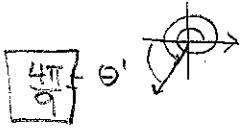


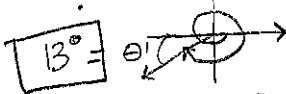
Find each reference angle, if it exists.

1)  $\frac{31\pi}{9} = 3\frac{4\pi}{9}$



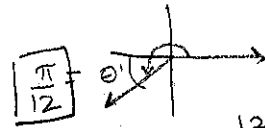
$$\frac{31\pi}{9} - 3\pi = \frac{4\pi}{9}$$

2)  $-527^\circ$



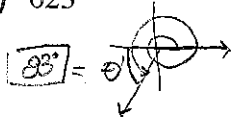
$$\frac{-527}{13} = -40.538$$

3)  $\frac{13\pi}{12} = 1\frac{\pi}{12}$



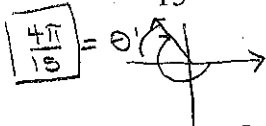
$$\frac{13\pi}{12} - \pi = \frac{\pi}{12}$$

4)  $623^\circ$



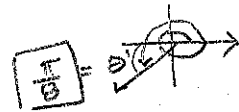
$$\frac{623}{1} - 540 = 83$$

5)  $-\frac{19\pi}{15} = -1\frac{4\pi}{15}$



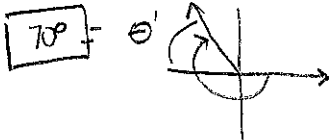
$$\frac{19\pi}{15} - 1\pi = \frac{4\pi}{15}$$

6)  $\frac{25\pi}{8} = 3\frac{\pi}{8}$



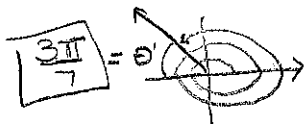
$$\frac{25\pi}{8} - 3\pi = \frac{\pi}{8}$$

7)  $-250^\circ$



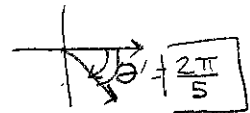
$$\frac{250}{1} - 180 = 70$$

8)  $\frac{32\pi}{7} = 4\frac{4\pi}{7}$



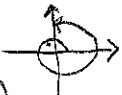
$$5 - \frac{32\pi}{7} = \frac{3\pi}{7}$$

9)  $-\frac{2\pi}{5}$



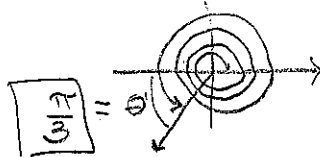
$$\frac{2\pi}{5} - 0\pi = \frac{2\pi}{5}$$

10)  $450^\circ$



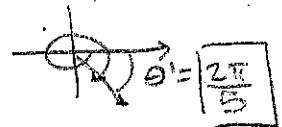
none

11)  $\frac{22\pi}{3} = 7\frac{\pi}{3}$



$$\frac{22\pi}{3} - 7\pi = \frac{\pi}{3}$$

12)  $-\frac{12\pi}{5} = -2\frac{2\pi}{5}$



$$\frac{12\pi}{5} - 2\pi = \frac{2\pi}{5}$$

State if the given angles are coterminal. Show work to support your answer!

13)  $240^\circ, 600^\circ$

$$\begin{array}{r} 240 \\ +360 \\ \hline 600^\circ \end{array} \checkmark \quad \boxed{\text{yes}}$$

14)  $\frac{15\pi}{8}, \frac{47\pi}{8}$

$$\frac{15\pi}{8} + 2\pi = \frac{31\pi}{8}$$

$$\frac{31\pi}{8} + 2\pi = \frac{47\pi}{8} \checkmark \quad \boxed{\text{yes}}$$

Find a coterminal angle between  $0^\circ$  and  $360^\circ$ .

15)  $640^\circ$

$$\begin{array}{r} 640^\circ \\ -360^\circ \\ \hline \end{array} \quad \boxed{280^\circ}$$

16)  $-442^\circ$

$$\begin{array}{r} -442^\circ \\ +360 \\ \hline -82^\circ \\ +360 \\ \hline \end{array} \quad \boxed{278^\circ}$$

Find a coterminal angle between 0 and  $2\pi$ .

17)  $-\frac{33\pi}{18} + 2\pi = \boxed{\frac{\pi}{6}}$

18)  $\frac{23\pi}{4} - 2\pi = \frac{15\pi}{4}$

$$\frac{15\pi}{4} - 2\pi = \boxed{\frac{7\pi}{4}}$$

Find a positive and a negative coterminal angle for each given angle.

19)  $-\frac{7\pi}{6}$

$$-\frac{7\pi}{6} + 2\pi = \boxed{\frac{5\pi}{6}}$$

$$-\frac{7\pi}{6} - 2\pi = \boxed{-\frac{19\pi}{6}}$$

20)  $\frac{29\pi}{45}$

$$\frac{29\pi}{45} - 2\pi = \boxed{-\frac{61\pi}{45}}$$

$$\frac{29\pi}{45} + 2\pi = \boxed{\frac{119\pi}{45}}$$