

4.1 Radian Measure Worksheet with solutions

This document was composed and formatted by Annie Bernatchez.

The course material originated from www.jensenmath.ca

1) Determine mentally the exact radian measure for each angle, given that 30° is exactly $\frac{\pi}{6}$ radians.

a) $60^\circ = 2(30^\circ)$

$$= 2\left(\frac{\pi}{6}\right) = \frac{\pi}{3}$$

b) 90°

$$= \frac{3\pi}{6} = \frac{\pi}{2}$$

c) 120°

$$= \frac{4\pi}{6} = \frac{2\pi}{3}$$

d) 150°

$$= \frac{5\pi}{6}$$

2) Determine mentally the exact radian measure for each angle, given that 30° is exactly $\frac{\pi}{6}$ radians.

a) $15^\circ = \frac{\left(\frac{\pi}{6}\right)}{2}$

$$= \frac{\pi}{12}$$

b) $10^\circ = \frac{\left(\frac{\pi}{6}\right)}{3}$

$$= \frac{\pi}{18}$$

c) $7.5^\circ = \frac{\left(\frac{\pi}{6}\right)}{4}$

$$= \frac{\pi}{24}$$

d) $5^\circ = \frac{\left(\frac{\pi}{6}\right)}{6}$

$$= \frac{\pi}{36}$$

3) Determine mentally the exact radian measure for each angle, given that 45° is exactly $\frac{\pi}{4}$ radians.

a) $90^\circ = \frac{2\pi}{4}$

$$= \frac{\pi}{2}$$

b) 135°

$$= \frac{3\pi}{4}$$

c) $180^\circ = \frac{4\pi}{4}$

$$= \pi$$

d) 225°

$$= \frac{5\pi}{4}$$

4) Determine mentally the exact radian measure for each angle, given that 45° is exactly $\frac{\pi}{4}$ radians.

a) $22.5^\circ = \frac{\left(\frac{\pi}{4}\right)}{2}$

$$= \frac{\pi}{8}$$

$$\begin{aligned}\text{b) } 15^\circ &= \frac{\left(\frac{\pi}{4}\right)}{3} \\ &= \frac{\pi}{12}\end{aligned}$$

$$\begin{aligned}\text{c) } 9^\circ &= \frac{\left(\frac{\pi}{4}\right)}{5} \\ &= \frac{\pi}{20}\end{aligned}$$

$$\begin{aligned}\text{d) } 3^\circ &= \frac{\left(\frac{\pi}{4}\right)}{15} \\ &= \frac{\pi}{60}\end{aligned}$$

5) Determine the EXACT radian measure for each angle

$$\begin{aligned}\text{a) } 40^\circ &\times \frac{\pi}{180} \\ &= \frac{2\pi}{9}\end{aligned}$$

$$\begin{aligned}\text{b) } 10^\circ &\times \frac{\pi}{180} \\ &= \frac{\pi}{18}\end{aligned}$$

$$\begin{aligned}\text{c) } 315^\circ &\times \frac{\pi}{180} \\ &= \frac{7\pi}{4}\end{aligned}$$

$$\begin{aligned}\text{d) } 210^\circ &\times \frac{\pi}{180} \\ &= \frac{7\pi}{6}\end{aligned}$$

$$\begin{aligned}\text{e) } 300^\circ &\times \frac{\pi}{180} \\ &= \frac{5\pi}{3}\end{aligned}$$

$$\begin{aligned}\text{f) } 75^\circ &\times \frac{\pi}{180} \\ &= \frac{5\pi}{12}\end{aligned}$$

6) Determine the APPROXIMATE radian measure, to the nearest hundredth, for each angle.

$$\begin{aligned}\text{a) } 23^\circ &\times \frac{\pi}{180} \\ &\cong 0.40\end{aligned}$$

$$\begin{aligned}\text{b) } 51^\circ &\times \frac{\pi}{180} \\ &\cong 0.89\end{aligned}$$

$$\begin{aligned}\text{c) } 82^\circ &\times \frac{\pi}{180} \\ &\cong 1.43\end{aligned}$$

$$\begin{aligned}\text{d) } 128^\circ &\times \frac{\pi}{180} \\ &\cong 2.23\end{aligned}$$

$$\begin{aligned}\text{e) } 240^\circ &\times \frac{\pi}{180} \\ &\cong 4.19\end{aligned}$$

$$\begin{aligned}\text{f) } 330^\circ &\times \frac{\pi}{180} \\ &\cong 5.76\end{aligned}$$

7) Determine the EXACT degree measure for each angle.

