1. Find the measure of the angle $\theta$, given that $\theta$ is an integer when measured in radians.

\[ \theta \]

What is the radian measure of the angle? 

2. Convert the following degree measure to radians.

$78.3285^\circ$  

$78.3285^\circ = \boxed{\text{radians}}$  

(Type an integer or a decimal. Round to four decimal places as needed.)

3. Find the exact value of the following expression without using a calculator.

\[ \cos \frac{5\pi}{6} \]

(Simplify your answer, including any radicals. Use integers or fractions for any numbers in the expression.)

4. Find the exact value of the following expression without using a calculator.

\[ \sin \left( -\frac{\pi}{3} \right) \]
5. A space vehicle is orbiting Saturn in a circular orbit. What radian measure corresponds to (a) 4.5 orbits? (b) \( \frac{7}{3} \) orbit?

(a) The radian measure corresponding to 4.5 orbits is \( \square \).
(Type an exact answer in terms of \( \pi \). Type an integer or a simplified fraction.)

(b) The radian measure corresponding to \( \frac{7}{3} \) orbit is \( \square \).
(Type an exact answer in terms of \( \pi \). Type an integer or a simplified fraction.)

6. Through how many radians will the hour hand on a clock rotate in (a) 16 hr? In (b) 7 hr?

(a) In 16 hr, the hour hand on the clock will rotate \( \square \) radians.
(Type an exact answer in terms of \( \pi \). Type an integer or a simplified fraction.)

(b) In 7 hr, the hour hand on the clock will rotate \( \square \) radians.
(Type an exact answer in terms of \( \pi \). Type an integer or a simplified fraction.)

7. If the radius of a circle is doubled, how is the length of the arc intercepted by a fixed central angle changed?

Choose the correct answer below.

- A. The length remains the same.
- B. The length is doubled.
- C. The length is quadrupled.

8. Two cities are 1900 km apart and lie on the same north-south line. The latitude of the northernmost city is 82° N. What is the latitude of the other city? The radius of the Earth is approximately 6400 km.

The latitude of the other city is approximately \( \square \)° N.
(Do not round until the final answer. Then round to the nearest integer as needed.)
9. Refer to the figure to the right.

(a) How many inches will the weight in the figure rise if the pulley is rotated through an angle of 77° 40’?

(b) Through what angle, to the nearest minute, must the pulley be rotated to raise the weight 3 in.?

(a) The weight in the figure will rise [ ] inches.
(Do not round until the final answer. Then round to the nearest tenth as needed.)

(b) In order for the weight to rise 3 inches, the pulley must rotate through [ ]° [ ]’.
(Do not round until the final answer. Then round to the nearest minute as needed.)

10. The figure shows the chain drive of a bicycle. How far will the bicycle move if the pedals are rotated through 180°? Assume the radius of the bicycle wheel is 12.3 inches.

The bicycle will travel approximately [ ] in.
(Round to the nearest tenth.)

11. Find the area of the sector shown in the figure.

The area is [ ].
(Simplify your answer. Type an exact answer in terms of π. Use integers or fractions for any numbers in the expression.)
12. The figure shows a medicine wheel, which is a Native American structure. This circular structure is perhaps 2500 yr old. There are 26 aboriginal spokes in the wheel, all equally spaced.

(a) Find the measure of each central angle in degrees and in radians.

The central angle in degrees is approximately \( \square^\circ \).

(Type an integer or a simplified fraction.)

The central angle in radians is approximately \( \square \).

(Simplify your answer. Type an exact answer in terms of \( \pi \). Use integers or fractions for any numbers in the expression.)

(b) If the radius of the wheel is 74.0 ft, find the circumference.

\( \square \) ft. (Round to the nearest tenth as needed.)

(c) Find the length of each arc intercepted by consecutive pairs of spokes.

\( \square \) ft.

(Do not round until the final answer. Then round to the nearest hundredth as needed.)

(d) Find the area of each sector formed by consecutive spokes.

\( \square \) ft\(^2\).

(Do not round until the final answer. Then round to the nearest tenth as needed.)

13. Find the value of \( s \) in the interval \( \left[ 0, \frac{\pi}{2} \right] \) that satisfies the given statement.

\( \tan s = 0.6077 \)

\( s = \square \) radians

(Round to eight decimal places as needed.)

14. Find the exact values of \( s \) in the interval \( [0, 2\pi) \) that satisfy the given condition \( \cos^2 s = \frac{1}{4} \).

\( s = \square \)

(Use a comma to separate answers as needed. Simplify your answers. Type exact answers, using \( \pi \) as needed. Use integers or fractions for any numbers in the expression.)
15. Use a calculator to approximate $\cos (-4.9107)$.

$\cos (-4.9107) \approx \square$

(Round to four decimal places as needed.)

16. For the value of $s$ below, use a calculator to find $\sin s$ and $\cos s$ and then use the results to decide in which quadrant an angle of $s$ radians lies.

$s = 67$

$\sin s = \square$

(Round to four decimal places as needed.)

