# 2.2 Applications of Radian Measure

1. a. i. $\frac{\pi}{12}$

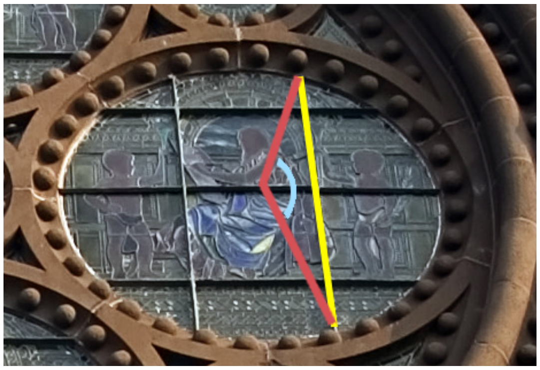
ii.$\approx$ 0.3 radians
iii.15°
b. i.20°. Answers may vary, anything above 15° and less than 25° is reasonable.
ii.$\frac{\pi}{9}$ Again, answers may vary

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

b. $\approx 26\ cm$

3. a. $\frac{\pi}{16}$

b. Let's assume, to simplify, that the chord stretches to the center of each of the dots. We need to find the measure of the central angle of the circle that connects those two dots.



Since there are 13 dots, this angle is $\frac{13\pi}{16}$. The length of the chord then is:

$$
\begin{aligned}
&= 2r\sin\frac{\theta}{2} \\
&= 2 \times 1.2 \times \sin(\frac{1}{2} \times \frac{13\pi}{16})
\end{aligned}
$$

The chord is approximately 2.30 m, or 230 cm.

4. Each section is $\frac{\pi}{6}$ radians. The area of one section of the stands is therefore the area of the outer sector minus the area of the inner sector:

$$
\begin{aligned}
A &= A_{outer} - A_{inner} \\
A &= \frac{1}{2}(r_{outer})^2 \times \frac{\pi}{6} - \frac{1}{2}(r_{inner})^2 \times \frac{\pi}{6} \\
A &= \frac{1}{2}(110)^2 \times \frac{\pi}{6} - \frac{1}{2}(55)^2 \times \frac{\pi}{6}
\end{aligned}
$$

The area of each section is approximately 2376 $ft^2$.

a. The students have 4 sections or $\approx 9503\ ft^2$
b. There are 3 general admission sections or $\approx 7127\ ft^2$
c. There is only one press and officials section or $\approx 2376\ ft^2$

5. It is actually easier to calculate the angular velocity first. $\omega = \frac{2\pi}{12} = \frac{\pi}{6}$, so the angular velocity is $\frac{\pi}{6}\ rad$, or 0.524. Because the linear velocity depends on the radius,each girl has her own.

Lois: $v = r\omega = 3 \cdot \frac{\pi}{6} = \frac{\pi}{2}$ or 1.57 $m/sec$
Doris: $v = r\omega = 10 \cdot \frac{\pi}{6} = \frac{5\pi}{3}$ or 5.24 $m/sec$

6. a. $v = \frac{d}{t} \rightarrow 3 \times 10^8 = \frac{27,000}{t} \rightarrow t = \frac{2.7 \times 10^4}{3 \times 10^8} = 0.9 \times 10^{-4} = 9 \times 10^{-5}$ or 0.00009 seconds.

b. $\omega = \frac{\theta}{t} = \frac{2\pi}{0.00009} \approx 69,813\ rad/sec$
c. The proton rotates around once in 0.00009 seconds. So, in one second it will rotate around the LHC $1 \div 0.00009 = 11,111.11$ times, or just over 11,111 rotations.