

Chapter 2, Introduction to Trigonometry

Focus Exercise Answers

Section 2.1 Special Right Triangles

1. $a = \frac{9\sqrt{3}}{2}$
 $c = 9$

2. $a = 21$
 $c = 14\sqrt{3}$

3. $a = 4\sqrt{6}$
 $c = 8\sqrt{2}$

4. $a = 5$
 $c = \frac{10\sqrt{3}}{3}$

5. $a = 6\sqrt{3}$
 $b = 6$

6. $a = \frac{3\sqrt{3}}{2}$
 $b = \frac{3}{2}$

7. $a = 15$
 $b = 5\sqrt{3}$

8. $a = \frac{3}{4}$
 $b = \frac{\sqrt{3}}{4}$

9. $a = 9$
 $c = 18$

10. $a = 4\sqrt{3}$
 $c = 8\sqrt{3}$

11. $a = \sqrt{6}$
 $c = 2\sqrt{6}$

12. $a = \frac{2\sqrt{15}}{3}$
 $c = \frac{4\sqrt{15}}{3}$

13. $b = 5$
 $c = 5\sqrt{2}$

14. $b = 9\sqrt{2}$
 $c = 18$

15. $b = 4\sqrt{3}$
 $c = 4\sqrt{6}$

16. $b = 7\sqrt{6}$
 $c = 14\sqrt{3}$

17. $a = 6$
 $b = 6$

18. $a = 7\sqrt{2}$
 $b = 7\sqrt{2}$

19. $a = \frac{11\sqrt{2}}{2}$
 $b = \frac{11\sqrt{2}}{2}$

20. $a = \frac{3\sqrt{10}}{2}$
 $b = \frac{3\sqrt{10}}{2}$

21. $x = 8$
 $p = 8\sqrt{2}$
 $y = 4$
 $h = 4\sqrt{3}$

22. $h = 6\sqrt{3}$
 $x = 12$
 $m = 12$
 $p = 12\sqrt{2}$

23. $m = 10\sqrt{2}$
 $x = 10\sqrt{2}$
 $y = 5\sqrt{2}$
 $h = 5\sqrt{6}$

24. $y = 3\sqrt{3}$
 $x = 6\sqrt{3}$
 $m = 6\sqrt{3}$
 $p = 6\sqrt{6}$

25. $x = 6$
 $h = 4\sqrt{3}$
 $p = 4\sqrt{3}$
 $y = 4\sqrt{6}$

26. $h = 14$
 $y = 14\sqrt{2}$
 $m = 7$
 $x = 7\sqrt{3}$

$$\begin{aligned}
 27. \quad h &= 3\sqrt{2} \\
 p &= 3\sqrt{2} \\
 m &= \frac{3\sqrt{2}}{2} \\
 x &= \frac{3\sqrt{6}}{2}
 \end{aligned}$$

$$\begin{aligned}
 28. \quad m &= 5\sqrt{3} \\
 h &= 10\sqrt{3} \\
 p &= 10\sqrt{3} \\
 y &= 10\sqrt{6}
 \end{aligned}$$

$$\begin{aligned}
 29. \quad h &= 6 \\
 m &= 6\sqrt{2} \\
 y &= 2\sqrt{6} \\
 x &= 4\sqrt{6}
 \end{aligned}$$

$$\begin{aligned}
 30. \quad x &= \sqrt{3} \\
 m &= \frac{3}{2} \\
 h &= \frac{3\sqrt{2}}{4} \\
 p &= \frac{3\sqrt{2}}{4}
 \end{aligned}$$

$$\begin{aligned}
 31. \quad h &= 6\sqrt{2} \\
 p &= 6\sqrt{2} \\
 y &= 4\sqrt{3} \\
 x &= 8\sqrt{3}
 \end{aligned}$$

$$\begin{aligned}
 32. \quad y &= \frac{1}{2} \\
 m &= \frac{\sqrt{3}}{2} \\
 h &= \frac{\sqrt{6}}{4} \\
 p &= \frac{\sqrt{6}}{4}
 \end{aligned}$$