$\cos s = \square$

(Round to four decimal places as needed.)

Base on the values of $\sin s$ and $\cos s$, in which quadrant is an angle of $s$ radians located?

- A. Quadrant IV
- B. Quadrant I
- C. Quadrant II
- D. Quadrant III

17. Find the exact value of $s$ in the given interval that has the given circular function value. Do not use a calculator.

$\left[ 0, \frac{\pi}{2} \right]; \tan s = 1$

$s = \square$ radians

(Simplify your answer. Type an exact answer, using $\pi$ as needed. Use integers or fractions for any numbers in the expression.)

18. The tires of a bicycle have radius 13.0 in. and are turning at the rate of 215 revolutions per min. See the figure. How fast is the bicycle traveling in miles per hour? (Hint: 5280 ft = 1 mi)

How fast is the bicycle traveling?

$\square$ mph (Type an integer or decimal rounded to the nearest tenth as needed.)
19. A thread is being pulled off a spool at the rate of 65.4 cm per sec. Find the radius of the spool if it makes 133 revolutions per min.

\[ r = \square \text{ cm} \]

(Route to two decimal places as needed.)

20. A 95-horsepower outboard motor at full throttle will rotate its propeller at exactly 4200 revolutions per min. Find the angular speed of the propeller in radians per second.

4200 rev per min \( \approx \square \) radians per sec

(Route to the nearest tenth as needed.)

21. The function graphed to the right is of the form \( y = a \sin bx \) or \( y = a \cos bx \), where \( b > 0 \).

Determine the equation of the graph.

\[ y = \square \]

(route an expression using \( x \) as the variable.)

22. The function graphed is of the form \( y = a \sin bx \) or \( y = a \cos bx \), where \( b > 0 \). Determine the equation of the graph.

\[ y = \square \] (Use integers or fractions for any numbers in the expression.)
23. The graph below is an example of a periodic function relating feet to time. What is the period (in hours)?

![Graph](image)

The period is \( \square \) hours.

24. The temperature in a certain city is modeled by

\[
T(x) = 25 + 37 \sin \left( \frac{2\pi}{365}(x - 101) \right)
\]

where \( T(x) \) is the temperature in degrees Fahrenheit on day \( x \), with \( x = 1 \) corresponding to January 1 and \( x = 365 \) corresponding to December 31. Use a calculator to estimate the temperature on day 200.

The temperature will be about \( \square \)°.
(Round to the nearest integer as needed.)

25. Pure sounds produce single sine waves on an oscilloscope. Find the amplitude and period of the sine wave graph. On the vertical scale, each square represents .5; on the horizontal scale, each square represents \( 30^\circ \) or \( \frac{\pi}{6} \).

![Graph](image)

The amplitude is \( \square \).
(Simplify your answer. Type an exact answer, using \( \pi \) as needed. Use integers or fractions for any numbers in the expression.)

The period is \( \square \).
(Simplify your answer. Type an exact answer, using \( \pi \) as needed. Use integers or fractions for any numbers in the expression.)
The average monthly temperature (in °F) in a city is shown in the table. Complete parts (a)-(f).

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>°F</td>
<td>55</td>
<td>56</td>
<td>57</td>
<td>60</td>
<td>63</td>
<td>64</td>
<td>64</td>
<td>64</td>
<td>62</td>
<td>60</td>
<td>57</td>
<td>56</td>
</tr>
</tbody>
</table>

(a) Plot the average monthly temperature over a two-year period, letting x = 1 correspond to January during the first year. Choose the correct graph below.

Do the data seem to indicate a translated sine graph?

- Yes
- No

(b) The highest average monthly temperature is 65°F in July, and the lowest average monthly temperature is 55°F in January. Their average is 60°F. Graph the data together with the line y = 60. Choose the correct graph below.

What does this line represent with regard to temperature in the city?

- A. It represents the average monthly temperature.
- B. It represents the average yearly temperature.
- C. It represents the average 18-month temperature.

(c) Approximate the amplitude, period, and phase shift of the translated sine wave.

The amplitude is □.
The period is □.
26. (cont.) The vertical shift is □. The horizontal shift is □.

(d) Determine a function of the form $f(x) = a \sin [b(x - d)] + c$, where $a$, $b$, $c$, and $d$ are constants, that models the data.

Choose the correct function below.

- **A.** $f(x) = 5 \sin \left(\frac{\pi}{6}(x - 4)\right) + 60$
- **B.** $f(x) = 55 \sin \left(\frac{\pi}{6}(x - 1)\right) + 5$
- **C.** $f(x) = 5 \cos \left(\frac{\pi}{6}(x - 4)\right) + 55$
- **D.** $f(x) = 65 \cos \left(\frac{\pi}{6}(x - 4)\right) + 55$

(e) Graph $f$ together with the data on the same coordinate axes. How well does $f$ model the given data?

- **A.** The function gives a good model for the data.
- **B.** The function gives a bad model for the data.

(f) Use the sine regression capability of a graphing calculator to find the equation of a sine curve that fits these data. Choose the correct equation below.

