

Prerequisite Skills

1. a) $\sin \theta = -\frac{4}{5}$, $\cos \theta = \frac{3}{5}$
 b) $\cos \theta = -\frac{8}{17}$, $\tan \theta = -\frac{15}{8}$
 c) $\sin x = -\frac{7}{25}$, $\tan x = \frac{7}{24}$
2. a) $\csc \theta = \frac{25}{7}$, $\cot \theta = -\frac{24}{7}$
 b) $\sec x = \frac{5}{4}$, $\cot x = -\frac{4}{3}$
 c) $\csc \theta = -\frac{13}{5}$, $\sec \theta = -\frac{13}{12}$
3. a) 0.4384 b) -0.0523
 c) -3.7321 d) -0.1736
 e) -0.2250 f) -0.1763
 g) 1.1034 h) -2.2812
 i) 2.1445 j) 1.6243
 k) -1.0006 l) -1.3270
4. a) 55° b) 54°
 c) 19° d) 115°
5. a) $6\sqrt{2}$ b) $5\sqrt{5}$
6. a) $f^2 + 2fg + g^2$ b) $m^2 - n^2$
 c) $30a^2 - 29ab - 7b^2$
 d) $1 - 2\sin x \cos x$

4.1 Radian Measure

1. a) $\frac{13\pi}{36}$ b) $\frac{17\pi}{18}$
 c) $\frac{4\pi}{3}$ d) $\frac{11\pi}{15}$
 e) $\frac{39\pi}{20}$
2. a) 0.82 b) 3.80
 c) 5.85 d) 2.88
 e) 1.27
3. a) 51.4° b) 225.0°
 c) 157.5° d) 100.0°
 e) 65.5°
4. 5.4 cm
5. $\frac{\pi}{9}$, $\frac{\pi}{3}$, $\frac{5\pi}{9}$
6. 18π rad/s or 56.55 rad/s
7. a) $900^\circ/\text{s}$ b) 5π rad/s
8. 0.01 rad/s

9. a) $r = \sqrt{\frac{2A}{\theta}}$ b) 9.6 cm

4.2 Trigonometric Ratios and Special Angles

1. a) -0.9587 b) 0.2198
 c) -0.7975 d) 1.0470
 e) 0.1844 f) 1.7953
2. a) 0.8660 b) 0.5774
 c) -0.7071 d) 0.2282
 e) -2.0000 f) 1.0103
3. $\sin \frac{11\pi}{6} = -\frac{1}{2}$, $\cos \frac{11\pi}{6} = \frac{\sqrt{3}}{2}$,
 $\tan \frac{11\pi}{6} = -\frac{1}{\sqrt{3}}$, $\csc \frac{11\pi}{6} = -2$,
 $\sec \frac{11\pi}{6} = \frac{2}{\sqrt{3}}$, $\cot \frac{11\pi}{6} = -\sqrt{3}$
4. a) $18(\sqrt{3}-1)$ m b) 13.2 m
5. a) i) $\frac{\sqrt{3}}{3}$ ii) 1 iii) $\frac{\sqrt{2}-2\sqrt{3}}{2}$
6. a) i) $\frac{\sqrt{3}}{2}$ ii) -1 iii) $-\sqrt{3}$

4.3 Equivalent Trigonometric Expressions

1. $\cos \frac{\pi}{6} = \sin \left(\frac{\pi}{2} - \frac{\pi}{6} \right)$
2. $-\tan \frac{\pi}{3} = \cot \left(\frac{\pi}{3} + \frac{\pi}{2} \right)$
3. a) 0.7818 b) -0.7818
 4. a) 1.1918 b) -1.1918
 5. 0.12
 6. 2.36
7. $\sin \frac{\pi}{18} \approx 0.1736$
9. a) -0.9749 b) -0.9749
 10. a) 0.8391 b) -0.8391
11. a) $-\frac{\pi}{2}$

4.4 Compound Angle Formulas

1. a) $\sin \left(\frac{\pi}{3} + \frac{\pi}{6} \right); 1$

- b) $\cos\left(\frac{\pi}{3} + \frac{5\pi}{12}\right); -\frac{1}{\sqrt{2}}$
 c) $\sin\left(\frac{5\pi}{9} - \frac{7\pi}{18}\right); \frac{1}{2}$
 d) $\cos\left(\frac{5\pi}{12} - \frac{\pi}{4}\right); \frac{\sqrt{3}}{2}$
2. a) $\frac{-\sqrt{3}+1}{2\sqrt{2}}$ b) $\frac{1+\sqrt{3}}{2\sqrt{2}}$
 c) $\frac{\sqrt{3}}{2}$
3. a) $\frac{5}{13}$ b) $-\frac{24}{25}$
 c) $-\frac{36}{325}$ d) $-\frac{204}{325}$
 e) $-\frac{323}{325}$ f) $-\frac{253}{325}$
4. a) $\frac{\sqrt{3}-1}{2\sqrt{2}}$ b) $\frac{1+\sqrt{3}}{2\sqrt{2}}$
5. a) $\sin b = \frac{4}{5}, \tan b = -\frac{4}{3}$
 b) $-\frac{7}{25}$ c) $-\frac{24}{25}$
 d) $\frac{24}{7}$ e) 2.21
 f) The angle $2b$ lies in the third quadrant due to signs of the three primary ratios.
6. a) $\frac{\sqrt{2-\sqrt{3}}}{2}$

4.5 Prove Trigonometric Identities

8. a) No, the graphs are not the same for all values.
 b) Answers may vary. Sample answer: Let $x = 0$; **L.S.** \neq **R.S.**

Chapter 4 Review

1. a) 207.4° b) 30.9°
 c) 311.1° d) 100.3°
2. a) 1.03 b) 4.24
 c) 2.16 d) 7.42
3. a) $\frac{25\pi}{36}$ b) $\frac{4\pi}{9}$
 c) $\frac{4\pi}{45}$
4. 27.8 cm
5. a) $\frac{\sqrt{6}}{4}$ b) $2\sqrt{3} + 1$
6. 22.8 m
7. $\frac{\pi}{14}$
8. 0.87 rad
9. a) 0.9511 b) -0.9511
10. a) $\frac{117}{125}$ b) $-\frac{4}{5}$
 c) $-\frac{24}{25}$
11. $15\left(\frac{\sqrt{3}-1}{2\sqrt{2}}\right)$ m
13. This is an identity.

Chapter 4 Test

1. D
 2. B
 3. A
 4. A
 5. $\frac{1-\sqrt{3}}{2\sqrt{2}}$
 6. a) 1.57 rad/s b) 94.2 cm
 7. $\frac{70}{\sqrt{3}}$ m
 10. Answers may vary. Sample answer: It is not an identity. Let $x = \frac{\pi}{4}$; **L.S.** \neq **R.S.**