

## Chapter 4

$$(83) \frac{5\pi}{3} \cdot \frac{180}{\pi} = \frac{900}{3} = \boxed{300^\circ}$$

$$(84) \frac{5}{1} \cdot \frac{180}{\pi} = \frac{900}{\pi} \approx \boxed{286.48^\circ}$$

$$(85) \frac{120}{1} \cdot \frac{\pi}{180} = \frac{120\pi}{180} = \boxed{\frac{2\pi}{3}}$$

$$(86) \frac{-36}{1} \cdot \frac{\pi}{180} = \frac{-36\pi}{180} = \boxed{-\frac{\pi}{5}}$$

$$(87) -28 + 360 = \boxed{332^\circ}$$

$$-28 - 360 = \boxed{-388^\circ}$$

$$(88) \frac{7\pi}{5} + \frac{2\pi}{1} = \frac{7\pi}{5} + \frac{10\pi}{5} = \boxed{\frac{17\pi}{5}}$$

$$\frac{7\pi}{5} - \frac{2\pi}{1} = \frac{7\pi}{5} - \frac{10\pi}{5} = \boxed{-\frac{3\pi}{5}}$$

$$(89) \frac{9 \text{ min}}{1} \cdot \frac{1 \text{ deg}}{60 \text{ min}} = .15^\circ$$

$$> 66.1625^\circ \approx \boxed{66.16^\circ}$$

$$\frac{45 \text{ sec}}{1} \cdot \frac{1 \text{ min}}{60 \text{ sec}} = .75 \text{ min} \cdot \frac{1 \text{ deg}}{60 \text{ min}} = .0125^\circ$$

$$(90) \frac{0.23 \text{ deg}}{1} \cdot \frac{60 \text{ min}}{1 \text{ deg}} = 13.8 \text{ min}$$

$$\frac{0.8 \text{ min}}{1} \cdot \frac{60 \text{ sec}}{1 \text{ min}} = 48 \text{ sec}$$

$$> \boxed{-92^\circ 13' 48''}$$

$$(91) \text{ Convert } 162^\circ \text{ into radians: } \frac{162}{1} \cdot \frac{\pi}{180} = \frac{162\pi}{180} = \frac{9\pi}{10}$$

$$s = ? \quad \theta = \frac{9\pi}{10} \quad r = 9.5 \quad \Rightarrow \quad s = \theta r$$

$$s = \left(\frac{9\pi}{10}\right)(9.5)$$

$$\boxed{s = 26.86 \text{ cm}}$$

$$92) s = 7.9, \theta = \frac{\pi}{6}, r = ? \Rightarrow s = \theta r$$

$$\frac{7.9}{\frac{\pi}{6}} = \frac{\pi}{6} \cdot r$$

$$r = 15.1 \text{ feet}$$

$$93) \text{ Difference in latitudes: } 40.325 - 25.025 = 15.3^\circ$$

$$\text{Convert } 15.3^\circ \text{ to radians: } \frac{15.3 \cdot \pi}{180} = \frac{15.3\pi}{180} \approx 0.2670$$

$$s = ?, r = 3960, \theta = 0.2670 \Rightarrow s = \theta r$$

$$s = (0.2670)(3960)$$

$$s = 1057.32 \text{ miles}$$

$$94) s = 688, r = 4000, \theta = ? \Rightarrow s = \theta r$$

$$688 = \theta(4000)$$

$$\theta = \frac{688}{4000} \approx 0.172 \text{ radians}$$

$$\frac{0.172 \cdot 180}{1 \cdot \pi} \approx 9.8549^\circ$$

↑ convert to DMS

$$\frac{.8549 \text{ deg} \cdot 60 \text{ min}}{1 \cdot 1 \text{ deg}} = 51.294 \text{ min}$$

$$\frac{.294 \text{ min} \cdot 60 \text{ sec}}{1 \cdot 1 \text{ min}} = 17.64 \text{ sec}$$

