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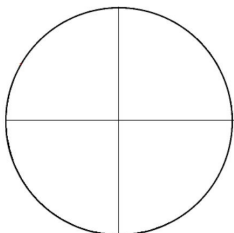
Name: _____

PRACTICE Drawing Angles in Radians and Exact Values

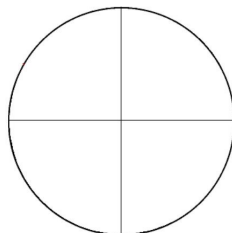
For each of the following

- Draw the angle given in standard position
- Find the related acute angle
- Draw and label the special triangle
- Use the triangle to state the trig ratios (primary on the left column, secondary on the right column)

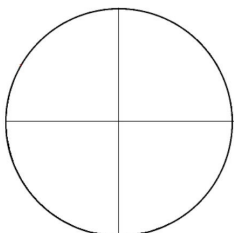
1. $\frac{3\pi}{4}$



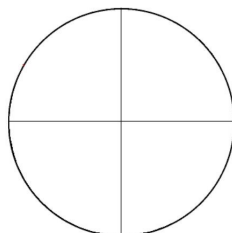
2. $\frac{4\pi}{3}$



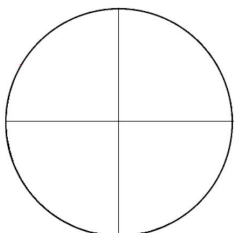
3. $\frac{\pi}{6}$



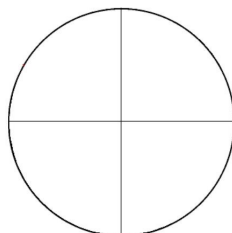
4. $\frac{5\pi}{3}$



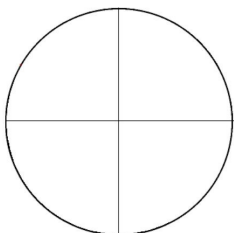
5. $\frac{5\pi}{4}$



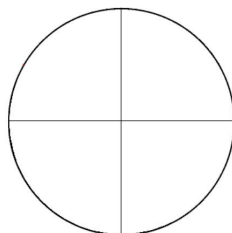
6. $\frac{2\pi}{3}$



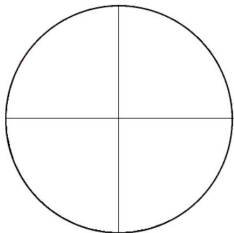
7. $\frac{11\pi}{6}$



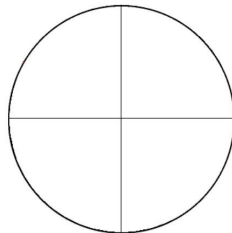
8. $\frac{7\pi}{6}$



9. $-\frac{\pi}{4}$



10. $\frac{3\pi}{2}$



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PRACTICE Solving for the Angles

For each of the following

a. Draw the terminal arms in the correct quadrants

b. Find all answers for the angle in radians within first positive revolution (exact angles if possible)

11. $\sin \theta = -\frac{\sqrt{3}}{2}$

12. $\cos \theta = -\frac{\sqrt{2}}{2}$

13. $\tan \theta = -1$

14. $\tan \theta = \frac{\sqrt{3}}{3}$

15. $\sin \theta = \frac{1}{2}$

16. $\cos \theta = -\frac{\sqrt{3}}{2}$

17. $\cos \theta = 0$

18. $\sin \theta = -1$

19. $\tan \theta = 0$

20. $\cos \theta = -1$

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PRACTICE More Exact Values

For each of the following state primary ratios for 1st column, and secondary ratios for 2nd column

21. Point $P(-1, -3)$ on terminal arm in standard position 22. Point $Q(-4, 0)$ on terminal arm in standard position

23. $\sec \theta = -\frac{3}{2}$

24. $\csc \theta = 7$

PRACTICE Approximate Values

For each of the following

- Identify if x is the angle, or if x is the ratio (pay attention to the position it is in)
- if the angle is given, find the approximate ratio using a calculator (can't use special triangles on non-special angles)
if the ratio is given, find all possible approximate angles within first positive revolution.

