Math 154 Test 3 Review

I. Draw the angle $\theta$ in standard position. Find and label its reference angle $\hat{\theta}$.

a) $215°$ b) $109°$ c) $307°$ d) $-130°$

II. Find the exact value without using a calculator.

a) $\sin 210°$ b) $\sec 135°$ c) $\csc 300°$ d) $\tan(-150°)$

III. Find all values of $\theta$ in the interval $0° \le \theta < 360°$ that satisfy the given equation.

a) $\sin\theta = -\frac{\sqrt{2}}{2}$ b) $\cos\theta = 0$ c) $\tan\theta = \frac{\sqrt{3}}{3}$ d) $\csc\theta = 2$

IV. Approximate the value using a calculator.

a) $\sin 37°$ b) $\sec 156°$ c) $\csc 298°$ d) $\tan(-107°)$

V. Find all values of $\theta$ in the interval $0° \le \theta < 360°$ that satisfy the given equation. Round to the nearest tenth of a degree.

a) $\sin\theta = 0.75$ b) $\cos\theta = -0.33$ c) $\tan\theta = 6$ d) $\csc\theta = -4$

VI. Convert $\theta$ to radians.

a) $240°$ b) $105°$ c) $216°$ d) $(2\pi)°$

VII. Convert $\theta$ to degrees.

a) $\frac{11\pi}{6}$ b) $\frac{3\pi}{8}$ c) $-\frac{7\pi}{10}$ d) $4$

VIII. Find the exact value without using a calculator.

a) $\sin\frac{\pi}{3}$ b) $\sec\pi$ c) $\csc\frac{11\pi}{6}$ d) $\tan\frac{5\pi}{4}$

IX. Find all values of $\theta$ (in radians) in the interval $0 \le \theta < 2\pi$ that satisfy the given equation.

a) $\sin\theta = \frac{\sqrt{3}}{2}$ b) $\cos\theta = -\frac{1}{2}$ c) $\tan\theta = -1$ d) $\csc\theta = -\frac{2\sqrt{3}}{3}$

X. $t$ is the distance from $(1,0)$ to the given point $(x, y)$ along the unit circle. Find $\sin t$, $\cos t$, and $\tan t$. (If necessary, round to the nearest hundredth.)

a) $(0.31, -0.95)$ b) $(-1, 0)$ c) $(-0.6, -0.8)$ d) $(0.96, -0.28)$

XI. Simplify, using exact values.

a) $5\cos\left(2x - \frac{\pi}{3}\right) + 4$ for $x = \frac{2\pi}{3}$ & $x = \pi$ b) $\frac{3}{4}\cos\left(2x - \frac{\pi}{2}\right) - 1$ for $x = \frac{\pi}{2}$ & $x = \frac{3\pi}{4}$

XII. Find the arc length, *s*, for the given central angle $\theta$ and radius *r*.

a) $\theta = \frac{7\pi}{6}$, $r = 8$ cm b) $\theta = 120°$, $r = 11$ in

XIII. Find the radius, *r*, for the given central angle $\theta$ and arc length *s*.

a) $\theta = \frac{3\pi}{4}$, $s = 20$ ft b) $\theta = 195°$, $s = 7$ m

XIV. Find the area *A* of the sector formed by the central angle $\theta$ in a circle of radius *r*.

a) $\theta = \frac{\pi}{5}$, $r = 18$ in b) $\theta = \frac{4\pi}{3}$, $r = 4$ m c) $\theta = 210°$, $r = 40$ cm d) $\theta = 75°$, $r = 2$ mi

XV. Point *P* moves with angular velocity $\omega$ on a circle of radius *r*. Find the distance traveled by the point in time *t*.

a) $\omega = 7$ rad/sec, $r = 9$ in, $t = 12$ sec b) $\omega = \frac{3\pi}{4}$ rad/sec, $r = 12$ cm, $t = 20$ sec

c) $\omega = 10$ rad/sec, $r = 4$ ft, $t = 3$ min d) $\omega = 800$ rpm, $r = 30$ in, $t = 15$ sec

XVI. Point *P* is moving with uniform circular motion on a circle of radius *r*.

a) Find $\omega$ if $r = 8$ cm & $v = 12$ cm/sec. b) Find $\omega$ if $r = 13$ in & $v = 80$ in/min.

c) Find *v* if $r = 7.2$ m & $\omega = 20$ rad/sec. d) Find *v* if $r = 40$ in & $\omega = 5\pi$ rad/sec.