- **A.** $f(x) = 9.84 \cos (0.54x - 2.15) + 60.03$
- **B.** $f(x) = 11.84 \cos (0.54x - 4.15) + 60.03$
- **C.** $f(x) = 4.84 \sin (0.54x - 2.15) + 60.03$
- **D.** $f(x) = 11.84 \sin (1.54x - 4.15) + 60.03$

27. Graph the following function.

$$y = 4 \cos \left(x + \frac{\pi}{2}\right)$$

Use the graphing tool to graph the function.
28. Graph the function over a two-period interval.

\[ y = -2 + \frac{1}{2} \tan (4x - 12\pi) \]

Choose the correct graph below.

29. Tell whether the statement is true or false. If false, tell why.

The graph of \( y = \tan x \) in the figure to the right suggests that 
\( \tan (-x) = \tan x \) for all \( x \) in the domain of \( \tan x \).

Choose the correct answer below.

\( \bigcirc \) A. True
\( \bigcirc \) B. False; \( \tan (-x) = -\tan x \) for all \( x \) in the domain.
\( \bigcirc \) C. False; there is no relation between \( \tan (-x) \) and \( \tan x \).

30. If \( c \) is any number, then how many solutions does the equation \( c = \tan x \) have in the interval \( (-2\pi, 2\pi] \)?

For any real number \( c \), the equation \( c = \tan x \) has \( \square \) solution(s) in the interval \( (-2\pi, 2\pi] \).
31. A rotating beacon is located 8 meters south of point R on an east-west wall. \( d \), the length of the light display along the wall from R, is given by \( d = 8 \tan \, 2\pi t \), where \( t \) is time measured in seconds since the beacon started rotating. (When \( t = 0 \), the beacon is aimed at point R. When the beacon is aimed to the right of R, the value of \( d \) is positive; \( d \) is negative if the beacon is aimed to the left of R.) Find \( d \) if \( t = 0.8 \) seconds.

\[
d = \square \text{ meters}
\]

(Round to the nearest hundredth as needed.)

32. The function graphed to the right is of the form \( y = a \sec \, bx \) or \( y = a \csc \, bx \) for some \( a \neq 0, b > 0 \). Determine the equation of the function.

An equation of the function shown is \( y = \square \).

33. Tell whether the statement is true or false. If false, tell why.

The graph of \( y = \sec \, x \) in the figure suggests that \( \sec \, (\, -x\, ) = \sec \, x \) for all \( x \) in the domain of \( \sec \, x \).

Choose the correct answer below.

○ A. True

○ B. False; \( \sec \, (\, -\pi\, ) = -1 \) and \( \sec \, (\, \pi\, ) = 1 \)

○ C. False; \( \sec \, (\, -\pi\, ) = 1 \) and \( \sec \, (\, \pi\, ) = -1 \)
Find the graph of the given function.

\[ y = \sec \left( x + \frac{3\pi}{4} \right) \]

Choose the correct graph of the function.
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>$-2$</td>
</tr>
<tr>
<td>2.</td>
<td>1.3671</td>
</tr>
<tr>
<td>3.</td>
<td>$-\frac{\sqrt{3}}{2}$</td>
</tr>
<tr>
<td>4.</td>
<td>$A, -\frac{\sqrt{3}}{2}$</td>
</tr>
<tr>
<td>5.</td>
<td>$\frac{9\pi}{14\pi} = \frac{3}{4}$</td>
</tr>
<tr>
<td>6.</td>
<td>$\frac{8\pi}{3} + \frac{7\pi}{6}$</td>
</tr>
<tr>
<td>7.</td>
<td>B</td>
</tr>
<tr>
<td>8.</td>
<td>65</td>
</tr>
<tr>
<td>9.</td>
<td>13.2</td>
</tr>
<tr>
<td>10.</td>
<td>100.2</td>
</tr>
<tr>
<td>11.</td>
<td>$24\pi$</td>
</tr>
</tbody>
</table>
12. \[ \frac{180}{13} \]
\[ \pi \]
\[ \frac{13}{465.0} \]
\[ 17.88 \]
\[ 661.7 \]

13. 0.54606204

14. \[ \frac{\pi}{3} \quad \frac{5\pi}{3} \quad \frac{2\pi}{3} \quad \frac{4\pi}{3} \]

15. 0.197

16. \[ -0.8555 \]
\[ -0.5178 \]
D

17. \[ \frac{\pi}{4} \]

18. 16.6

19. 4.70

20. 439.8

21. \[ -2 \sin(2x) \]

22. \[ -2 \cos\left(\frac{1}{4}x\right) \]

23. 20

24. 62
25. \[\frac{4}{2\pi} - \frac{\pi}{3}\]

26. Yes

27. \[\text{A}
\text{Yes}
\text{D}
\text{B}
5
12
60
4
\text{A}
\text{A}
\text{C}

28. D

29. B

30. 4

31. \(-24.62\)

32. \(\sec 2x\)

33. A
| 34. | D |