Section 2.2 Trigonometry: The Triangle Identities

1. $\sin A = \frac{2}{3}$ $\cos A = \frac{\sqrt{5}}{3}$ $\tan A = \frac{2\sqrt{5}}{5}$ $\cot A = \frac{\sqrt{5}}{2}$ $\sec A = \frac{3\sqrt{5}}{5}$ $\csc A = \frac{3}{2}$	2. $\sin A = \frac{\sqrt{3}}{2}$ $\cos A = \frac{1}{2}$ $\tan A = \sqrt{3}$ $\cot A = \frac{\sqrt{3}}{3}$ $\sec A = 2$ $\csc A = \frac{2\sqrt{3}}{3}$	3. $\sin B = \frac{\sqrt{5}}{3}$ $\cos B = \frac{2}{3}$ $\tan B = \frac{\sqrt{5}}{2}$ $\cot B = \frac{2\sqrt{5}}{5}$ $\sec B = \frac{3}{2}$ $\csc B = \frac{3\sqrt{5}}{5}$	4. $\sin B = \frac{1}{2}$ $\cos B = \frac{\sqrt{3}}{2}$ $\tan B = \frac{\sqrt{3}}{3}$ $\cot B = \sqrt{3}$ $\sec B = \frac{2\sqrt{3}}{3}$ $\csc B = 2$
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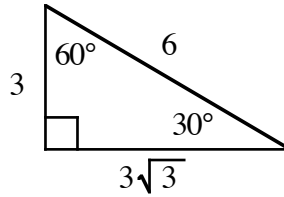
5. $\sin A = \frac{\sqrt{3}}{3}$ $\cos A = \frac{\sqrt{6}}{3}$ $\tan A = \frac{\sqrt{2}}{2}$ $\cot A = \sqrt{2}$ $\sec A = \frac{\sqrt{6}}{2}$ $\csc A = \sqrt{3}$	6. $\sin A = \frac{\sqrt{5}}{3}$ $\cos A = \frac{2}{3}$ $\tan A = \frac{\sqrt{5}}{2}$ $\cot A = \frac{2\sqrt{5}}{5}$ $\sec A = \frac{3}{2}$ $\csc A = \frac{3\sqrt{5}}{5}$	7. $\sin B = \frac{\sqrt{6}}{3}$ $\cos B = \frac{\sqrt{3}}{3}$ $\tan B = \sqrt{2}$ $\cot B = \frac{\sqrt{2}}{2}$ $\sec B = \sqrt{3}$ $\csc B = \frac{\sqrt{6}}{2}$	8. $\sin B = \frac{2}{3}$ $\cos B = \frac{\sqrt{5}}{3}$ $\tan B = \frac{2\sqrt{5}}{5}$ $\cot B = \frac{\sqrt{5}}{2}$ $\sec B = \frac{3\sqrt{5}}{5}$ $\csc B = \frac{3}{2}$
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9. No. In a right triangle, the sine ratio is $\frac{\text{opp}}{\text{hyp}}$ and the opposite side is always shorter than the hypotenuse, so sine will always be less than 1.

10. No. In a right triangle, the secant ratio is $\frac{\text{hyp}}{\text{adj}}$ and the hypotenuse is always longer than the adjacent side, so secant will never be less than 1.

Section 2.3 Trigonometry of Special Right Triangles

1.



$$\sin 60^\circ = \frac{\sqrt{3}}{2}$$

$$\cos 60^\circ = \frac{1}{2}$$

$$\tan 60^\circ = \sqrt{3}$$

$$\cot 60^\circ = \frac{\sqrt{3}}{3}$$

$$\sec 60^\circ = 2$$

$$\csc 60^\circ = \frac{2\sqrt{3}}{3}$$

$$\sin 30^\circ = \frac{1}{2}$$

$$\cos 30^\circ = \frac{\sqrt{3}}{2}$$

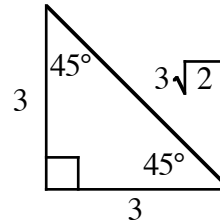
$$\tan 30^\circ = \frac{\sqrt{3}}{3}$$

$$\cot 30^\circ = \sqrt{3}$$

$$\sec 30^\circ = \frac{2\sqrt{3}}{3}$$

$$\csc 30^\circ = 2$$

2.