$$9^\circ 51' 17''$$

$$95) \text{ coterminal of } -\frac{2\pi}{3} + \frac{2\pi}{1} = -\frac{2\pi}{3} + \frac{6\pi}{3} = \frac{4\pi}{3}$$

$$\tan\left(\frac{4\pi}{3}\right) \Rightarrow \tan(240^\circ)$$

Reference angle =  $240 - 180 = 60^\circ$   $\left(-\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$  in Quad III

$$\tan\left(\frac{4\pi}{3}\right) = \frac{-\frac{\sqrt{3}}{2}}{-\frac{1}{2}} = \frac{\sqrt{3}}{1} = \sqrt{3}$$

$$96) \csc\left(\frac{4\pi}{3}\right) \Rightarrow \left(-\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$$

$$\sin\left(\frac{4\pi}{3}\right) = -\frac{\sqrt{3}}{2}$$

$$\csc\left(\frac{4\pi}{3}\right) = \frac{-2}{\frac{\sqrt{3}}{2}} = -\frac{2\sqrt{3}}{3}$$

$$97) \tan(1080) \Rightarrow \tan(360) \Rightarrow (1, 0)$$

$$\text{Coterminal angle} = 1080 - 360 = 720 - 360 = 360$$

$$\tan(360) = \frac{0}{1} = \boxed{0}$$

$$98) \cot\left(\frac{\pi}{3}\right) \Rightarrow \left(\frac{1}{a}, \frac{\sqrt{3}}{a}\right)$$

$$\cot\left(\frac{\pi}{3}\right) = \frac{1}{a} \cdot \frac{a}{\sqrt{3}} = \frac{1}{\sqrt{3}} = \boxed{\frac{\sqrt{3}}{3}}$$

$$99) \sec\left(\frac{\pi}{4}\right) \Rightarrow \left(\frac{\sqrt{a}}{a}, \frac{\sqrt{a}}{a}\right)$$

$$\cos\left(\frac{\pi}{4}\right) = \frac{\sqrt{a}}{a}$$

$$\sec\left(\frac{\pi}{4}\right) = \frac{a}{\sqrt{a}} = \frac{\sqrt{a}}{1} = \boxed{\sqrt{a}}$$

$$100) \csc\left(-\frac{17\pi}{6}\right)$$

$$\text{Coterminal angle} = \frac{-17\pi}{6} + 2\pi = \frac{-17\pi}{6} + \frac{12\pi}{6} = \frac{-5\pi}{6} + \frac{12\pi}{6} = \frac{7\pi}{6}$$

$$\csc\left(\frac{7\pi}{6}\right) = \csc(210^\circ)$$

$$\text{Ref. angle} = 210 - 180 = 30^\circ \quad \left(-\frac{\sqrt{3}}{2}, -\frac{1}{2}\right) \leftarrow \text{in Quad III}$$

$$\sin\left(\frac{7\pi}{6}\right) = -\frac{1}{2}$$

$$\csc\left(\frac{7\pi}{6}\right) = \boxed{-2}$$

$$101) \sin\left(\frac{121\pi}{2}\right) = \sin(10890^\circ)$$

$$\text{Coterminal angle} = 90^\circ \Rightarrow (0, 1)$$

$$\sin\left(\frac{121\pi}{2}\right) = \boxed{1}$$

$$102) \cos\left(-\frac{5\pi}{4}\right)$$

$$\text{Coterminal angle} = \frac{-5\pi}{4} + \frac{2\pi}{1} = \frac{-5\pi}{4} + \frac{8\pi}{4} = \frac{3\pi}{4}$$

$$\cos\left(\frac{3\pi}{4}\right) \Rightarrow \text{Ref. angle} = 180 - 135 = 45^\circ \Rightarrow \left(-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right) \leftarrow \text{in Quad II}$$

