

Section 7.1

$$1) \theta = s/r = \frac{5 \text{ cm.}}{2 \text{ cm.}} = 2.5 \text{ radians}$$

$$2) \theta = s/r = \frac{2 \text{ cm.}}{3 \text{ cm.}} = \frac{2}{3} \text{ radians}$$

$$3) \theta = s/r = \frac{200 \text{ cm.}}{1 \text{ m.}} \\ = \frac{200 \text{ cm.}}{100 \text{ cm.}} = 2 \text{ radians}$$

$$\left[\pi \text{ radians} = 180^\circ \text{ so } \frac{\pi}{180} \text{ radians} = 1^\circ \right]$$

$$5) \text{ a.) } 45^\circ = 45 \cdot \frac{\pi}{180} = \frac{\pi}{4} \approx 0.79 \text{ radians}$$

$$\text{b.) } 90^\circ = 90 \cdot \frac{\pi}{180} = \frac{\pi}{2} \approx 1.57 \text{ radians}$$

$$\text{c.) } 135^\circ = 135 \cdot \frac{\pi}{180} = \frac{3}{4}\pi \approx 2.36 \text{ radians}$$

$$6) \text{ a.) } 30^\circ = 30 \cdot \frac{\pi}{180} = \frac{\pi}{6} \approx 0.52 \text{ radians}$$

$$\text{b.) } 150^\circ = 150 \cdot \frac{\pi}{180} = \frac{5}{6}\pi \approx 2.62 \text{ radians}$$

$$\text{c.) } 300^\circ = 300 \cdot \frac{\pi}{180} = \frac{5}{3}\pi \approx 5.24 \text{ radians}$$

$$7) \text{ a.) } 0^\circ = 0 \cdot \frac{\pi}{180} = 0.00 \text{ radians}$$

$$\text{b.) } 360^\circ = 360 \cdot \frac{\pi}{180} = 2\pi \approx 6.28 \text{ radians}$$

$$\text{c.) } 450^\circ = 450 \cdot \frac{\pi}{180} = \frac{5}{2}\pi \approx 7.85 \text{ radians}$$

$$8) \text{ a.) } 36^\circ = 36 \cdot \frac{\pi}{180} = \frac{\pi}{5} \approx 0.63 \text{ radians}$$

$$\text{b.) } 35^\circ = 35 \cdot \frac{\pi}{180} = \frac{7}{36}\pi \approx 0.61 \text{ radians}$$

$$\text{c.) } 720^\circ = 720 \cdot \frac{\pi}{180} = 4\pi \approx 12.57 \text{ radians}$$

$$\left[\pi \text{ radians} = 180^\circ \text{ so } 1 \text{ radian} = \left(\frac{180}{\pi} \right)^\circ \approx 57.3^\circ \right]$$

9) a.) $\frac{\pi}{12} = \left(\frac{180}{12}\right)^\circ = 15^\circ$
 b.) $\frac{\pi}{6} = \left(\frac{180}{6}\right)^\circ = 30^\circ$
 c.) $\frac{\pi}{4} = \left(\frac{180}{4}\right)^\circ = 45^\circ$

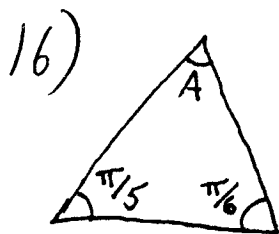
10) a.) $3\pi = (3 \cdot 180)^\circ = 540^\circ$
 b.) $3\frac{\pi}{2} = \left(3\frac{1}{2} \cdot 180\right)^\circ = 270^\circ$
 c.) $2\pi = (2 \cdot 180)^\circ = 360^\circ$

11) a.) $\frac{\pi}{3} = \left(\frac{180}{3}\right)^\circ = 60^\circ$
 b.) $5\frac{\pi}{3} = \left(5\frac{1}{3} \cdot 180\right)^\circ = 300^\circ$
 c.) $4\pi = (4 \cdot 180)^\circ = 720^\circ$

12) a.) $5\frac{\pi}{6} = \left(5\frac{1}{6} \cdot 180\right)^\circ = 150^\circ$
 b.) $11\frac{\pi}{6} = \left(11\frac{1}{6} \cdot 180\right)^\circ = 330^\circ$
 c.) $0 = (0 \cdot 180)^\circ = 0^\circ$

13) a.) $2 \text{ rad} = 2(57.3^\circ) = 114.6^\circ$
 b.) $3 \text{ rad} = 3(57.3^\circ) = 171.9^\circ$
 c.) $\pi^2 \text{ rad} \approx 9.87 \text{ rad} = (9.87)(57.3^\circ) = 565.6^\circ$