XVII. Arc Length Applications

a) A Ferris wheel has a diameter of 180 feet. If $\theta$ represents the central angle formed as the rider travels from her initial position $P_0$ to position $P_1$, find the distance traveled by the rider if $\theta = 240°$.

b) The minute hand on a clock is 3 feet long. Find the distance traveled by a point on the tip of the minute hand as the time changes from 3:00 pm to 4:20pm.

c) If the distance to the sun is approximately 93 million miles, and, from the earth, the sun subtends an angle of $0.5°$, estimate the distance to the sun. (Round to the nearest 1000 miles.)

d) A person standing on the earth sees an airplane overhead that subtends an angle of $0.8°$. If the plane is known to be 250 feet long, find the altitude of the plane to the nearest thousand feet.

XVIII. Sector Area Applications

a) A lawn sprinkler is set to rotate through $150°$ and project water 24 feet. Find the area of the lawn that is watered by the sprinkler.

b) An antique car has a windshield wiper 11 inches long that rotates through $95°$. If the rubber part of the blade is 7 inches long, find the area of the windshield that is cleaned by the wiper.

c) A bicycle wheel has a diameter of 70 cm, and has 15 spokes evenly distributed around the wheel. Find the area of the sector between two adjacent spokes?

d) A solar-power plant requires 950,000 square meters of land area to collect the required amount of energy from sunlight. If the land area is a $35°$ sector of a circle, what is its radius?

XIX. Velocity Applications

a) A bicycle wheel with a radius of 0.7 m is turning at 5 revolutions per second. Find the distance traveled in 20 minutes.

b) A lawn mower blade is 15 inches long and spinning at 750 revolutions per minute. How fast is a point on the tip of the blade moving in miles per hour?

c) A disk with radius *r* is spinning at 1000 rpm. If a point on the edge of the disk is moving with velocity *v*, find the velocity of a point halfway between the center of the disk and the edge of the disk. Express your answer in terms of *v*.

d) A Ferris wheel has a radius of 100 feet. If the wheel makes a complete revolution every 2 minutes, find the speed of a passenger in miles per hour.

e) A bullwheel is designed to pull a wire rope at a speed of 8 ft/sec. If the angular velocity of the wheel is 7 revolutions per minute, find the diameter of the wheel.

XX. Other Problems

a) A pulley with a radius of 9 inches is used to pull a water bucket from a well, old-school style. If the pulley is rotated through an angle of $70°$, how many inches will the bucket be raised?

b) A pulley with a radius of 9 inches is used to pull a water bucket from a well, old-school style. What angle must the pulley is rotated to raise the bucket by 4 feet?

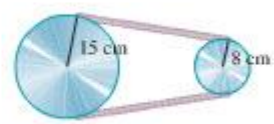
c) The tires of a bicycle have radius 13 inches and are turning at 280 revolutions per minute. How fast is the bicycle traveling in miles per hour?

d) Assume Earth rotates around the sun in a circular orbit with a radius of 93 million miles.

- Assuming that a year is 365 days, find the angle formed by Earth's movement in one day.
- Give the angular speed of Earth in radians per hour.
- Find the linear speed of Earth in miles per hour.

e)

Two pulleys are connected by a belt. The larger pulley has a radius of 15 cm, while the radius of the other pulley is 8 cm. The larger pulley rotates 25 times in 36 seconds. Find the angular speed of each pulley in radians per second.




f) The shoulder joint can rotate at 25 radians per second. If a golfer's arm is straight and the distance from the shoulder to the club head is 5 feet, find the linear speed of the club head from shoulder rotation in miles per hour.

g) A central angle of a circle with radius 150 cm intercepts an arc of 200 cm. Find the radian measure of the angle, and the area of the sector.

h) The arrow on a car's gas gauge is 0.5 inches long. Through what angle does the arrow rotate when it moves 1 inch on the gauge?

i) Point *P* is on a circle with radius 60 cm, and the ray *OP* is rotating with an angular speed of $\frac{\pi}{12}$ radians per second. Find the angle generated by *P* in 8 seconds, the distance traveled by *P* in 8 seconds, and the linear speed of *P*.

j) A Ferris wheel has a diameter of 100 feet. A rider takes a seat and then the wheel turns $\frac{2\pi}{3}$ radians.
How far above the ground is the rider?
If it takes 30 seconds to reach that point, what is the angular velocity of the wheel?