25. $\tan \frac{3\pi}{8} = x$

26. $\tan x = -0.8$

27. $\sin x = \frac{3}{8}$

28. $x = \sec \frac{\pi}{8}$

29. $x = \cot 4.76$

30. $-0.569 = \cos x$

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Name: ANSWERS

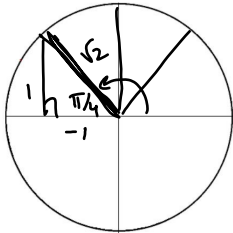
PRACTICE Drawing Angles in Radians and Exact Values

For each of the following

- Draw the angle given in standard position
- Find the related acute angle
- Draw and label the special triangle
- Use the triangle to state the trig ratios (primary on the left column, secondary on the right column)

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

related acute = $\frac{\pi}{4}$



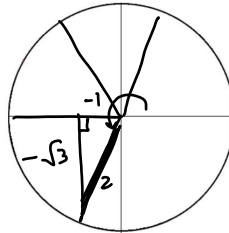
$$\sin \frac{3\pi}{4} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

$$\cos \frac{3\pi}{4} = \frac{-1}{\sqrt{2}} = -\frac{\sqrt{2}}{2}$$

$$\tan \frac{3\pi}{4} = -1$$

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

related acute = $\frac{\pi}{3}$



$$\csc \frac{4\pi}{3} = \frac{-2}{\sqrt{3}} = -\frac{2\sqrt{3}}{3}$$

$$\sec \frac{4\pi}{3} = -2$$

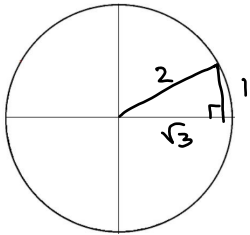
$$\cot \frac{4\pi}{3} = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$$

3. $\frac{\pi}{6}$ ← is acute

$$\sin \frac{\pi}{6} = \frac{1}{2}$$

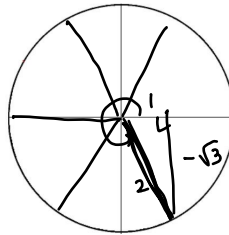
$$\cos \frac{\pi}{6} = \frac{\sqrt{3}}{2}$$

$$\tan \frac{\pi}{6} = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$$



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

related acute = $\frac{\pi}{3}$



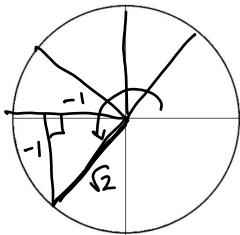
$$\csc \frac{5\pi}{3} = \frac{2}{-\sqrt{3}} = -\frac{2\sqrt{3}}{3}$$

$$\sec \frac{5\pi}{3} = 2$$

$$\cot \frac{5\pi}{3} = \frac{1}{-\sqrt{3}} = -\frac{\sqrt{3}}{3}$$

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

related acute = $\frac{\pi}{4}$



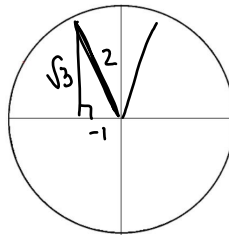
$$\sin \frac{5\pi}{4} = \frac{-1}{\sqrt{2}} = -\frac{\sqrt{2}}{2}$$

$$\cos \frac{5\pi}{4} = \frac{-1}{\sqrt{2}} = -\frac{\sqrt{2}}{2}$$

$$\tan \frac{5\pi}{4} = \frac{-1}{-1} = 1$$

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

related acute = $\frac{\pi}{3}$



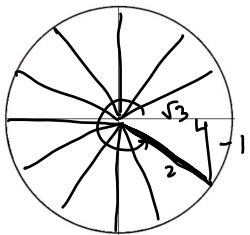
$$\csc \frac{2\pi}{3} = \frac{2}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$$

$$\sec \frac{2\pi}{3} = -2$$

$$\cot \frac{2\pi}{3} = \frac{-1}{\sqrt{3}} = -\frac{\sqrt{3}}{3}$$

7. $\frac{11\pi}{6}$

related acute = $\frac{\pi}{6}$



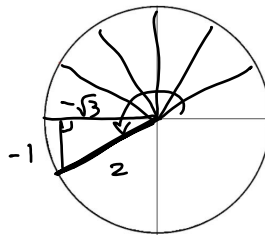
$$\sin \frac{11\pi}{6} = \frac{-1}{2}$$

$$\cos \frac{11\pi}{6} = \frac{\sqrt{3}}{2}$$

$$\tan \frac{11\pi}{6} = \frac{-1}{\sqrt{3}}$$

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

related acute = $\frac{\pi}{6}$



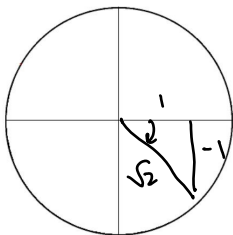
$$\csc \frac{7\pi}{6} = -2$$

$$\sec \frac{7\pi}{6} = \frac{2}{-\sqrt{3}} = -\frac{2\sqrt{3}}{3}$$

$$\cot \frac{7\pi}{6} = \frac{-\sqrt{3}}{-1} = \sqrt{3}$$

9. $-\frac{\pi}{4}$

related acute = $\frac{\pi}{4}$

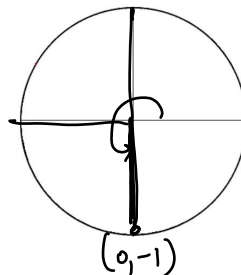


$$\sin\left(-\frac{\pi}{4}\right) = \frac{-1}{\sqrt{2}} = -\frac{\sqrt{2}}{2}$$

$$\cos\left(-\frac{\pi}{4}\right) = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

