Name _____ Date _____ Class _____

LESSON 13-3

Practice A

The Unit Circle

Convert each measure from degrees to radians or from radians to degrees.

1. $60°$

$60° \left(\frac{\pi \text{ radians}}{180°}\right) =$ _____

2. $-\frac{2\pi}{5}$

$\left(-\frac{2\pi}{5}\right)\left(\frac{180°}{\pi \text{ radians}}\right) =$ _____

3. $\frac{5\pi}{6}$

_____

4. $315°$

_____

5. $-\frac{3\pi}{4}$

_____

6. $-105°$

_____

7. $\frac{4\pi}{3}$

_____

8. $-\frac{\pi}{6}$

_____

9. $300°$

_____

10. $-10°$

_____

11. $\frac{16\pi}{9}$

_____

Find the exact value of each trigonometric function. Use the unit circle.

12. $\sin 60°$

a. At what point on the unit circle does the angle terminate? _____

b. Use $\sin\theta = y$. _____

13. $\cos \frac{5\pi}{3}$

_____

14. $\tan 225°$

_____

15. $\tan \pi$

_____

16. $\sin 330°$

_____

17. $\cos 150°$

_____

18. $\tan 240°$

_____

Solve.

19. John is adding a curved edge to the landscaping in front of the high school. The curve is an arc of a circle with a radius of 1600 feet. The central angle that intercepts the curve measures $\frac{\pi}{8}$ radians. Find the length of the curve to the nearest foot.

_____

LESSON 13-3

Practice A

The Unit Circle

Convert each measure from degrees to radians or from radians to degrees.

1. $60°$

$60°\left(\frac{\pi \text{ radians}}{180°}\right) = \frac{\pi}{3}$ radians

2. $-\frac{2\pi}{5}$

$\left(-\frac{2\pi}{5}\right)\left(\frac{180°}{\pi \text{ radians}}\right) = -72°$

3. $\frac{5\pi}{6}$ — $150°$

4. $315°$ — $\frac{7\pi}{4}$ radians

5. $-\frac{3\pi}{4}$ — $-135°$

6. $-105°$ — $-\frac{7\pi}{12}$ radians

7. $\frac{4\pi}{3}$ — $240°$

8. $-\frac{\pi}{6}$ — $-30°$

9. $300°$ — $\frac{5\pi}{3}$ radians

10. $-10°$ — $-\frac{\pi}{18}$ radians

11. $\frac{16\pi}{9}$ — $320°$

Find the exact value of each trigonometric function. Use the unit circle.

12. $\sin 60°$

a. At what point on the unit circle does the angle terminate? $\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$

b. Use $\sin\theta = y$. $\frac{\sqrt{3}}{2}$

13. $\cos\frac{5\pi}{3}$ — $\frac{1}{2}$

14. $\tan 225°$ — 1

15. $\tan\pi$ — undefined

16. $\sin 330°$ — $-\frac{1}{2}$

17. $\cos 150°$ — $-\frac{\sqrt{3}}{2}$

18. $\tan 240°$ — $\sqrt{3}$

Solve.

19. John is adding a curved edge to the landscaping in front of the high school. The curve is an arc of a circle with a radius of 1600 feet. The central angle that intercepts the curve measures $\frac{\pi}{8}$ radians. Find the length of the curve to the nearest foot.

628 ft

LESSON 13-3

Practice B

The Unit Circle

Convert each measure from degrees to radians or from radians to degrees.

1. $\frac{5\pi}{12}$ — $75°$

2. $215°$ — $\frac{43\pi}{36}$ radians

3. $-\frac{29\pi}{18}$ — $-290°$

4. $-180°$ — $-\pi$ radians

5. $\frac{5\pi}{3}$ — $300°$

6. $-\frac{7\pi}{6}$ — $210°$

7. $400°$ — $\frac{20\pi}{9}$ radians

8. $\frac{3\pi}{10}$ — $54°$

9. $35°$ — $\frac{7\pi}{36}$ radians

Use the unit circle to find the exact value of each trigonometric function.

10. $\cos\frac{2\pi}{3}$ — $-\frac{1}{2}$

11. $\tan\frac{5\pi}{4}$ — 1

12. $\tan\frac{5\pi}{6}$ — $-\frac{\sqrt{3}}{3}$

13. $\sin 315°$ — $-\frac{\sqrt{2}}{2}$

14. $\cos 225°$ — $-\frac{\sqrt{2}}{2}$

15. $\tan 60°$ — $\sqrt{3}$

Use a reference angle to find the exact value of the sine, cosine, and tangent of each angle.

16. $150°$ — $\frac{1}{2}; -\frac{\sqrt{3}}{2}; -\frac{\sqrt{3}}{3}$

17. $-225°$ — $\frac{\sqrt{2}}{2}; -\frac{\sqrt{2}}{2}; -1$

18. $-300°$ — $\frac{\sqrt{3}}{2}; \frac{1}{2}; \sqrt{3}$

19. $\frac{11\pi}{6}$ — $-\frac{1}{2}; \frac{\sqrt{3}}{2}; -\frac{\sqrt{3}}{3}$

20. $-\frac{2\pi}{3}$ — $-\frac{\sqrt{3}}{2}; -\frac{1}{2}; \sqrt{3}$

21. $\frac{5\pi}{4}$ — $-\frac{\sqrt{2}}{2}; -\frac{\sqrt{2}}{2}; 1$

Solve.