$$\cos\left(-\frac{5\pi}{4}\right) = \boxed{-\frac{\sqrt{2}}{2}}$$

$$103) m\angle B = 180 - 27 - 90 \Rightarrow \boxed{m\angle B = 63^\circ}$$

$$\frac{\sin(27^\circ)}{1} = \frac{a}{13}$$

$$\frac{\cos(27^\circ)}{1} = \frac{b}{13}$$

$$a = 13 \cdot \sin(27^\circ)$$

$$b = 13 \cdot \cos(27^\circ)$$

$$\boxed{a = 5.9}$$

$$\boxed{b = 11.6}$$

104)  $x = -1, y = -3, r = ?$

$$r = \sqrt{x^2 + y^2}$$

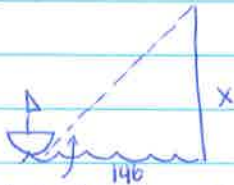
$$r = \sqrt{(-1)^2 + (-3)^2}$$

$$r = \sqrt{1+9}$$

$$r = \sqrt{10}$$

$$\csc \theta = \frac{r}{y} = \frac{\sqrt{10}}{-3}$$

105



$$\tan(12.3667) = \frac{x}{146} \Rightarrow x = 146 \cdot \tan(12.3667)$$

$$x = 32 \text{ feet}$$

$$12^\circ 22' : \frac{20 \text{ min}}{60 \text{ min}} \cdot 1 \text{ deg} = .3667$$

$$= 12.3667^\circ$$

106



$$53^\circ 49' : \frac{49 \text{ min}}{60 \text{ min}} \cdot 1 \text{ deg} = .8167$$

$$= 53.8167^\circ$$

$$90 - 53.8167 = 36.1833^\circ$$

$$\frac{\tan(36.1833)}{1} = \frac{32}{x} \Rightarrow \frac{32}{x} = \frac{\tan(36.1833)}{\tan(36.1833)}$$

$$x = \frac{32}{\tan(36.1833)} \approx 43.7 \approx 44 \text{ ft}$$

107)  $\sin \theta = \frac{-5}{13} \Rightarrow y = -5, r = 13, x = ?$

$$r = \sqrt{x^2 + y^2}$$

$$13 = \sqrt{x^2 + (-5)^2}$$

$$13 = \sqrt{x^2 + 25}$$

$$169 = x^2 + 25$$

$$144 = x^2$$

$$x = 12 \leftarrow x = -12 \text{ in quad III}$$

$$\cos \theta = \frac{x}{r} = \frac{-12}{13}$$

$$(108) \sin \theta = \frac{\sqrt{3}}{2} \Rightarrow y = \sqrt{3}, r = 2, x = ?$$

$$2 = \sqrt{x^2 + (\sqrt{3})^2}$$

$$4 = x^2 + 3$$

$$1 = x^2$$

$$1 = x^2$$

$$x = \pm 1 \leftarrow x = -1 \text{ in Quad II}$$

$$\Rightarrow \sec \theta = \frac{r}{x} = \frac{2}{-1} = \boxed{-\frac{2}{1}}$$

$$(109) x = 8, y = -15, r = ?$$

$$r = \sqrt{8^2 + (-15)^2}$$

$$r = \sqrt{64 + 225}$$

$$r = \sqrt{289}$$

$$r = 17$$

$$\sin \theta = \frac{y}{r} = \boxed{\frac{-15}{17}}$$

$$(110) \text{ If } \sec \theta < 0 \text{ then } \cos \theta < 0 \Rightarrow \boxed{\text{Quad III}}$$
  
$$\tan \theta > 0$$

$$(111) -\frac{17\pi}{6} + \frac{2\pi}{1} = -\frac{17\pi}{6} + \frac{12\pi}{6} = -\frac{5\pi}{6} + \frac{12\pi}{6} = \boxed{\frac{7\pi}{6}} \leftarrow \text{coterminal}$$

$$\frac{7\pi}{6} - \pi = \frac{7\pi}{6} - \frac{6\pi}{6} = \boxed{\frac{\pi}{6}} \leftarrow \text{Reference angle}$$