$$\sin 45^\circ = \frac{\sqrt{2}}{2}$$

$$\cos 45^\circ = \frac{\sqrt{2}}{2}$$

$$\tan 45^\circ = 1$$

$$\cot 45^\circ = 1$$

$$\sec 45^\circ = \sqrt{2}$$

$$\csc 45^\circ = \sqrt{2}$$

3. & 4. In a 45-45-90 triangle, the adjacent side and the opposite side are the same, so

$$(3) \sin(45^\circ) = \frac{\text{opp}}{\text{hyp}} = \frac{\text{adj}}{\text{hyp}} = \cos(45^\circ)$$

$$(4) \tan(45^\circ) = \frac{\text{opp}}{\text{adj}} = \frac{\text{opp}}{\text{opp}} = 1$$

5. 1

6. $2\sqrt{3}$

7. -5

8. $-3\sqrt{2}$

9. 1

10. $-2\sqrt{2}$

11. $\frac{\sqrt{2}}{2}$

12. $\sqrt{2}$

13. $\frac{1}{2}$

14. $\frac{3}{4}$

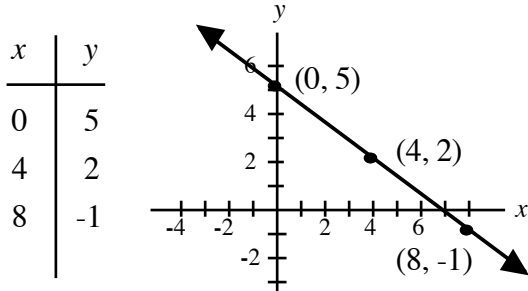
15. $\frac{1}{3}$

16. $\frac{4}{3}$

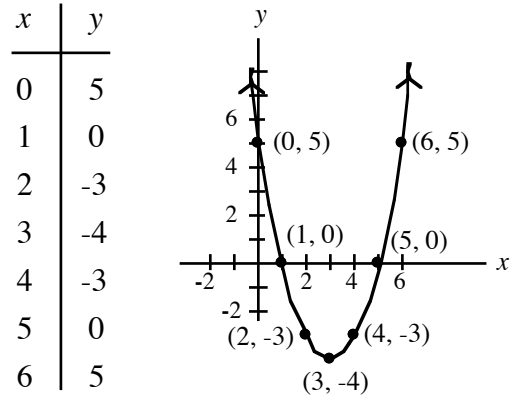
Section 2.4 Points in the x - y -Plane

- 1. Quad III and IV
- 2. Quad I and IV
- 3. Quad II and IV
- 4. Quad I and III
- 5. Quad II and III
- 6. Quad I and II
- 7. Quad I and III

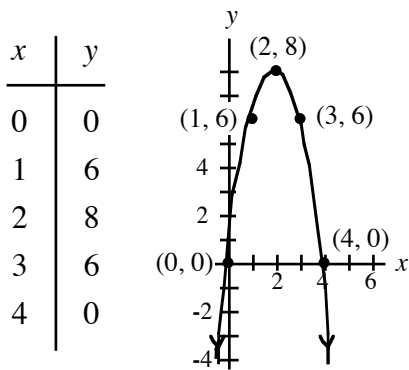
8



9.



10.