14) a.) $1.32 \text{ rad} = (1.32)(57.3^\circ) = 75.6^\circ$
 b.) $0.96 \text{ rad} = (0.96)(57.3^\circ) = 55.01^\circ$
 c.) $\frac{1}{\pi} \text{ rad.} \approx 0.32 \text{ rad} = (0.32)(57.3^\circ) = 18.3^\circ$



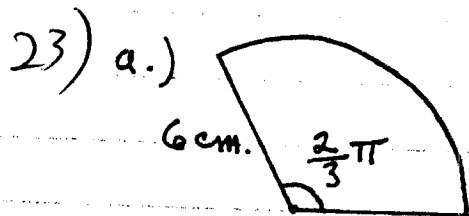
$$A + \frac{\pi}{5} + \frac{\pi}{6} = \pi \rightarrow$$

$$A = \frac{30\pi}{30} - \frac{6\pi}{30} - \frac{5\pi}{30} \rightarrow$$

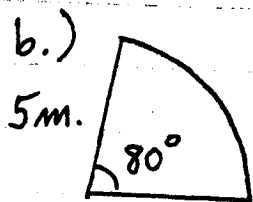
$$A = \frac{19}{30} \pi$$

$$20) s = r\theta = (12)(\pi/5) = \frac{12}{5}\pi \approx 7.54 \text{ cm.}$$

$$22) s = r\theta = (1)(5\pi/6) = \frac{5}{6}\pi \approx 2.62 \text{ in.}$$

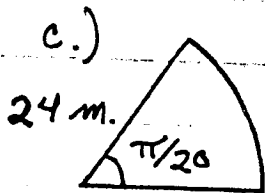


$$\begin{aligned} A &= \frac{\frac{2}{3}\pi}{2\pi} \cdot \pi r^2 \\ &= \frac{1}{3} \cdot \pi (6)^2 = 12\pi \\ &\approx 37.20 \text{ cm}^2 \end{aligned}$$

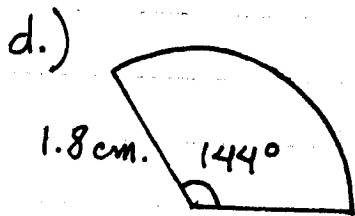


$$80^\circ = 80 \cdot \frac{\pi}{180} = \frac{4}{9}\pi \text{ radians, then}$$

$$\begin{aligned} A &= \frac{\frac{4}{9}\pi}{2\pi} \cdot \pi r^2 = \frac{2}{9} \cdot \pi (5)^2 = \frac{50}{9}\pi \\ &\approx 17.45 \text{ m}^2 \end{aligned}$$



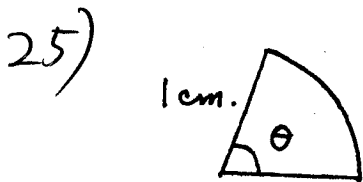
$$\begin{aligned} A &= \frac{\pi/20}{2\pi} \cdot \pi r^2 = \frac{1}{40} \cdot \pi (24)^2 \\ &= \frac{72}{5}\pi \approx 45.24 \text{ m}^2 \end{aligned}$$



$$144^\circ = 144 \cdot \frac{\pi}{180} = \frac{4}{5}\pi \text{ radians, then}$$

$$A = \frac{\frac{4}{5}\pi}{2\pi} \cdot \pi r^2 = \frac{2}{5} \cdot \pi (1.8)^2$$

$$= 1.296\pi \approx 4.07 \text{ cm}^2$$

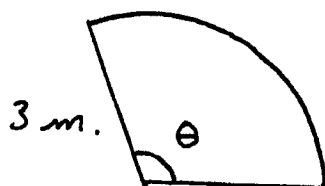


$$A = \frac{\pi}{5} \text{ cm}^2 \text{ and}$$

$$A = \frac{\theta}{2\pi} \cdot \pi r^2 = \frac{\theta}{2\pi} \cdot \pi (1)^2 = \frac{\theta}{2} \rightarrow$$

$$\frac{\pi}{5} = \frac{\theta}{2} \rightarrow \theta = \frac{2}{5}\pi \text{ radians}$$

26)

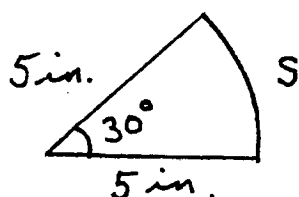


$A = 20 \text{ m}^2$ and

$$A = \frac{\theta}{2\pi} \cdot \pi r^2 = \frac{\theta}{2\pi} \cdot \pi (3)^2 = \frac{9}{2} \theta$$

$$\rightarrow 20 = \frac{9}{2} \theta \rightarrow \theta = \frac{2}{9} \cdot 20 = \frac{40}{9} \approx 4.44 \text{ radians}$$