$$\tan\left(-\frac{\pi}{4}\right) = \frac{-1}{1} = -1$$

10. $\frac{3\pi}{2}$



$$\csc \frac{3\pi}{2} = \frac{r}{y} = \frac{1}{-1} = -1$$

$$\sec \frac{3\pi}{2} = \frac{r}{x} = \frac{1}{0} = \text{undefined}$$

$$\cot \frac{3\pi}{2} = \frac{x}{y} = \frac{0}{-1} = 0$$

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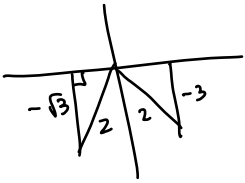
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PRACTICE Solving for the Angles

For each of the following

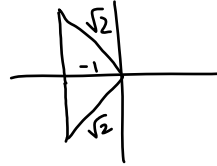
- Draw the terminal arms in the correct quadrants
- Find all answers for the angle in radians within first positive revolution (exact angles if possible)

11. $\sin \theta = -\frac{\sqrt{3}}{2}$ related to $\frac{\pi}{3}$ angle



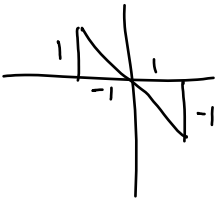
$\therefore \theta_1 = \frac{4\pi}{3}$
 $\theta_2 = \frac{5\pi}{3}$

12. $\cos \theta = -\frac{\sqrt{2}}{2} = -\frac{1}{\sqrt{2}}$ related to $\frac{\pi}{4}$ angle



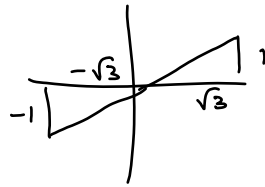
$\therefore \theta_1 = \frac{3\pi}{4}$
 $\theta_2 = \frac{5\pi}{4}$

13. $\tan \theta = -\frac{1}{1} \frac{y}{x} \text{ or } \frac{1}{-1}$ related to $\frac{\pi}{4}$



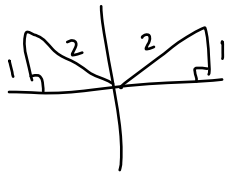
$\theta_1 = \frac{3\pi}{4}$
 $\theta_2 = \frac{7\pi}{4}$

14. $\tan \theta = \frac{\sqrt{3}}{3} = \frac{1}{\sqrt{3}} \frac{y}{x} \text{ or } \frac{-1}{-\sqrt{3}}$ related to $\frac{\pi}{6}$ angle



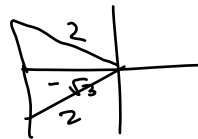
$\theta_1 = \frac{\pi}{6}$
 $\theta_2 = \frac{7\pi}{6}$

15. $\sin \theta = \frac{1}{2} \frac{y}{r}$ related to $\frac{\pi}{6}$ angle



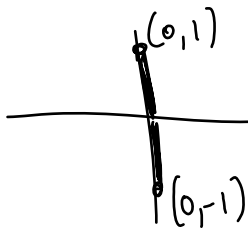
$\therefore \theta_1 = \frac{\pi}{6}$
 $\theta_2 = \frac{5\pi}{6}$

16. $\cos \theta = -\frac{\sqrt{3}}{2} = \frac{x}{r}$ related to $\frac{\pi}{6}$ angle



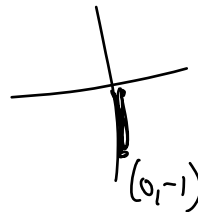
$\theta_1 = \frac{5\pi}{6}$
 $\theta_2 = \frac{7\pi}{6}$

17. $\cos \theta = 0 = x$



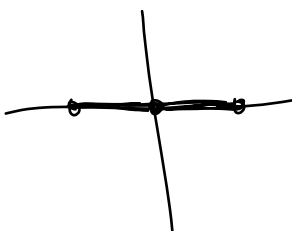
$\theta_1 = \frac{\pi}{2}$
 $\theta_2 = \frac{3\pi}{2}$

