 - 4(2)(-1)}}{2 \cdot 2}$

$\sin x = \dfrac{6 \pm \sqrt{36+8}}{4}$

$x = \sin^{-1}\left(\dfrac{6 \pm \sqrt{44}}{4}\right)$

Solve the equation on the interval $[0,2\pi)$.

$10\sin^2 x + 3\cos x - 9 = 0$

$1 - \cos^2 x$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

A. x = ☐

(Type your answer in radians. Use a comma to separate answers as needed. Do not round until the final answer. Then round to four decimal places as needed.)

B. There is no solution.

$10(1 - \cos^2 x) + 3\cos x - 9 = 0$

$10 - 10\cos^2 x + 3\cos x - 9 = 0$

$-10\cos^2 x + 3\cos x + 1 = 0$

$-10 \cdot 1 = -10$

$5 \quad -2 = 3$

$-10\cos^2 x + 5\cos x - 2\cos x + 1$

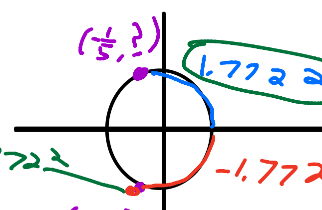
$-5\cos x(2\cos x - 1) - 1(2\cos x - 1)$

$(2\cos x - 1)(-5\cos x - 1) = 0$

$\cos x = \frac{1}{2}$ or $\cos x = -\frac{1}{5}$

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

$\cos^{-1}\left(-\frac{1}{5}\right) = x \Rightarrow x = 1.77$



Solve the equation on the interval $[0,2\pi)$. Do not use a calculator.

$\sin 3x + \sin x - \cos x = 0$

$2\sin\frac{\overset{4x}{3x+x}}{2}\cos\frac{\overset{2x}{3x-x}}{2} = 2\sin 2x\cos x$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- **A.** $x =$ ☐
  (Simplify your answer. Type an exact answer, using π as needed. Use integers or fractions for any numbers in the expression. Use a comma to separate answers as needed.)
- **B.** There is no solution.

$$\sin\alpha + \sin\beta = 2\sin\frac{\alpha+\beta}{2}\cos\frac{\alpha-\beta}{2}$$

$\underbrace{\sin 3x + \sin x} - \cos x = 0$

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

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

$\cos x = 0$ or $2\sin 2x - 1 = 0$

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

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

$2x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{13\pi}{6}, \frac{17\pi}{6}$ ($+2\pi$, $+2\pi$)

$\frac{\cancel{2}x}{\cancel{2}} = \frac{\pi}{2\cdot 6}, \frac{5\pi}{2\cdot 6}, \frac{13\pi}{2\cdot 6}, \frac{17\pi}{2\cdot 6}$

$x = \frac{\pi}{12}, \frac{5\pi}{12}, \frac{13\pi}{12}, \frac{17\pi}{12}$

Solve the equation on the interval $[0,2\pi)$.

$3\cos x + 6\sqrt{2} = \cos x + 5\sqrt{2} \Rightarrow$

$-\cos x \quad -\cos x$

$3\cos x - \cos x + 6\sqrt{2} = 5\sqrt{2} \Rightarrow \frac{\cancel{2}\cos x}{\cancel{2}} = \frac{-\sqrt{2}}{2}$

$-6\sqrt{2} \quad -6\sqrt{2}$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- **A.** $x = \frac{3\pi}{4}, \frac{5\pi}{4}$
  (Simplify your answer. Type an exact answer, using π as needed. Type your answer in radians. Use integers or fractions for any numbers in the expression. Use a comma to separate answers as needed.)
- **B.** There is no solution.

$\cos x = \frac{-\sqrt{2}}{2}$

$x = \frac{3\pi}{4}, \frac{5\pi}{4}$

Use an identity to solve the equation on the interval $[0,2\pi)$.

$$\sin 2x \cos x + \cos 2x \sin x = -\frac{\sqrt{2}}{2}$$

$a = 2x \quad b = x$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

A. $x = \frac{5\pi}{12}, \frac{13\pi}{12}, \frac{7\pi}{4}, \frac{7\pi}{12}, \frac{5\pi}{4}, \frac{23\pi}{12}$

(Type an exact answer, using π as needed. Use a comma to separate answers as needed. Type your answer in radians. Simplify your answer. Use integers or fractions for any numbers in the expression.)

B. There is no solution.

$\sin(a+b) = \sin a \cos b + \cos a \sin b$

$\sin(2x+x) = \sin 3x = \sin 2x \cos x + \sin x \cos 2x$

$2\pi = \frac{8\pi}{4}$

$\sin 3x = -\frac{\sqrt{2}}{2}$

3 Times around

$+\frac{8\pi}{4}$ $+\frac{8\pi}{4}$

$\frac{\cancel{3}x}{\cancel{3}} = \frac{5\pi}{3\cdot 4}, \frac{7\pi}{3\cdot 4}, \frac{13\pi}{3\cdot 4}, \frac{15\pi}{3\cdot 4}, \frac{21\pi}{3\cdot 4}, \frac{23\pi}{3\cdot 4} = \boxed{\frac{5\pi}{12}, \frac{7\pi}{12}, \frac{13\pi}{12}, \frac{15\pi}{12}, \frac{21\pi}{12}, \frac{23\pi}{12}}$

$+\frac{8\pi}{4}$ $\frac{8\pi}{4}$