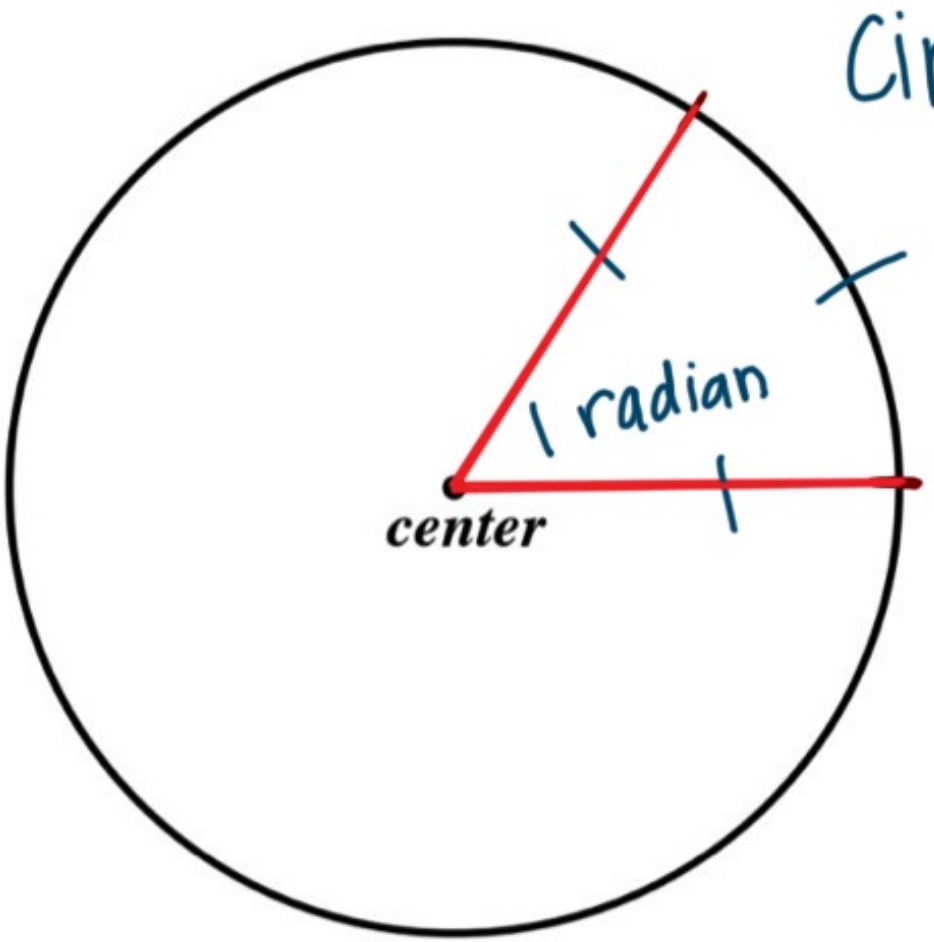
# 9.3 Radians




Take a piece of string and cut it so that it is the length of 1 radius. Mark a starting point and measure how many radii it takes to go the full circumference. Record your answer below.

# of radii 6.28

The exact number of radii is $2\pi$

**Arc length:** the distance between 2 points on the circumference of a circle

**Radian:** another unit for angles

$$\theta = \frac{\text{arc length}}{\text{radius}}$$

$\theta$ in radians

☆ Put the unit where you want to end up on top

| Convert radians to degrees | Convert degrees to radians |
| --- | --- |
| multiply by $\frac{180^\circ}{\pi \text{ radians}}$ | multiply by $\frac{\pi \text{ radians}}{180^\circ}$ |