18. $\sin \theta = -1 = y$



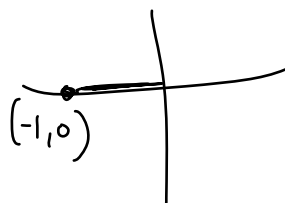
$\theta = \frac{3\pi}{2}$ only

19. $\tan \theta = 0$ slope



$\theta_1 = 0$
 $\theta_2 = \pi$
 $\theta_3 = 2\pi$

20. $\cos \theta = -1 = x$



$\theta = \pi$ only

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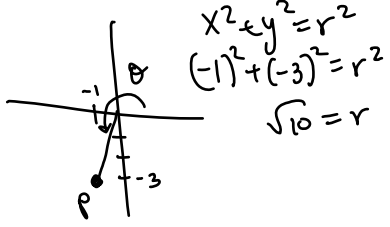
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PRACTICE More Exact Values

For each of the following state primary ratios for 1st column, and secondary ratios for 2nd column

21. Point $P(-1, -3)$ on terminal arm in standard position

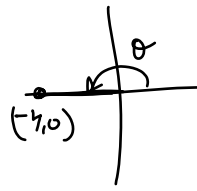
22. Point $Q(-4, 0)$ on terminal arm in standard position



$$\sin \theta = \frac{y}{r} = \frac{-3}{\sqrt{10}} = \frac{-3\sqrt{10}}{10}$$

$$\cos \theta = \frac{x}{r} = \frac{-1}{\sqrt{10}} = \frac{-\sqrt{10}}{10}$$

$$\tan \theta = \frac{y}{x} = \frac{-3}{-1} = 3$$



$$\csc \theta = \frac{r}{y} = \frac{4}{0} = \text{undefined}$$

$$\sec \theta = \frac{r}{x} = \frac{4}{-4} = -1$$

$$\cot \theta = \frac{x}{y} = \frac{-4}{0} = \text{undefined}$$

23. $\sec \theta = -\frac{3}{2} = \frac{r}{x}$

$$x^2 + y^2 = r^2$$

$$(-2)^2 + y^2 = 3^2$$

$$y = \pm \sqrt{5}$$

$$\sin \theta = \pm \frac{\sqrt{5}}{3}$$

$$\cos \theta = \frac{-2}{3}$$

$$\tan \theta = \pm \frac{\sqrt{5}}{2}$$

24. $\csc \theta = \frac{7}{1} = \frac{r}{y}$

$$x^2 + y^2 = r^2$$

$$x^2 + 1^2 = 7^2$$

$$x = \pm \sqrt{48} = \pm 4\sqrt{3}$$

$$\csc \theta \rightarrow \sec \theta = \frac{7}{\pm 4\sqrt{3}} = \pm \frac{7\sqrt{3}}{12}$$

$$\cot \theta = \frac{\pm 4\sqrt{3}}{1}$$

PRACTICE Approximate Values

For each of the following

- Identify if x is the angle, or if x is the ratio (pay attention to the position it is in)
- if the angle is given, find the approximate ratio using a calculator (can't use special triangles on non-special angles)
if the ratio is given, find all possible approximate angles within first positive revolution.

25. $\tan \frac{3\pi}{8} = x$ x is a ratio

$$2.414 \approx x$$

26. $\tan x = -0.8$ x is an angle

rough work: $\tan^{-1}(-0.8) = -0.675$ acute but negative

$$\therefore x_1 \approx \pi - 0.675 \approx 2.467$$

$$x_2 \approx 2\pi - 0.675 \approx 5.608$$

27. $\sin x = \frac{3}{8}$ x is an angle

rough: $\sin^{-1}(\frac{3}{8}) = 0.384$ acute \therefore

$$\therefore x_1 \approx 0.384$$

$$x_2 \approx \pi - 0.384 = 2.757$$

28. $x = \sec \frac{\pi}{8}$ x is a ratio

$$x = \frac{1}{\cos \frac{\pi}{8}}$$

no such button exists on calculator \therefore rewrite

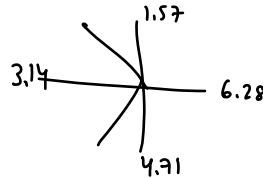
$$x \approx 1.082$$

29. $x = \cot 4.76$ x is a ratio

$$x = \frac{1}{\tan 4.76}$$

$$x \approx -0.048$$

30. $-0.569 = \cos x$ x is an angle



rough: $\cos^{-1}(-0.569) = 2.176$ obtuse

$$\therefore x_1 \approx 2.176$$

$$x_2 \approx 2\pi - 2.176 \approx 4.107$$