27)



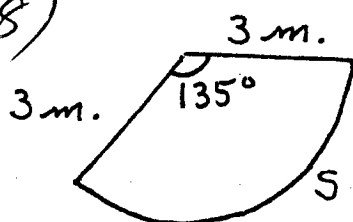
a.) $S = r\theta = 5\left(\frac{\pi}{6}\right) \approx 2.62 \text{ in.}$

$\rightarrow$ perimeter

$$P = 5 + 5 + 2.62 = 12.62 \text{ in.};$$

b.) area $A = \frac{\frac{\pi}{6}}{2\pi} \cdot \pi r^2 = \frac{1}{12} \pi (5)^2 \approx 6.54 \text{ in}^2$

28)



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

a.) $S = r\theta = 3\left(\frac{3}{4}\pi\right) \approx 7.07 \text{ m.}$

$\rightarrow$ perimeter

$$P = 3 + 3 + 7.07 = 13.07 \text{ m.};$$

b.) area $A = \frac{\frac{3}{4}\pi}{2\pi} \cdot \pi r^2 = \frac{3}{8} \pi (3)^2 \approx 10.60 \text{ m}^2$

$$30) \text{ a.) } 15 \frac{\text{rev.}}{\text{sec.}} \times \frac{2\pi \text{ rad.}}{\text{rev.}} = 30\pi \frac{\text{rad.}}{\text{sec.}}$$

$$\text{b.) } 15 \frac{\text{rev.}}{\text{sec.}} = \frac{15 \text{ circles}}{\text{sec.}} = \frac{15(2\pi r) \text{ cm.}}{\text{sec.}}$$

$$= 30\pi(20) \frac{\text{cm.}}{\text{sec.}} = 600\pi \frac{\text{cm.}}{\text{sec.}}$$

$$31) \text{ a.) } \frac{1080^\circ}{\text{sec.}} \times \frac{2\pi \text{ rad.}}{360^\circ} = 6\pi \frac{\text{rad.}}{\text{sec.}}$$

$$\text{b.) } 6\pi \frac{\text{rad.}}{\text{sec.}} \times \frac{1 \text{ rev.}}{2\pi \text{ rad.}} = 3 \frac{\text{rev.}}{\text{sec.}} = \frac{3 \text{ circles}}{\text{sec.}}$$

$$= \frac{3(2\pi r) \text{ cm.}}{\text{sec.}} = \frac{6\pi(25) \text{ cm.}}{\text{sec.}} = 150\pi \frac{\text{cm.}}{\text{sec.}}$$

$$35) \text{ a.) } \frac{1 \text{ rev.}}{24 \text{ hr.}} \times \frac{2\pi \text{ rad.}}{1 \text{ rev.}} = \frac{\pi \text{ rad.}}{12 \text{ hr.}} \times \frac{1 \text{ hr.}}{3600 \text{ sec.}}$$

$$= \frac{\pi}{43,200} \frac{\text{rad.}}{\text{sec.}} \approx 0.000073 \frac{\text{rad.}}{\text{sec.}}$$

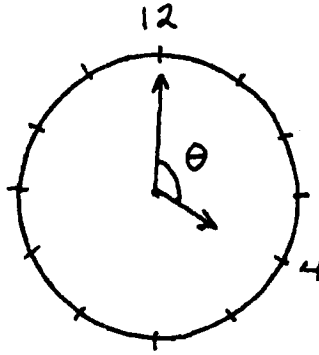
$$\text{b.) } \frac{1 \text{ rev.}}{24 \text{ hr.}} = \frac{1 \text{ circle}}{24 \text{ hr.}} = \frac{2\pi r \text{ mi.}}{24 \text{ hr.}}$$

$$= \frac{2\pi(3960) \text{ mi.}}{24 \text{ hr.}} \approx 1040 \text{ mph.}$$

37) Since arc BC is the same length as radius AC, the measure of angle A is 1 radian.

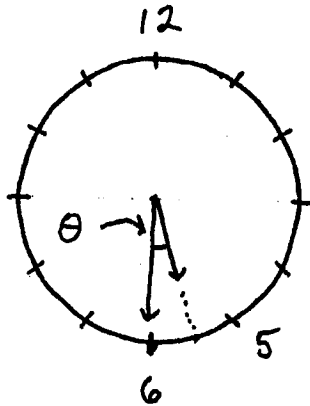
38)

a.)