$$(112) -440 + 360 = -80 + 360 = 280^\circ \leftarrow \text{coterminal}$$

$$360 - 280 = \boxed{80^\circ} \leftarrow \text{Reference angle}$$

$$(113) x = 4, r = 9, y = ?$$

$$9 = \sqrt{4^2 + y^2}$$

$$81 = 16 + y^2$$

$$65 = y^2$$

$$y = \pm \sqrt{65}$$

$$y = -\sqrt{65} \leftarrow y = -\sqrt{65} \text{ in Quad IV}$$

$$\Rightarrow \sin(\alpha) = \frac{y}{r} = \frac{-\sqrt{65}}{9} = \boxed{\frac{-\sqrt{65}}{9}}$$

$$(114) \quad x=4, r=7, y=?$$

$$7 = \sqrt{4^2 + y^2}$$

$$7 = \sqrt{16 + y^2}$$

$$49 = 16 + y^2$$

$$33 = y^2$$

$$y = \sqrt{33}$$

$$\sin(\alpha) = \frac{y}{r} = \frac{\sqrt{33}}{7} \Rightarrow \boxed{(c)}$$

$$(115) \quad y=6, r=7, x=?$$

$$7 = \sqrt{x^2 + 6^2}$$

$$7 = \sqrt{x^2 + 36}$$

$$49 = x^2 + 36$$

$$13 = x^2$$

$$x = \sqrt{13} \Rightarrow$$

$\leftarrow x = -\sqrt{13}$  when cos is neg.

$$\cos(\alpha) = \frac{x}{r} = \frac{-\sqrt{13}}{7} \Rightarrow \boxed{(b)}$$

$$(116) \quad \sin(\alpha) = \frac{-2}{3} \Rightarrow \csc(\alpha) = \frac{-3}{2} \Rightarrow \boxed{(d)}$$

$$(117) \quad y=3, r=4, x=?$$

$$4 = \sqrt{x^2 + 3^2}$$

$$4 = \sqrt{x^2 + 9}$$

$$16 = x^2 + 9$$

$$7 = x^2$$

$$x = \sqrt{7} \leftarrow$$

$x = -\sqrt{7}$  in Quad II

$$\tan(\alpha) = \frac{y}{x} = \frac{3}{-\sqrt{7}} = \frac{-3\sqrt{7}}{7} \Rightarrow \boxed{(a)}$$

$$(118) \quad y=3, x=4, r=?$$

$$r = \sqrt{4^2 + 3^2}$$

$$r = \sqrt{16 + 9}$$

$$\sec(\alpha) = \frac{r}{x} = \frac{5}{4} \Rightarrow \boxed{(c)}$$

$$(121) \text{ Period} = \frac{2\pi}{b} = \frac{2\pi}{4} = \frac{\pi}{2} \Rightarrow \boxed{(b)}$$

$$(122) \text{ Period} = \frac{2\pi}{b} = \frac{2\pi}{3} \Rightarrow \boxed{(d)}$$

$$(123) \text{ Period} = \frac{2\pi}{b} = \frac{2\pi}{\frac{1}{4}} = \frac{2\pi}{1} \div \frac{1}{4} = \frac{2\pi}{1} \cdot \frac{4}{1} = 8\pi \Rightarrow \boxed{(c)}$$

$$(124) \text{ P.S.} = \left| \frac{c}{b} \right| = \left| \frac{\frac{\pi}{4}}{1} \right| = \left| \frac{\pi}{4} \right| = \frac{\pi}{4} \text{ right} \Rightarrow \boxed{(a)}$$

$$(125) \text{ P.S.} = \left| \frac{\frac{\pi}{2}}{a} \right| = \left| \frac{\frac{\pi}{2} \div \frac{2}{1}}{1} \right| = \left| \frac{\frac{\pi}{2} \cdot \frac{1}{2}}{1} \right| = \left| \frac{\pi}{4} \right| = \frac{\pi}{4} \text{ right} \Rightarrow \boxed{(b)}$$