11. $d = 5$

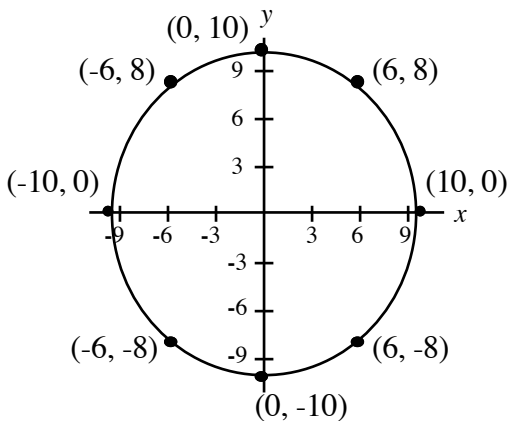
12. $d = 2\sqrt{13}$

13. $d = 5\sqrt{5}$

14. $d = 7$

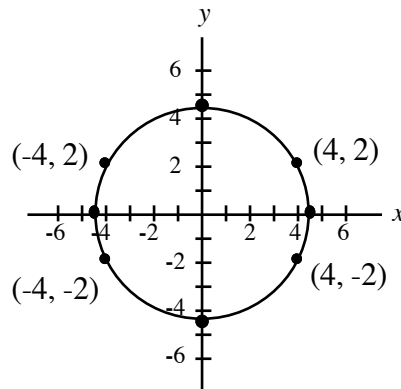
15. a) $r = 10$

c) $x^2 + y^2 = 100$



16. a) $r = 2\sqrt{5} \approx 4.5$

c) $x^2 + y^2 = 20$



#17-20 are started but left incomplete here.

$$17. \left(\frac{3}{5}\right)^2 + \left(-\frac{4}{5}\right)^2 \stackrel{?}{=} 1$$

$$18. \left(-\frac{\sqrt{2}}{2}\right)^2 + \left(-\frac{\sqrt{2}}{2}\right)^2 \stackrel{?}{=} 1$$

$$19. \left(-\frac{\sqrt{3}}{2}\right)^2 + \left(\frac{1}{2}\right)^2 \stackrel{?}{=} 1$$

$$20. \left(-\frac{2}{3}\right)^2 + \left(-\frac{\sqrt{5}}{3}\right)^2 \stackrel{?}{=} 1$$

Section 2.5 Trigonometry in the x - y -Plane

For #1-6, the plotting of the point in the x - y -plane is not shown.

1. $r = 2\sqrt{10}$ $\sin \theta = \frac{3\sqrt{10}}{10}$ $\cos \theta = \frac{\sqrt{10}}{10}$ $\tan \theta = 3$ $\cot \theta = \frac{1}{3}$ $\sec \theta = \sqrt{10}$ $\csc \theta = \frac{\sqrt{10}}{3}$	2. $r = 5$ $\sin \theta = \frac{-3}{5}$ $\cos \theta = \frac{4}{5}$ $\tan \theta = \frac{-3}{4}$ $\cot \theta = \frac{-4}{3}$ $\sec \theta = \frac{5}{4}$ $\csc \theta = \frac{-5}{3}$	3. $r = 5$ $\sin \theta = -1$ $\cos \theta = 0$ $\tan \theta$ is undefined $\cot \theta = 0$ $\sec \theta$ is undefined $\csc \theta = -1$
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<p>4. $r = 3$</p> <p>$\sin \theta = 0$</p> <p>$\cos \theta = 1$</p> <p>$\tan \theta = 0$</p> <p>$\cot \theta$ is undefined</p> <p>$\sec \theta = 1$</p> <p>$\csc \theta$ is undefined</p>	<p>5. $r = 4$</p> <p>$\sin \theta = \frac{-3}{4}$</p> <p>$\cos \theta = \frac{-\sqrt{7}}{4}$</p> <p>$\tan \theta = \frac{3\sqrt{7}}{7}$</p> <p>$\cot \theta = \frac{\sqrt{7}}{3}$</p> <p>$\sec \theta = \frac{-4\sqrt{7}}{7}$</p> <p>$\csc \theta = \frac{-4}{3}$</p>	<p>6. $r = 2$</p> <p>$\sin \theta = \frac{-\sqrt{2}}{2}$</p> <p>$\cos \theta = \frac{\sqrt{2}}{2}$</p> <p>$\tan \theta = -1$</p> <p>$\cot \theta = -1$</p> <p>$\sec \theta = \sqrt{2}$</p> <p>$\csc \theta = -\sqrt{2}$</p>
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|-----------------------|-----------------------|-----------------------|-----------------------|
| 7. 70° | 8. 80° | 9. 25° | 10. 85° |
| 11. 20° | 12. 75° | 13. 35° | 14. 10° |
| 15. Quad II | 16. Quad I | 17. Quad II | 18. Quad IV |
| 19. Quad I | 20. Quad IV | 21. Quad II | 22. Quad III |