**EXAMPLE**

**Convert each degree measure to radians. Leave your answer in reduced fraction form.** with π (NO decimals!)

A. $\frac{225^\circ}{1} \cdot \frac{\pi}{180^\circ}$

$\frac{225\pi}{180} = \boxed{\frac{5\pi}{4}}$

B. $315^\circ \cdot \frac{\pi}{180^\circ}$

$\boxed{\frac{7\pi}{4}}$

C. $300^\circ \cdot \frac{\pi}{180^\circ}$

$\boxed{\frac{5\pi}{3}}$

TI 83/84

225 ÷ 180 MATH 1: ▸Frac enter

**EXAMPLE**

**Convert each radian measure to degrees.**

D. $\frac{3\pi}{4}$ rad. $\frac{180^\circ}{\pi \text{ rad}}$

$\frac{3 \cdot 180^\circ}{4} = 135^\circ$

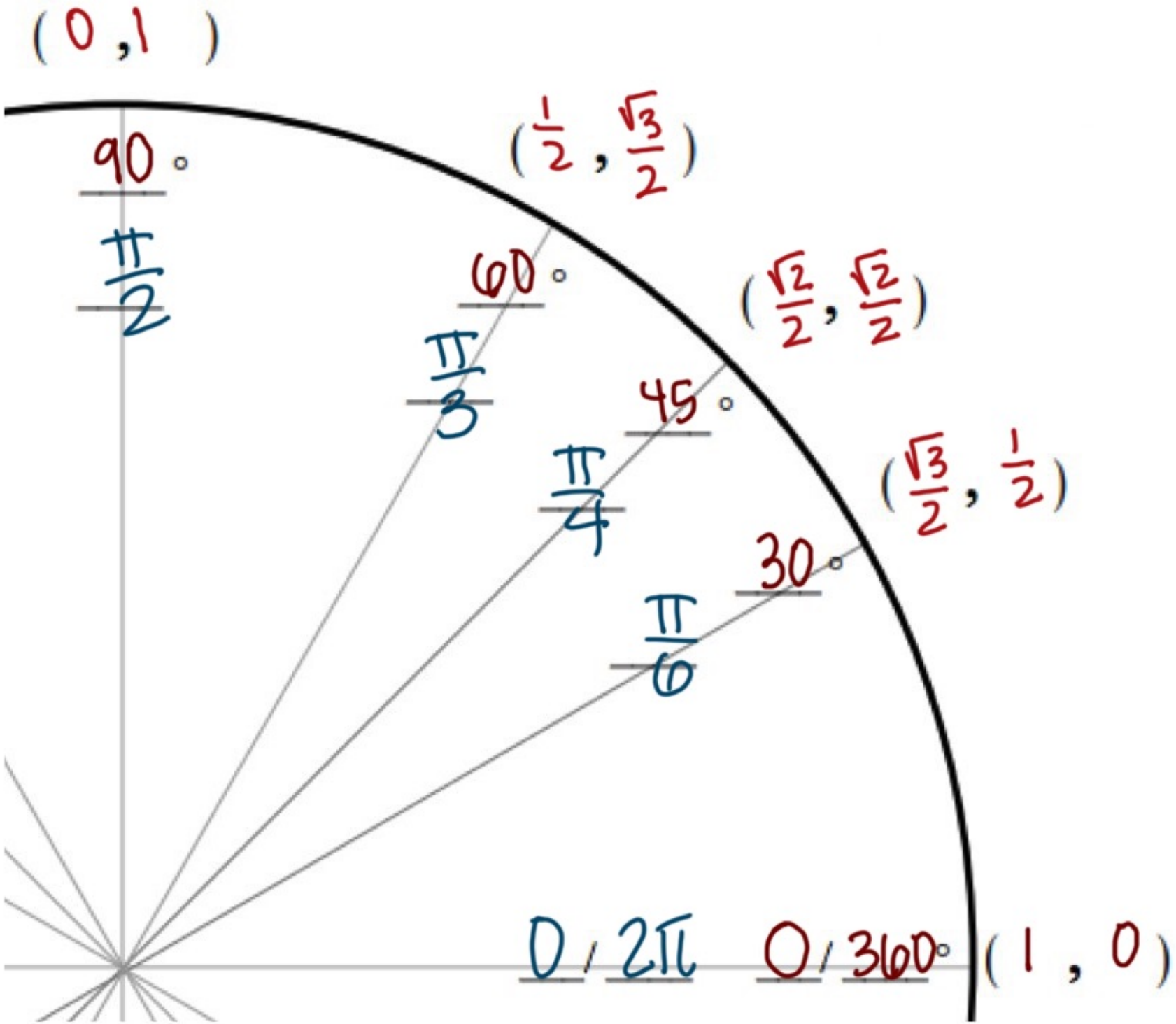
E. $\frac{7\pi}{6} \cdot \frac{180}{\pi}$