$$(126) \text{ P.S.} = \left| \frac{\pi}{b} \right| = \frac{\pi}{6} \text{ left} \Rightarrow \boxed{(a)}$$

$$(127) \text{ P.S.} = \left| \frac{\frac{\pi}{4}}{\frac{1}{4}} \right| = \left| \frac{\frac{\pi}{4} \div \frac{1}{4}}{1} \right| = \left| \frac{\frac{\pi}{4} \cdot \frac{4}{1}}{1} \right| = \left| \frac{4\pi}{4} \right| = |\pi| = \pi \text{ left} \Rightarrow \boxed{(b)}$$

(128) New x-values:

$\frac{1}{2}x + \frac{\pi}{3} = 0$	$\frac{1}{2}x + \frac{\pi}{3} = \frac{\pi}{2}$	$\frac{1}{2}x + \frac{\pi}{3} = \pi$	$\frac{1}{2}x + \frac{\pi}{3} = \frac{3\pi}{2}$	$\frac{1}{2}x + \frac{\pi}{3} = 2\pi$
$\frac{1}{2}x = -\frac{\pi}{3}$	$\frac{1}{2}x = \frac{\pi}{2} - \frac{\pi}{3}$	$\frac{1}{2}x = \frac{\pi}{1} - \frac{\pi}{3}$	$\frac{1}{2}x = \frac{3\pi}{2} - \frac{\pi}{3}$	$\frac{1}{2}x = \frac{2\pi}{1} - \frac{\pi}{3}$
$x = -\frac{\pi}{3} \div \frac{1}{2}$	$\frac{1}{2}x = \frac{3\pi}{6} - \frac{2\pi}{6}$	$\frac{1}{2}x = \frac{3\pi}{3} - \frac{\pi}{3}$	$\frac{1}{2}x = \frac{9\pi}{6} - \frac{2\pi}{6}$	$\frac{1}{2}x = \frac{6\pi}{3} - \frac{\pi}{3}$
$x = -\frac{\pi}{3} \cdot \frac{2}{1}$	$\frac{1}{2}x = \frac{\pi}{6}$	$\frac{1}{2}x = \frac{2\pi}{3}$	$\frac{1}{2}x = \frac{7\pi}{6}$	$\frac{1}{2}x = \frac{5\pi}{3}$
$x = -\frac{2\pi}{3}$	$x = \frac{\pi}{6} \div \frac{1}{2}$	$x = \frac{2\pi}{3} \div \frac{1}{2}$	$x = \frac{7\pi}{6} \div \frac{1}{2}$	$x = \frac{5\pi}{3} \div \frac{1}{2}$
	$x = \frac{\pi}{6} \cdot \frac{2}{1}$	$x = \frac{2\pi}{3} \cdot \frac{2}{1}$	$x = \frac{7\pi}{6} \cdot \frac{2}{1}$	$x = \frac{5\pi}{3} \cdot \frac{2}{1}$
	$x = \frac{2\pi}{6}$	$x = \frac{4\pi}{3}$	$x = \frac{14\pi}{6}$	$x = \frac{10\pi}{3}$
	$x = \frac{\pi}{3}$		$x = \frac{7\pi}{3}$	

$$\text{Period} = \frac{2\pi}{b} = \frac{2\pi}{\frac{1}{2}} = \frac{2\pi}{1} \div \frac{1}{2} = \frac{2\pi}{1} \cdot \frac{2}{1} = 4\pi$$

new x	x-axis	y-axis	-3y	-3y+4
$-2\pi/3$	0	1	-3	1
$\pi/3$	$\pi/2$	0	0	4
$4\pi/3$	$\pi$	-1	3	7
$7\pi/3$	$3\pi/2$	0	0	4
$10\pi/3$	$2\pi$	1	-3	1