<p>23. $\sin \theta = \frac{3}{5}$</p> <p>$\cos \theta = \frac{-4}{5}$</p> <p>$\tan \theta = \frac{-3}{4}$</p>	<p>24. $\sin \theta = \frac{4}{5}$</p> <p>$\cos \theta = \frac{3}{5}$</p> <p>$\tan \theta = \frac{4}{3}$</p>	<p>25. $\sin \theta = \frac{-\sqrt{11}}{6}$</p> <p>$\cos \theta = \frac{-5}{6}$</p> <p>$\tan \theta = \frac{\sqrt{11}}{5}$</p>
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<p>26. $\sin \theta = \frac{-1}{2}$</p> <p>$\cos \theta = \frac{\sqrt{3}}{2}$</p> <p>$\tan \theta = \frac{-\sqrt{3}}{3}$</p>	<p>27. $\sin \theta = \frac{-3\sqrt{10}}{10}$</p> <p>$\cos \theta = \frac{-\sqrt{10}}{10}$</p> <p>$\tan \theta = 3$</p>	<p>28. $\sin \theta = \frac{\sqrt{5}}{5}$</p> <p>$\cos \theta = \frac{-2\sqrt{5}}{5}$</p> <p>$\tan \theta = \frac{-1}{2}$</p>
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<p>29. $\sin \theta = \frac{-\sqrt{15}}{4}$</p> <p>$\cos \theta = \frac{1}{4}$</p> <p>$\tan \theta = -\sqrt{15}$</p>	<p>30. $\sin \theta = \frac{1}{3}$</p> <p>$\cos \theta = \frac{2\sqrt{2}}{3}$</p> <p>$\tan \theta = \frac{\sqrt{2}}{4}$</p>
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- 31.** No. In the x - y -plane, the sine ratio is $\frac{y}{r}$ and the y -value is never more than the radius, r , so sine will never be more than 1.
- 32.** Yes. In the x - y -plane, all trig values could be negative, so the secant will be less than 1 when it is negative.

Section 2.6 Trigonometric Identities

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|--|---|---|--|
| 1. $\frac{1}{6}$ | 2. 2 | 3. $\frac{\sqrt{7}}{2}$ | 4. $\frac{\sqrt{2}}{4}$ |
| 5. $-\sqrt{3}$ | 6. $\frac{\sqrt{5}}{5}$ | 7. $\frac{3\sqrt{2}}{8}$ | 8. $\frac{\sqrt{6}}{4}$ |
| 9. Undefined | 10. -1 | 11. $\frac{4}{25}$ | 12. $\frac{3}{25}$ |
| 13. $\frac{2}{3}$ | 14. $\frac{1}{8}$ | 15. $\frac{25}{18}$ | 16. $\frac{9}{2}$ |
| 17. $\tan \theta = \frac{24}{7}$; $\cot \theta = \frac{7}{24}$ | 18. $\tan \theta = \frac{2\sqrt{5}}{5}$; $\cot \theta = \frac{\sqrt{5}}{2}$ | 19. $\tan \theta = \sqrt{15}$; $\cot \theta = \frac{\sqrt{15}}{15}$ | 20. $\tan \theta = 1$; $\cot \theta = 1$ |
| 21. $\tan \theta$ is undefined; $\cot \theta = 0$ | 22. $\tan \theta = 0$; $\cot \theta$ is undefined | 23. $\sin \theta = \frac{4}{5}$ | 24. $\sin \theta = \frac{-\sqrt{14}}{4}$ |
| 25. $\sin \theta = \frac{1}{2}$ | 26. $\sin \theta = \frac{-\sqrt{5}}{3}$ | | |