

Unit Circle Fluency

Part I — Foundations

1. A radian is based on arc length. Explain the relationship between radius, arc length, and radians.

Part II — Degree ↔ Radian Conversion

2. How do you convert an angle from degrees to radians?
3. When converting an angle from degrees to radians, how do you write it in radians as a fraction in terms of π ? Explain:
4. Draw a picture of each angle in standard position. Convert the following angles in Degrees to Radians. Write your answer as a fraction in terms of π :

a) 30°

c) 135°

e) 315°

b) 60°

d) 225°

f) 330°

5. Describe how to convert an angle from radians to degrees?
6. Convert the following angles in radians to degrees, then draw each angle:

a) $\frac{2\pi}{3}$

d) $\frac{7\pi}{6}$

g) $\frac{5\pi}{6}$

b) $\frac{5\pi}{3}$

e) $\frac{5\pi}{4}$

h) $\frac{3\pi}{20}$

c) $\frac{11\pi}{3}$

f) $\frac{\pi}{12}$

i) $\frac{5\pi}{9}$

Part III — Drawing & Coterminal Angles

7. Determine which quadrant each angle terminates in without drawing it completely.

a) $\frac{5\pi}{6}$

b) $\frac{7\pi}{4}$

c) $-\frac{11\pi}{6}$

d) $\frac{5\pi}{3}$

8. Draw the following angles in standard position.

a) $\frac{2\pi}{3}$

c) $\frac{7\pi}{4}$

e) $\frac{4\pi}{3}$

b) $-\frac{10\pi}{6}$

d) $\frac{9\pi}{5}$

f) $\frac{5\pi}{4}$

9. What is the angle of a terminal arm that rotates counter clockwise, went past the initial arm 17 times, and is pointing straight up?
10. Determine whether if each pair of angles given are coterminal. Justify your answer. If the pair of angles are coterminal, find a general formula for all the other coterminal angles:

a) 65° & 425°

c) $\frac{7\pi}{4}$ & $\frac{17\pi}{4}$

e) $\frac{-12\pi}{7}$ & $\frac{196\pi}{7}$

b) $\frac{4\pi}{3}$ & $\frac{10\pi}{3}$

d) $\frac{18\pi}{5}$ & $\frac{78\pi}{5}$

f) $\frac{-1002\pi}{6}$ & $\frac{1000\pi}{3}$

11. What are coterminal angles? How do you check if two angles are coterminal? Explain?

Part IV — Reference Angles

12. Determine a coterminal angle between 0 and 2π .

a) $\frac{13\pi}{3}$

b) $-\frac{10\pi}{6}$

c) $\frac{17\pi}{4}$

d) $\frac{22\pi}{9}$

13. Find the reference angle of:

$\frac{5\pi}{3}$

$\frac{7\pi}{6}$

$-\frac{11\pi}{4}$

Part V — Exact Trig Values

14. Determine whether each value is positive or negative WITHOUT evaluating.

a) $\sin\left(\frac{5\pi}{6}\right)$

b) $\cos\left(\frac{7\pi}{4}\right)$

c) $\tan\left(\frac{11\pi}{6}\right)$

d) $\sin\left(-\frac{3\pi}{4}\right)$

15. Determine the exact value without a calculator:

$\sin\left(\frac{5\pi}{6}\right)$

$\cos\left(\frac{7\pi}{4}\right)$

$\tan\left(\frac{11\pi}{6}\right)$

$\sin\left(-\frac{3\pi}{4}\right)$

Part VI — Coterminal Properties

16. Suppose angles “A” and “B” are coterminal, indicate which of the statements below are true. Explain:

a) $\sin A = \sin B$

b) $\tan A = \tan B$

c) $A = B \pm 360^\circ(n)$