

Radians, Arc Length and the Unit Circle

Grade 12 – Precalculus math · Test · Standards: F-TF.A.1, F-TF.A.2, F-TF.A.3, F-TF.A.4

Name: _____ Date: _____ Class: _____

This 45-minute test has 9 questions worth 20 points. It covers conversions, arc length, exact values, quadrants and signs, symmetry and speeds. Leave answers exact unless a decimal is requested, and show each step.

Standards: F-TF.A.1, F-TF.A.2, F-TF.A.3, F-TF.A.4 · **Level:** Grade 12 Precalculus

Time: 45 minutes · 9 questions · Total: 20 points · Calculator: as allowed by your teacher

Question 1 Convert Angle Measures (2 points)

(a) Convert 315° to radians. (1 point) (b) Convert $7\pi/18$ radians to degrees. (1 point)

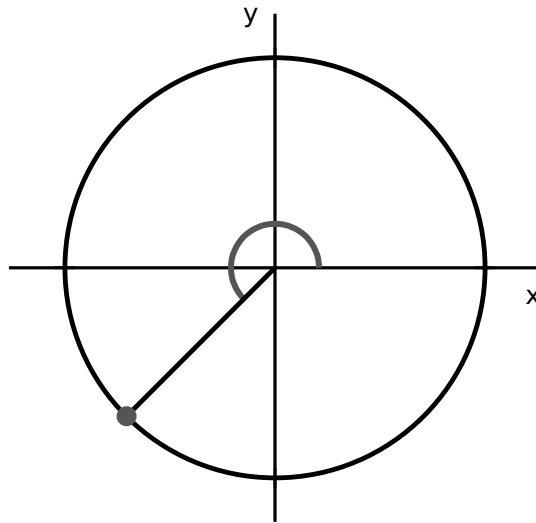
Question 2 Sprinkler Arc (2 points)

A lawn sprinkler throws water 18 feet and sweeps through an angle of $5\pi/6$ radians.

- Find the length of the arc the water reaches. (1 point)
- Find the angle in degrees (nearest tenth) that gives a 30-foot arc at the same radius. (1 point)

Question 3 Point on the Unit Circle (2 points)

The terminal side of $\theta = 5\pi/4$ meets the unit circle as shown.



Angle $\theta = 5\pi/4$.

- Give the exact coordinates of the point. (1 point)
- Find $\tan \theta$. (1 point)

Question 4 Exact Trigonometric Values (3 points)

Find the exact value. (a) $\cos(3\pi/4)$ (1 point) (b) $\sin(-7\pi/6)$ (1 point) (c) $\tan(5\pi/3)$ (1 point)

Question 5 Find Cosine and Tangent (2 points)

Angle θ lies in Quadrant III and $\sin \theta = -5/13$. Find $\cos \theta$ and $\tan \theta$.

Question 6 Reference Angle and Sine (2 points)

(a) Find the reference angle of $17\pi/6$. (1 point) (b) Find $\sin(17\pi/6)$. (1 point)

Question 7 Tire Rotation (3 points)

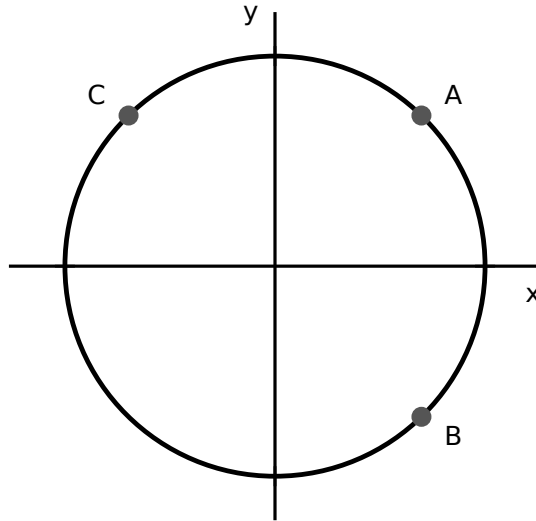
A tire of radius 15 inches turns 420 revolutions per minute.

- Find the angular speed in radians per minute. (1 point)
- Find the linear speed of the tread in inches per minute. (1 point)
- Convert that speed to miles per hour (63,360 inches per mile), to the nearest tenth. (1 point)

Question 8 Symmetry of Marked Points (2 points)

Point A is at angle 0.8 radian, with $\cos 0.8 \approx 0.697$ and $\sin 0.8 \approx 0.717$. Point B is at -0.8

radian, and point C is at $\pi - 0.8$ radian.



Points A, B and C on the unit circle.

- Find the coordinates of B. (1 point)
- Find the coordinates of C. (1 point)

Question 9 Particle Motion (2 points)

A point starts at $(1, 0)$ and moves counterclockwise on the unit circle at $\pi/3$ radians per second.

- (a) Find its exact position after 7 seconds. (1 point) (b) When does it first reach $(-1, 0)$? (1 point)