Name KEY (:) Period _____ Desk _____ Score _____

Precalculus **4.1-4.3 Review**

Do your work ON A SEPARATE SHEET OF PAPER.

Convert from radians to degrees.

1. $\frac{2\pi}{3}$ $\frac{2\pi}{3}\left(\frac{180}{\pi}\right) = \boxed{120°}$

2. $\frac{\pi}{4}$ $\frac{\pi}{4}\left(\frac{180}{\pi}\right) = \boxed{45°}$

Convert from degrees to radians.

3. 150° $150\left(\frac{\pi}{180}\right) = \boxed{\frac{5\pi}{6}}$

4. 270° $270\left(\frac{\pi}{180}\right) = \boxed{\frac{3\pi}{2}}$

5. a. If the measure of a sector is 60° and has a radius of 5 inches, find the arc length.

Sin Sin $(2\pi r)\left(\frac{\theta}{360}\right) = (10\pi)\left(\frac{60}{360}\right) = \boxed{\frac{5\pi}{3} \text{ inches}}$

b. If the arc length of a sector is 2.5 cm and has an angle measure of $\frac{\pi}{3}$ *radians*, find the radius.

arc length: $(2\pi r)\left(\frac{\theta}{2\pi}\right)$

$2.5 = (2\pi r)\left(\frac{\frac{\pi}{3}}{2\pi}\right) \Rightarrow$ $3 \cdot 2.5 = \frac{\pi}{3} r \cdot 3$

$\frac{7.5}{\pi} = \frac{\pi r}{\pi}$

$\boxed{\text{radius} = \frac{7.5}{\pi} \text{ cm}}$

6. A Ferris wheel with radius 60 feet makes one complete turn every 40 seconds.

- What its **linear speed** (in feet per second)?

$\left(\frac{1 \text{ rev}}{40 \text{ sec}}\right)\left(\frac{120\pi \text{ ft}}{1 \text{ rev}}\right) = \boxed{3\pi \text{ feet per second}}$

- What is its **angular speed** in degrees per second?

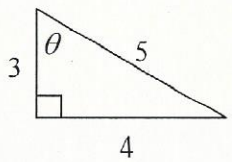
$\frac{360°}{40 \text{ sec}} = \boxed{9° \text{ per second}}$

- What is its **angular speed** in radians per second?

$\frac{2\pi}{40 \text{ sec}} = \boxed{\frac{\pi}{20} \text{ radians per second}}$

Find the six trig functions of the angle θ.

7.



$\sin\theta = \frac{4}{5}$ $\csc\theta = \frac{5}{4}$

$\cos\theta = \frac{3}{5}$ $\sec\theta = \frac{5}{3}$

$\tan\theta = \frac{4}{3}$ $\cot\theta = \frac{3}{4}$

Evaluate without using a calculator. (You must have these memorized).

8. $\sin 45°$ $\frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$

9. $\cos\frac{\pi}{3} = \frac{1}{2}$

10. $\tan\frac{\pi}{4} = 1$

11. $\cos 30° = \frac{\sqrt{3}}{2}$

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

13. $\tan\frac{\pi}{3} = \sqrt{3}$

14. $\cos 45°$ $\frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$

15. $\sin\frac{\pi}{3}$ $\frac{\sqrt{3}}{2}$

16. $\sec\frac{\pi}{4}$ $\frac{1}{\cos\frac{\pi}{4}} = \frac{1}{\frac{1}{\sqrt{2}}} = \sqrt{2}$

17. $\cot 30°$ $\frac{1}{\tan 30} = \frac{1}{\frac{1}{\sqrt{3}}} = \sqrt{3}$

Find the acute angle θ that satisfies the given equation.

*Recall: an acute angle is less than 90°

18. $\cos\theta = \frac{\sqrt{3}}{2}$ $\theta = \frac{\pi}{6}$ or $30°$

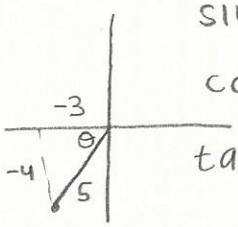
19. $\sin\theta = \frac{\sqrt{2}}{2}$ $\theta = 45°$ or $\frac{\pi}{4}$

20. $\csc\theta = 2$ $\sin\theta = \frac{1}{2}$ $\theta = \frac{\pi}{6}$ or $30°$

21. $\tan\theta = \frac{1}{\sqrt{3}}$ $\theta = 30°$ or $\frac{\pi}{6}$

Point P is on the terminal side of angle θ. Evaluate the six trig functions.