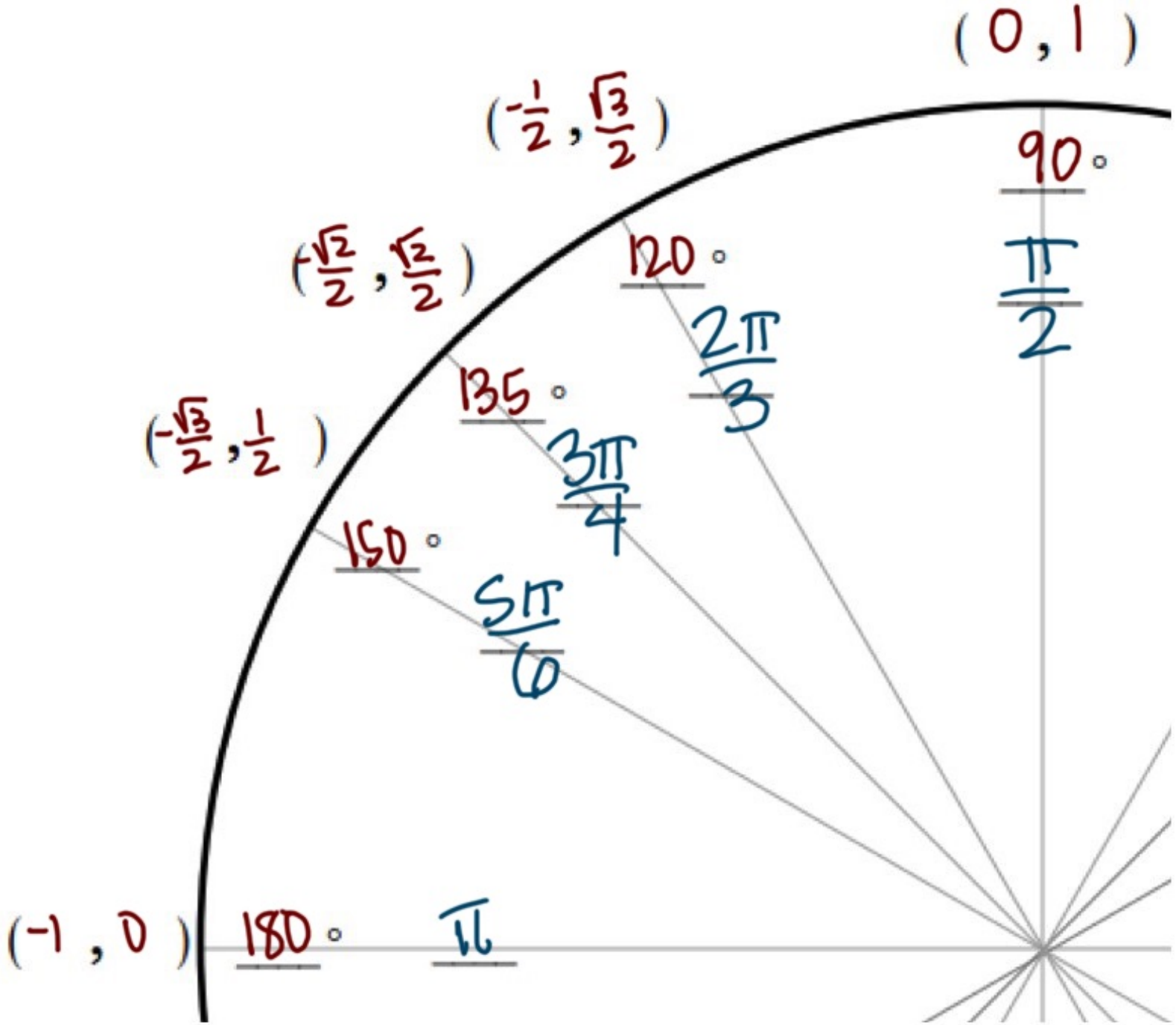
$210^\circ$