22. San Antonio, Texas, is located about 30° north of the equator. If Earth's radius is about 3959 miles, approximately how many miles is San Antonio from the equator?

2073 mi

LESSON 13-3

Practice C

The Unit Circle

Convert each measure from degrees to radians or from radians to degrees.

1. $-\frac{3\pi}{2}$ — $-270°$

2. $450°$ — $\frac{5\pi}{2}$ radians

3. $\frac{5\pi}{18}$ — $50°$

4. $-200°$ — $-\frac{10\pi}{9}$ radians

5. $\frac{7\pi}{4}$ — $315°$

6. $-\frac{11\pi}{6}$ — $-330°$

7. $350°$ — $\frac{35\pi}{18}$ radians

8. $\frac{7\pi}{20}$ — $63°$

9. $12°$ — $\frac{\pi}{15}$ radians

10. $\frac{13\pi}{10}$ — $234°$

11. $222°$ — $\frac{37\pi}{30}$ radians

12. $-105°$ — $-\frac{7\pi}{12}$ radians

Find the exact value of the sine, cosine, and tangent of each angle.

13. $330°$ — $-\frac{1}{2}; \frac{\sqrt{3}}{2}; -\frac{\sqrt{3}}{3}$

14. $\frac{7\pi}{4}$ — $-\frac{\sqrt{2}}{2}; \frac{\sqrt{2}}{2}; -1$

15. $240°$ — $-\frac{\sqrt{3}}{2}; -\frac{1}{2}; \sqrt{3}$

16. $\frac{5\pi}{6}$ — $\frac{1}{2}; -\frac{\sqrt{3}}{2}; -\frac{\sqrt{3}}{3}$

17. $225°$ — $-\frac{\sqrt{2}}{2}; -\frac{\sqrt{2}}{2}; 1$

18. $120°$ — $\frac{\sqrt{3}}{2}; -\frac{1}{2}; -\sqrt{3}$

19. $45°$ — $\frac{\sqrt{2}}{2}; \frac{\sqrt{2}}{2}; 1$

20. $-\pi$ — $0; -1; 0$

21. $-\frac{5\pi}{6}$ — $-\frac{1}{2}; -\frac{\sqrt{3}}{2}; \frac{\sqrt{3}}{3}$

22. $-\frac{\pi}{4}$ — $-\frac{\sqrt{2}}{2}; \frac{\sqrt{2}}{2}; -1$

23. $-\frac{\pi}{3}$ — $-\frac{\sqrt{3}}{2}; \frac{1}{2}; -\sqrt{3}$

24. $135°$ — $\frac{\sqrt{2}}{2}; -\frac{\sqrt{2}}{2}; -1$

Solve.

25. A pendulum is 18 feet long. Its central angle is 44°. The pendulum makes one back and forth swing every 12 seconds. To the nearest foot, how far does the pendulum swing each minute?

138 ft

LESSON 13-3

Reteach

The Unit Circle

Radians are a real number measure of rotation.

To convert between radians and degrees, use the following identity.

π radians $= 180°$

To convert from degrees to radians, solve the identity for 1 degree.	To convert from radians to degrees, solve the identity for 1 radian.
1 degree $= \frac{\pi \text{ radians}}{180°}$	1 radian $= \frac{180°}{\pi \text{ radians}}$

Convert $60°$ to radians.

$60° = 60°\left(\frac{\pi \text{ radians}}{180°^{3}}\right) = \frac{\pi}{3}$ radians

Use dimensional analysis to help. Notice that the degrees cancel so the remaining unit is radians.

Convert $\frac{5\pi}{4}$ radians to degrees.

$\frac{5\pi}{4}$ radians $= \left(\frac{5\pi}{4}\text{ radians}\right)\left(\frac{^{45}180°}{\pi \text{ radians}}\right) = 225°$

The radians cancel so the remaining unit is degrees.

Convert each measure from degrees to radians.

1. $-45°$

$-45° = -45°\left(\frac{\pi \text{ radians}}{180°}\right) = -\frac{\pi}{4}$ radians

2. $150°$

$150° = 150°\left(\frac{\pi \text{ radians}}{180°}\right) = \frac{5\pi}{6}$ radians

3. $210°$ — $\frac{7\pi}{6}$ radians

4. $-120°$ — $-\frac{2\pi}{3}$ radians

Convert each measure from radians to degrees.

5. $\frac{4\pi}{3}$ radians

$\frac{4\pi}{3}$ radians $= \left(\frac{4\pi}{3}\text{ radians}\right)\left(\frac{180°}{\pi \text{ radians}}\right) = 240°$

6. $-\frac{3\pi}{2}$ radians

$-\frac{3\pi}{2}$ radians $= \left(-\frac{3\pi}{2}\text{ radians}\right)\left(\frac{180°}{\pi \text{ radians}}\right) = -270°$

7. $\frac{\pi}{6}$ radians — $30°$

8. $\frac{5\pi}{3}$ radians — $300°$