22. (-3, -4)

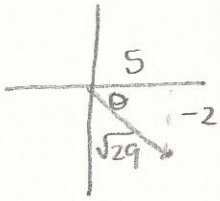


$\sin\theta = \frac{-4}{5}$ $\csc\theta = \frac{-5}{4}$

$\cos\theta = \frac{-3}{5}$ $\sec\theta = \frac{-5}{3}$

$\tan\theta = \frac{-4}{-3} = \frac{4}{3}$ $\cot\theta = \frac{3}{4}$

23. (5, −2)



$\sin\theta = \frac{-2}{\sqrt{29}}$ $\csc\theta = \frac{-\sqrt{29}}{2}$

$\cos\theta = \frac{5}{\sqrt{29}}$ $\sec\theta = \frac{\sqrt{29}}{5}$

$\tan\theta = \frac{-2}{5}$ $\cot\theta = \frac{-5}{2}$

Name two positive coterminal angles and two negative coterminal angles to the given angle.

24. 55°

Positive: $55+360=415°$, $415+360=775°$

Negative: $55-360=-305°$, $-305-360=-665°$

25. −320°

Pos.: $-320+360=40°$, $40+360=400°$

neg.: $-320-360=-680°$, $-680-360=-1040°$

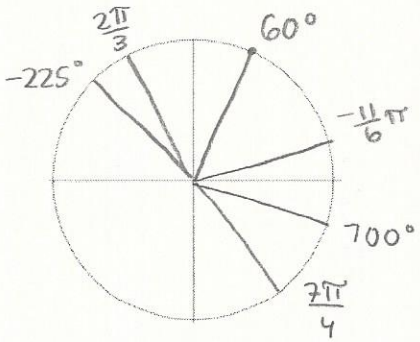
26. $\frac{5}{6}\pi$

Pos.: $\frac{5\pi}{6}+2\pi=\frac{17\pi}{6}$, $\frac{17\pi}{6}+2\pi=\frac{29\pi}{6}$

neg.: $\frac{5\pi}{6}-2\pi=\frac{-7\pi}{6}$, $\frac{-7\pi}{6}-2\pi=\frac{-19\pi}{6}$

Locate the angle on the unit circle.

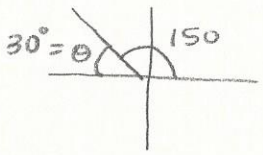
27. 60°
28. $700° = 360 + 340°$
29. −225°
30. $\frac{2\pi}{3}$
31. $\frac{7\pi}{4}$
32. $-\frac{11\pi}{6}$



S	A
T	C

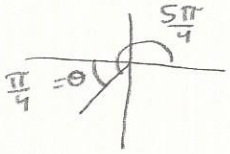
Evaluate without using a calculator.

33. $\sin 150°$



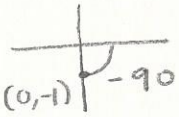
$\sin 150 = \sin 30 = \frac{1}{2}$

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



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

35. $\tan(-90°)$

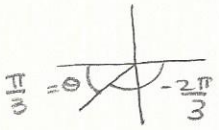


$\tan = \frac{y}{x}$

$\tan(-90) = \frac{-1}{0}$

undefined

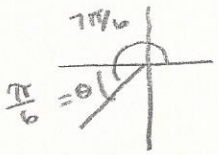
36. $\sin\left(-\frac{2\pi}{3}\right)$



$\sin(\frac{-2\pi}{3}) = -\sin(\frac{\pi}{3})$

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

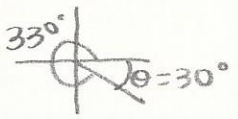
37. $\cot\left(\frac{7\pi}{6}\right) = \frac{1}{\tan(\frac{7\pi}{6})}$



$\cot(\frac{7\pi}{6}) = \frac{1}{\tan(\frac{\pi}{6})} = \frac{1}{\frac{1}{\sqrt{3}}}$