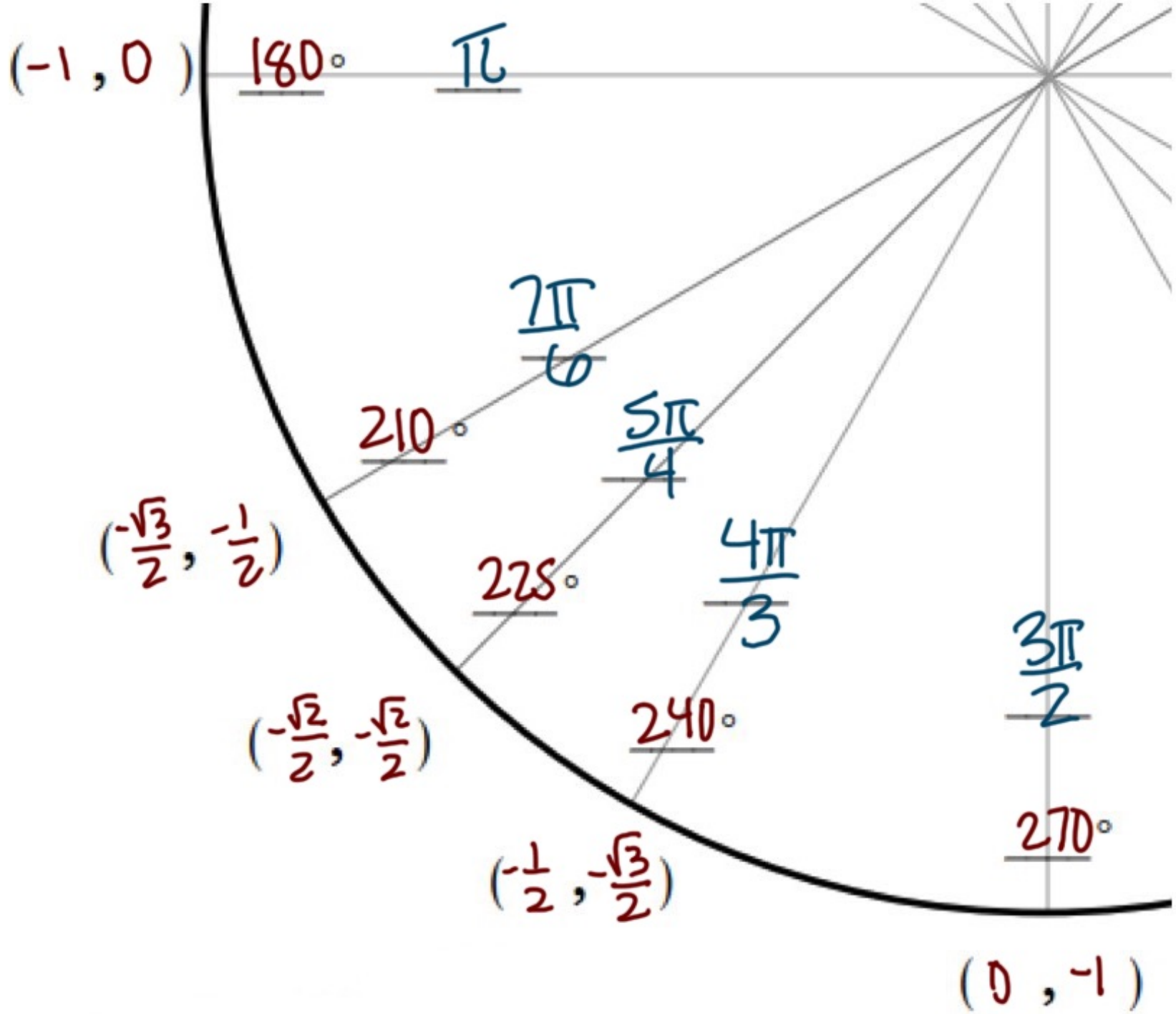
F. $\frac{5\pi}{3} \cdot \frac{180}{\pi}$

