RLP-ALG2B · RLP Algebra 2B — Logarithms, Transformations, Trigonometry and Statistical Inference

Unit 3: Trigonometric Functions

Practice Workbook. The same problems, in the same order, as the Practice sections of the online lessons.

Name _____ Period _____

Lesson 3.1 — Radians and the Unit Circle

FLUENCY

1. Convert 150° to radians.

2. Convert 75° to radians.

3. Convert $5\pi/6$ radians to degrees.

4. Convert $2\pi/9$ radians to degrees.

5. Convert 400° to radians.

6. Find the exact value of $\tan(2\pi)$.

7. Find the exact value of $\cos(5\pi/6)$.

8. Find the exact value of $\tan(5\pi/4)$.

9. Find the exact value of $\sin(4\pi/3)$.

10. Find the exact value of $\cos(3\pi/4)$.

APPLICATION

11. A bicycle wheel of radius 0.35 m turns through 4 radians. How far does the bike roll?

12. A Ferris wheel of radius 20 m turns through $3\pi/4$ radians. How far does a rider travel along the arc?

13. A clock's minute hand is 12 cm long. How far does its tip travel in 20 minutes? Give the angle in radians too.

CHALLENGE

14. Without a calculator, decide the sign of sin 10 (radians). Then check.

REVIEW

15. Solve for x: $2^x = 100$. Give an exact answer using logarithms and a decimal to the nearest thousandth.

16. Solve and graph: $|x - 6| \geq 3$

Lesson 3.2 — Graphing the Six Trigonometric Functions Lab

FLUENCY

1. Find the exact value of $\sin(45°)$.
2. Find the exact value of $\cos(240°)$.
3. Find the exact value of $\sin(330°)$.
4. State the period of $\sin\theta$, $\tan\theta$ and $\sec\theta$.
5. Where are the vertical asymptotes of $\sec\theta$ and of $\cot\theta$?
6. State the range of $\sin\theta$ and of $\csc\theta$.

7. Evaluate $\csc(\pi/6)$, $\sec(\pi/3)$, $\cot(\pi/4)$ and $\sec \pi$.

8. Find the zeros of $\cot \theta$ on $0 \le \theta \le 2\pi$.

APPLICATION

9. State the amplitude, period and midline of $y = 3 \sin(2\theta)$.

10. State the period and asymptotes of $y = \tan(\theta/2)$ on $-2\pi < \theta < 2\pi$.

11. A voltage is modeled by $V(t) = 170 \sin(120\pi t)$. Find its amplitude, period and frequency.

CHALLENGE

12. Solve $\csc \theta = 2$ on $0 \le \theta < 2\pi$, and explain using the graph of $\sin \theta$.

REVIEW

13. Find the center and radius of the circle $x^2 - 6x + y^2 - 12y + 44 = 0$.

14. Evaluate: $\log_2 \sqrt{2}$

Lesson 3.3 — Proving and Using the Pythagorean Identity

FLUENCY

1. Find the exact value of $\tan(\pi/3)$.

2. Find the exact value of $\cos(3\pi/2)$.

3. Find the exact value of $\cos(\pi/4)$.

4. If $\cos\theta = -5/13$ and θ is in Quadrant III, find $\sin\theta$ and $\tan\theta$.

5. If $\sin\theta = -1/2$ and θ is in Quadrant IV, find $\cos\theta$ and $\tan\theta$.

6. If $\sec\theta = 3$ and θ is in Quadrant IV, find $\cos\theta$ and $\sin\theta$.

7. If $\sin\theta = 3/5$ in Quadrant II, find $\cos\theta$ and $\tan\theta$.

8. If $\tan\theta = -1/2$ in Quadrant IV, find $\cos\theta$ and $\sin\theta$.

APPLICATION

9. A wheelchair ramp makes an angle θ with the ground where $\sin\theta = 0.28$. Find $\cos\theta$ and the ramp's horizontal run if it is 7.5 m long.

10. Prove $(1 - \cos\theta)(1 + \cos\theta) = \sin^2\theta$.

11. Derive $\tan^2\theta + 1 = \sec^2\theta$ from the Pythagorean identity and state the restriction.

CHALLENGE

12. Prove $\sin^4\theta - \cos^4\theta = \sin^2\theta - \cos^2\theta$.

REVIEW

13. Complete the square to write $y = x^2 + 8x + 13$ in vertex form, and give the vertex.

14. A quantity starts at 15,000 and grows by 12% each year. Write a model and find its value after 14 years, to the nearest whole number.

Lesson 3.4 — Modeling Periodic Phenomena

FLUENCY

1. Write a cosine model for a quantity with maximum 11, minimum 3 and period 6 that is at its maximum at $t = 0$.

2. Write a model for a Ferris wheel rider: diameter 60 m, lowest point 2 m above ground, one turn every 10 minutes, boarding at the bottom.

3. State the amplitude, period, midline and phase shift of $y = 5\sin(2(t - 1)) + 3$.

4. Write a sine model with amplitude 2, period 24 and midline $y = 10$ that crosses the midline going up at $t = 0$.

5. What period does $y = \cos(12.42t)$ have, and what should the model be for a 12.42-hour period?

6. A tide has highs of 5.4 ft and lows of 0.8 ft with period 12.42 hours and a high at $t = 3$. Write a model.

APPLICATION

7. Using $D(t) = 2.70\cos(2\pi(t - 172)/365) + 12.17$ for St. Louis daylight hours, estimate daylight on day 80 (about March 21) and day 355 (about December 21).

8. For $h(t) = 25 - 20\cos(\pi t/2)$ (Ferris wheel, minutes), find the height after 30 seconds and after 3 minutes.

9. With the tide model above, find the height at $t = 6$ and the average rate of rise from the low at $t = 9.21$ to the high at $t = 15.42$.

CHALLENGE

10. For $h(t) = 32 - 30\cos(\pi t/5)$, find the first two times the rider is 50 m up.

REVIEW

11. Solve: $|x - 8| = 7$

12. Write as a single logarithm: $2\log x + \log y - 4\log z$

Unit 3 checkpoint

1. 150° = _____ radians.
2. sin(7π/6) = ?
   A. 1/2
   B. −1/2
   C. √3/2
   D. −√3/2
3. True or false: sin(30) = 0.5 in radian mode.
4. Period of y = tan θ?
   A. π/2
   B. π
   C. 2π
   D. 4π
5. csc(π/6) = _____ and sec(π/3) = _____.
6. True or false: sec θ has vertical asymptotes where cos θ = 0.

7. sin θ = 3/5, Quadrant II. tan θ = ?
   A. 3/4
   B. −3/4
   C. 4/3
   D. −4/5

8. True or false: Checking sin²θ + cos²θ = 1 at three angles proves it.

9. Model with max 11, min 3, period 6?
   A. 4 cos(πt/3) + 7
   B. 8 cos(6t) + 3
   C. 4 cos(3t) + 7
   D. 7 cos(πt/3) + 4

10. For h(t) = 25 − 20 cos(πt/2), the rider is at the top at t = _____.

11. A tide graph in your model is nearly flat. The most likely cause is…
    A. no tide
    B. degree mode with a radian formula
    C. wrong midline
    D. wrong datum