$$\begin{aligned}\text{a) } \frac{\pi}{5} &\times \frac{180}{\pi} \\ &= 36^\circ\end{aligned}$$

$$\begin{aligned}\text{b) } \frac{\pi}{9} &\times \frac{180}{\pi} \\ &= 20^\circ\end{aligned}$$

c) $\frac{5\pi}{12} \times \frac{180}{\pi}$

$= 75^\circ$

d) $\frac{5\pi}{18} \times \frac{180}{\pi}$

$= 50^\circ$

e) $\frac{3\pi}{4} \times \frac{180}{\pi}$

$= 135^\circ$

f) $\frac{3\pi}{2} \times \frac{180}{\pi}$

$= 270^\circ$

8) Determine the APPROXIMATE degree measure, to the nearest tenth, for each angle.

a) $2.34 \times \frac{180}{\pi}$

$\cong 134.1^\circ$

b) $3.14 \times \frac{180}{\pi}$

$\cong 179.9^\circ$

c) $5.27 \times \frac{180}{\pi}$

$\cong 301.9^\circ$

d) $7.53 \times \frac{180}{\pi}$

$\cong 431.4^\circ$

e) $0.68 \times \frac{180}{\pi}$

$\cong 39^\circ$

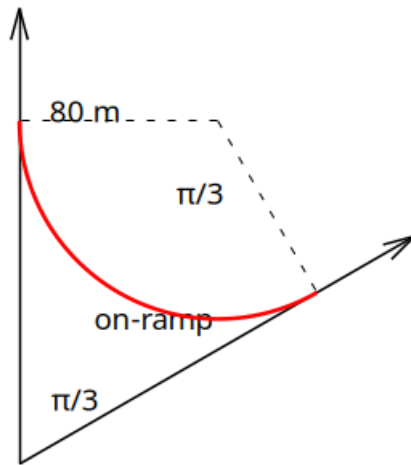
f) $1.72 \times \frac{180}{\pi}$

$\cong 98.5^\circ$

9) A circle of radius 25 cm has a central angle of 4.75 radians. Determine the length of the arc that subtends this angle.

$$\begin{aligned}\theta &= \frac{a}{r} \\ 4.75 &= \frac{a}{25} \\ a &= 118.75 \text{ cm}\end{aligned}$$

10) Two highways meet at an angle measuring $\frac{\pi}{3}$ radians, as shown. An on-ramp in the shape of a circular arc is to be built such that the arc has a radius of 80 m.



a) Determine an EXACT expression for the length of the on-ramp.

$$\begin{aligned}\theta &= \frac{a}{r} \\ \frac{\pi}{3} &= \frac{a}{80} \\ a &= \frac{80\pi}{3} \text{ m}\end{aligned}$$

b) Determine the length of the on-ramp, to the nearest tenth of a meter.

$$\cong 83.8 \text{ m}$$

11) David made a swing for his niece Sarah using ropes 2.4 m long, so that Sarah swings through an arc length of 1.2 meters. Determine the angle through which Sarah swings, in both radians and degrees.

$$\begin{aligned}\theta &= \frac{a}{r} \\ \theta &= \frac{1.2}{2.4} \\ \theta &= 0.5 \text{ radians}\end{aligned}$$

$$0.5 \times \frac{180}{\pi} \cong 28.6^\circ$$

Answer Key

1) a) $\frac{\pi}{3}$ b) $\frac{\pi}{2}$ c) $\frac{2\pi}{3}$ d) $\frac{5\pi}{6}$

2) a) $\frac{\pi}{12}$ b) $\frac{\pi}{18}$ c) $\frac{\pi}{24}$ d) $\frac{\pi}{36}$

3) a) $\frac{\pi}{2}$ b) $\frac{3\pi}{4}$ c) π d) $\frac{5\pi}{4}$

4) a) $\frac{\pi}{8}$ b) $\frac{\pi}{12}$ c) $\frac{\pi}{20}$ d) $\frac{\pi}{60}$

5) a) $\frac{2\pi}{9}$ b) $\frac{\pi}{18}$ c) $\frac{7\pi}{4}$ d) $\frac{7\pi}{6}$ e) $\frac{5\pi}{3}$ f) $\frac{5\pi}{12}$

6) a) 0.40 b) 0.89 c) 1.43 d) 2.23 e) 4.19 f) 5.76

7) a) 36° b) 20° c) 75° d) 50° e) 135° f) 270°

8) a) 134.1° b) 179.9° c) 301.9° d) 431.4° e) 39° f) 98.5°

9) 118.75 cm

10) a) $\frac{80\pi}{3}$ m b) 83.8 m

11) 0.5 radians; 28.6°