Graphing Sine, Cosine, Secant, and Cosecant Functions

Trigonometry Worksheet · Grade 10–12

Name: ________________________________ Date: ___________________

Learning Objectives

- Identify the amplitude and period of sine and cosine functions
- Graph sine and cosine functions by plotting key points over one period
- Extend understanding to secant and cosecant graphs using their reciprocal relationships

Problems

1. Find the amplitude of the function below:

$$y = 5\sin(\theta)$$

2. Find the period of the function below. Express your answer in degrees.

$$y = \sin(3\theta)$$

3. Find both the amplitude and the period of the function below. Express the period in degrees.

$$y = 4\cos(3\theta)$$

4. Find the period of the function below. Express your answer in degrees.

$$y = 2\sin\left(\frac{\theta}{3}\right)$$

5. List the five key x-values used to partition one period when graphing the function below. Use degrees.

$$y = \sin(3\theta)$$

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6. Describe the starting behavior of the cosine function versus the sine function when graphing one period. Then identify the starting y-value for the function below at theta equals 0.

$$y = 4\cos(3\theta)$$

7. Find the amplitude and period of the function below, then list the five key points (theta, y) for one complete period. Use degrees.

$$y = 2\sin\left(\frac{\theta}{3}\right)$$

8. The function below is a cosecant function. Using the fact that cosecant is the reciprocal of sine, identify where the vertical asymptotes occur within one period. Use degrees.

$$y = \csc(3\theta)$$

9. Find the amplitude and period of the function below. Then describe the full sequence of y-values at the five key points for one period. Use degrees.

$$y = -3\cos(2\theta)$$

10. For the secant function below, find the period, identify the asymptotes, and describe how you would sketch the graph over one period using the corresponding cosine graph as a guide. Use degrees.

$$y = \sec(3\theta)$$

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Graphing Sine, Cosine, Secant, and Cosecant Functions — Answer Key

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Answer Key

1. Answer: 5

- The general form is y = a sin(b theta)
- The amplitude is the absolute value of a
- |5| = 5

2. Answer: 120 degrees

- The period formula is 2pi / b
- Here b = 3, so the period = 2pi / 3
- Convert: 2 * 180 / 3 = 360 / 3 = 120 degrees

3. Answer: Amplitude = 4, Period = 120 degrees

- Amplitude = |a| = |4| = 4
- Period = 2pi / b = 2pi / 3
- Convert to degrees: 2 * 180 / 3 = 120 degrees

4. Answer: 1080 degrees

- b = 1/3, so the period = 2pi / (1/3)
- Simplify: 2pi * 3 = 6pi
- Convert 6pi to degrees: 6 * 180 = 1080 degrees

5. Answer: 0, 30, 60, 90, 120 degrees

- The period is 120 degrees
- Divide into 4 equal parts: 120 / 4 = 30 degrees each
- Key points: 0, 30, 60, 90, 120 degrees

6. Answer: Cosine starts at the maximum (y = 4); sine starts at the center (y = 0)

- Sine starts at the center (y = 0) and goes up first
- Cosine starts at the maximum amplitude
- For y = 4cos(3theta), at theta = 0: y = 4 * cos(0) = 4 * 1 = 4

7. Answer: Amplitude = 2, Period = 1080 deg; Key points: (0,0), (270,2), (540,0), (810,-2), (1080,0)

- Amplitude = |2| = 2
- Period = 2pi / (1/3) = 6pi = 1080 degrees
- Divide 1080 by 4 = 270 degrees per partition
- Key points: (0,0), (270,2), (540,0), (810,-2), (1080,0)

8. Answer: Vertical asymptotes at theta = 0, 60, and 120 degrees

- csc(theta) = 1/sin(theta), so asymptotes occur where sin(3theta) = 0
- sin(3theta) = 0 when 3theta = 0, 180, 360 degrees
- Divide by 3: theta = 0, 60, 120 degrees within one period

9. Answer: Amplitude = 3, Period = 180 deg; Key y-values: -3, 0, 3, 0, -3

- Amplitude = |-3| = 3
- Period = 2pi / 2 = pi = 180 degrees
- Cosine normally starts at max, but the negative sign reflects it
- At theta = 0: y = -3*cos(0) = -3 (starts at minimum)
- Key y-values at 0, 45, 90, 135, 180 degrees: -3, 0, 3, 0, -3

10. Answer: Period = 120 deg; asymptotes at theta = 30 and 90 degrees; secant forms U-shaped curves where cosine reaches its maximum and minimum

- sec(theta) = 1/cos(theta), so first graph y = cos(3theta)
- Period of cos(3theta) = 2pi/3 = 120 degrees
- Asymptotes occur where cos(3theta) = 0: at 3theta = 90 and 270, so theta = 30 and 90 degrees
- Where cosine reaches its max (+1), secant opens upward (minimum of 1)
- Where cosine reaches its min (-1), secant opens downward (maximum of -1)
- Sketch U-shaped and upside-down U-shaped curves between the asymptotes