$= \sqrt{3}$

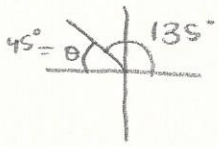
38. $\sec 330° = \frac{1}{\cos 330}$



$\sec(330) = \frac{1}{\cos 30} = \frac{1}{\frac{\sqrt{3}}{2}}$

$= \frac{2}{\sqrt{3}}$ or $\frac{2\sqrt{3}}{3}$

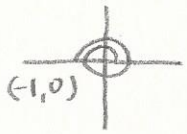
39. $\cos 135°$



$\cos 135° = -\cos 45°$

$= \frac{-1}{\sqrt{2}}$ or $\frac{-\sqrt{2}}{2}$

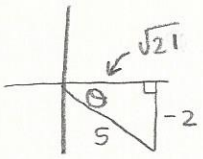
40. $\csc(3\pi) = \frac{1}{\sin 3\pi}$



$\csc(3\pi) = \frac{1}{\sin 3\pi} = \frac{1}{0}$

undefined.

41. Find $\tan\theta$ and $\sec\theta$ if $\underbrace{\sin\theta = -\frac{2}{5}}_{Q3\ Q4}$ and $\underbrace{\cos\theta > 0}_{Q1\ Q4}$.



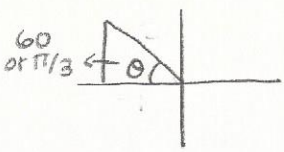
$\tan\theta = \frac{-2}{\sqrt{21}}$ or $\frac{-2\sqrt{21}}{21}$

$\sec\theta = \frac{1}{\cos\theta} = \frac{1}{\frac{\sqrt{21}}{5}} = \frac{5}{\sqrt{21}}$ or $\frac{5\sqrt{21}}{21}$

42. If $\cos\theta = -\frac{1}{2}$ for $0 \le \theta \le \pi$, what is the measure of θ?

$\underbrace{\quad}_{Q2\ Q3}$ $\underbrace{\quad}_{Q1\ Q2}$

← since this is a measure in radians, your answer should be in radians.



Recall: $\cos 60 = \frac{1}{2}$

$\cos\frac{\pi}{3} = \frac{1}{2}$

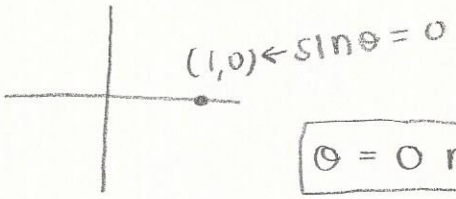
$\theta = \pi - \frac{\pi}{3} = \boxed{\frac{2\pi}{3}}$

43. If $\tan\theta = 0$ for $-\frac{\pi}{2} \le \theta \le \frac{\pi}{2}$, what is the measure of θ?

← Q4 and Q1

$\tan\theta = \frac{\sin\theta}{\cos\theta} = \frac{0}{\#}$

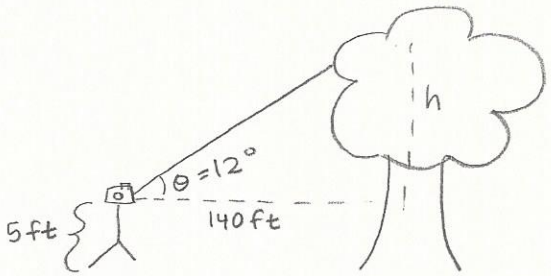
$\sin\theta = 0$



θ = 0 radians

Your answer cannot be 2π because θ is between $\frac{-\pi}{2}$ and $\frac{\pi}{2}$. 2π is not in that interval.

44. Kristen places her surveyor's telescope on the top of a tripod 5 feet above the ground. She measures an 12° elevation above the horizontal to the top of a tree that is 140 feet away. How tall is the tree? Round your answer to the nearest hundredth foot.



$140 \cdot \tan 12° = \frac{h}{140} \cdot 140$

$h = 140 \tan 12°$

$h = 29.76$

But, the camera is 5 feet above the ground.

Height of the tree: $29.76 + 5 =$ 34.76 feet

45. A radial arm saw has a circular cutting blade with a diameter of 14 inches. It spins 1500 rpm. If there are 10 cutting teeth per inch on the cutting blade, how many teeth cross the cutting surface each second?

$\left(\frac{1500\,\text{rev}}{1\,\text{min}}\right)\left(\frac{14\pi\,\text{in}}{1\,\text{rev}}\right)\left(\frac{10\,\text{teeth}}{1\,\text{in}}\right)\left(\frac{1\,\text{min}}{60\,\text{sec}}\right) =$ 3500π teeth per second ≈ 10995.57 teeth per second