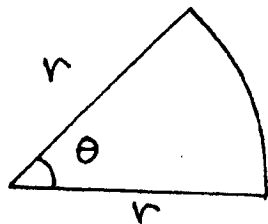
$$\begin{aligned}\theta &= \frac{4}{12} \text{ of } 2\pi \\ &= \frac{1}{3} \text{ of } 2\pi \\ &= \frac{2}{3}\pi \text{ radians}\end{aligned}$$

b.)



$$\begin{aligned}\theta &= \frac{1}{2} \text{ of } \frac{1}{12} \text{ of } 2\pi \\ &= \frac{1}{24} \text{ of } 2\pi \\ &= \frac{\pi}{12} \text{ radians}\end{aligned}$$

55)



perimeter is
 $12 = r + r + r\theta \rightarrow$
 $12 = 2r + r\theta ;$

a.) $12 = 2r + r\theta \rightarrow 12 = r(2 + \theta) \rightarrow$
 $r = \frac{12}{2 + \theta}$

b.) area $A = \frac{\theta}{2\pi} \cdot \pi r^2 = \frac{\theta}{2} r^2$ (This is
 not a quadratic function of θ .)

c.) $12 = 2r + r\theta \rightarrow r\theta = 12 - 2r \rightarrow$
 $\theta = \frac{12 - 2r}{r}$

d.) area $A = \frac{\theta}{2} r^2 = \frac{12 - 2r}{r} \cdot \frac{r^2}{2} \rightarrow$
 $A = (6 - r)r = 6r - r^2$ (This is
 a quadratic function of θ .)

e.) $A = 6r - r^2 = -(r^2 - 6r)$
 $= -(r^2 - 6r + 9) + 9$
 $= -(r - 3)^2 + 9$ then maximum

$A = 9 \text{ cm}^2$ when $r = 3 \text{ cm}$. and
 $\theta = \frac{12 - 6}{3} = 2 \text{ rad.}$

Section 7.2

25)

θ	$\sin \theta$	$\cos \theta$	$\tan \theta$
0	0	1	0
$\pi/2$	1	0	undefined
π	0	-1	0
$3\pi/2$	-1	0	undefined
2π	0	1	0

θ	$\csc \theta$	$\sec \theta$	$\cot \theta$
0	undefined	1	undefined
$\pi/2$	1	undefined	0
π	undefined	-1	undefined
$3\pi/2$	-1	undefined	0
2π	undefined	1	undefined

Section 7.3

16) a.) $\cos(2\pi/3) = -\cos(\pi/3) = -1/2$

b.) $\cos(-2\pi/3) = -\cos(\pi/3) = -1/2$

c.) $\sin(2\pi/3) = \sin(\pi/3) = \sqrt{3}/2$

d.) $\sin(-2\pi/3) = -\sin(\pi/3) = -\sqrt{3}/2$

18) a.) $\cos(17\pi/6) = \cos(5\pi/6) = -\cos(\pi/6) = -\sqrt{3}/2$

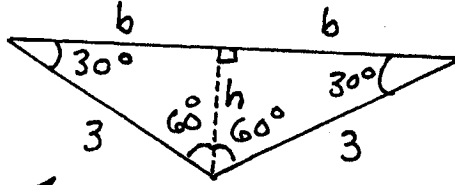
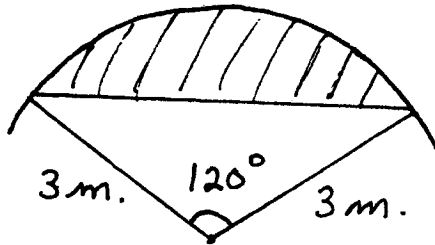
b.) $\cos(-17\pi/6) = \cos(-5\pi/6) = -\cos(\pi/6) = -\sqrt{3}/2$

c.) $\sin(17\pi/6) = \sin(5\pi/6) = \sin(\pi/6) = 1/2$

d.) $\sin(-17\pi/6) = \sin(-5\pi/6) = -\sin(\pi/6) = -1/2$

Worksheet 7

1) $120^\circ = \frac{2}{3}\pi \text{ rad.}$



$h = 3/2$ then

$$b^2 + h^2 = 3^2 \rightarrow$$

$$b^2 = 9 - (3/2)^2 = 9 - 9/4 = 27/4 \rightarrow b = \sqrt{27/4} \approx 2.6;$$

then area of shaded region is area of sector minus area of triangle $\rightarrow$ area

$$A = \frac{\frac{2}{3}\pi}{2\pi} \cdot \pi(3)^2 - \frac{1}{2}(2b)(h)$$

$$= \frac{1}{3}\pi(9) - (2.6)(3/2) \approx 5.52 \text{ m}^2$$