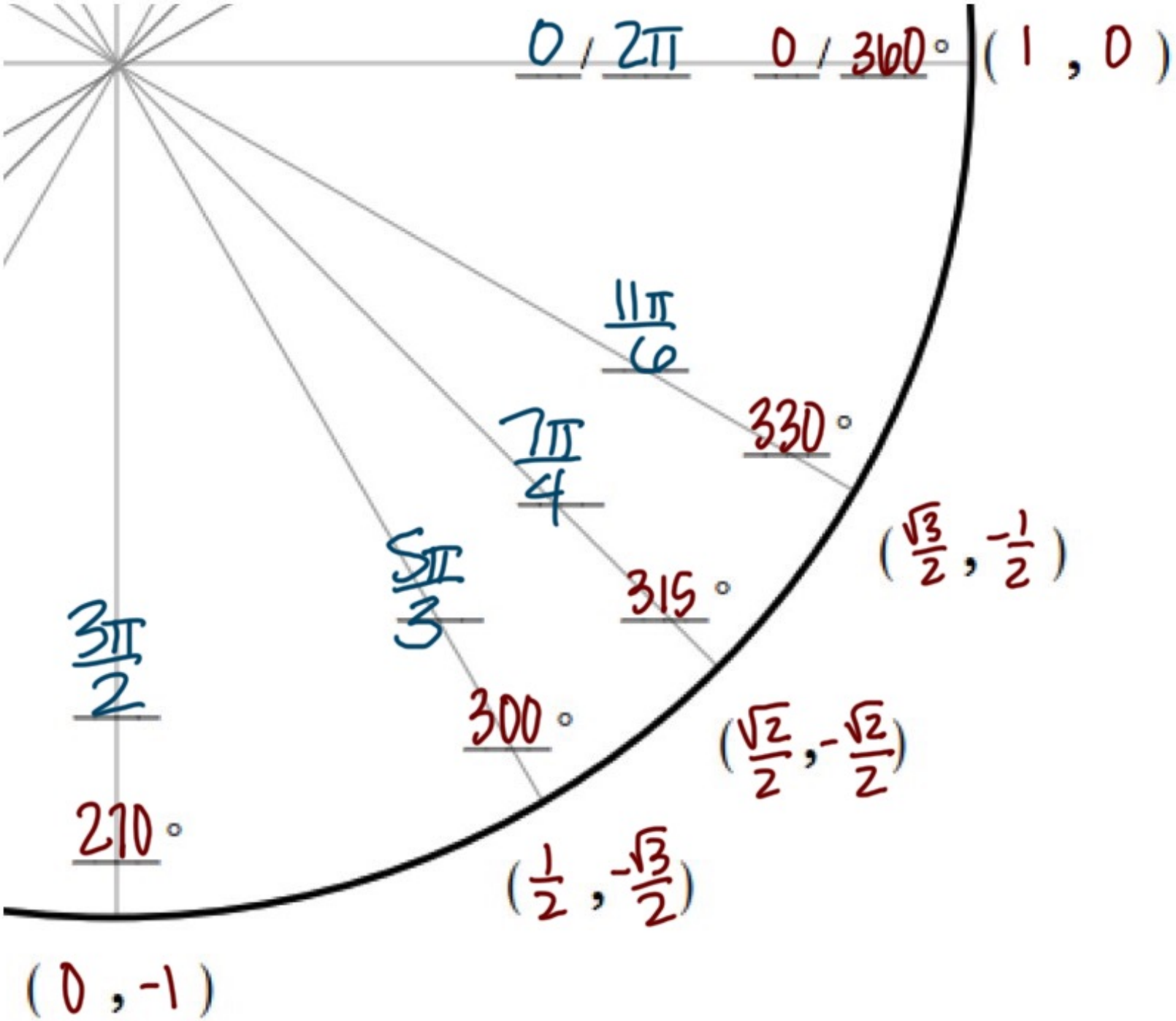
$300^\circ$

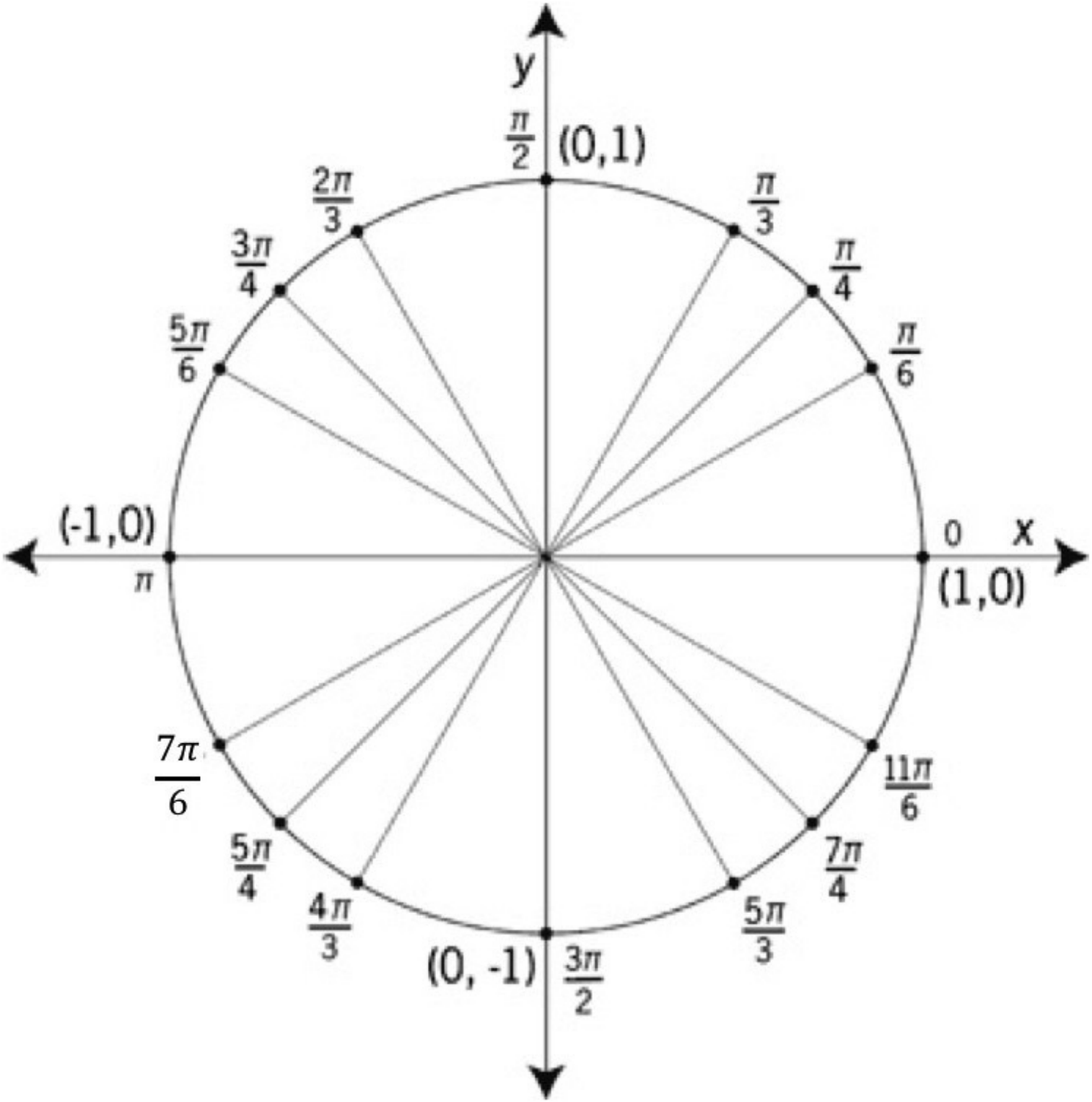
*** Go back to 9.2 notes and fill in the radian measure for each angle


(0, 1)
90°
π/2
(1/2, √3/2)
60°
π/3
(√2/2, √2/2)
45°
π/4
(√3/2, 1/2)
30°
π/6
0 / 2π
0 / 360°
(1, 0)


(0, 1)
$(-\frac{1}{2}, \frac{\sqrt{3}}{2})$
90°
$\frac{\pi}{2}$
$(-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2})$
120°
$\frac{2\pi}{3}$
135°
$\frac{3\pi}{4}$
$(-\frac{\sqrt{3}}{2}, \frac{1}{2})$
150°
$\frac{5\pi}{6}$
(-1, 0)
180°
$\pi$


(-1, 0)
180°
π
7π/6
210°
5π/4
(-√3/2, -1/2)
225°
4π/3
3π/2
(-√2/2, -√2/2)
240°
270°
(-1/2, -√3/2)
(0, -1)


0 / 2π
0 / 360°
(1, 0)
11π/6
330°
7π/4
315°
(√3/2, -1/2)
5π/3
300°
(√2/2, -√2/2)
3π/2
270°
(1/2, -√3/2)
(0, -1)


y
x
π/2
(0,1)
2π/3
π/3
3π/4
π/4
5π/6
π/6
(-1,0)
π
0
(1,0)
7π/6
11π/6
5π/4
7π/4
4π/3
5π/3
(0, -1)
3π/2

$\theta = \frac{\text{arc length}}{\text{radius}}$

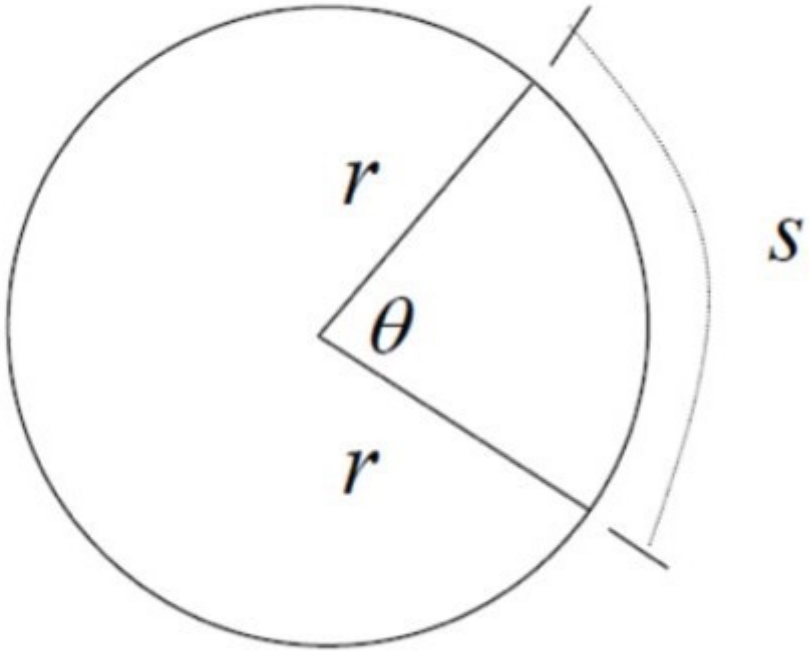
Radian

**Length of an intercepted arc:**

For a circle with radius $r$ and a central angle $\theta$ (in radians), the length $s$ of the intercepted arc is:

$$s = r \cdot \theta$$

↑ (angle in radians)



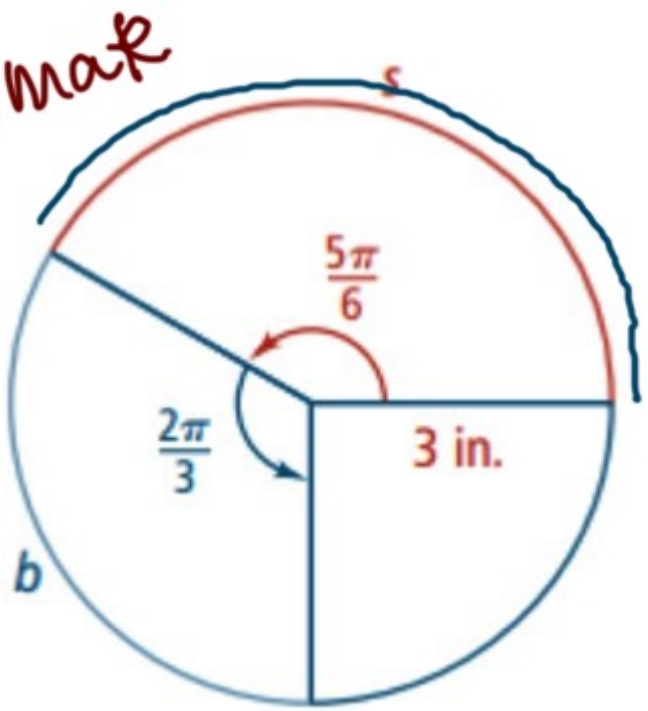

arc length

**EXAMPLE**

exact ↓ approximate ↓

G. Find the length of *s*.

$$s = 3 \cdot \frac{5\pi}{6} = \boxed{\frac{15\pi}{6} = 7.85 \text{ in}}$$




H. Find the length of *b*.

$$b = 3 \cdot \frac{2\pi}{3}$$

I. Find the length of the missing piece of the circumference.