1. Given the following graph of a function f, 

(4 pt.) a. Find the domain of f.

(4pt.) b. Find the range of f.

(2 pt.) c. Find f(6).

2. Given \( f(x) = x^2 \), let \( g(x) = f(x - 3) - 4 \).

Sketch the graph of g(x) below, labeling the vertex and x-intercepts of the graph. 
(Graph 8 pt., vertex 2 pt.)

(10 pt.) 3. Given \( f(x) = x^2 + x \), find the average rate of change of \( f \) from \( x = 2 \) to \( x = 3 \).

(10 pt.) 4. Given the polynomial function \( P(x) = x^3 - 2x^2 - 5x + 6 \), use the factor theorem to determine whether \( x - 1 \) is a factor of \( P(x) \). If so, express \( P(x) \) as a product of linear factors.

5. The Intermediate Value Theorem for Polynomial Functions: If \( f \) is a polynomial function and \([a, b]\) is a closed interval from the domain of \( f \), then \( f \) takes on every value between \( f(a) \) and \( f(b) \) in the interval \([a, b]\).
(6 pt.) a. Use the intermediate value theorem to show that \( f(x) = x^5 - 2 \) has a zero between \( x=1 \) and \( x=2 \).

(4 pt.) b. Use your calculator to estimate the zero to at least two decimal places of accuracy.

6. Given the rational function \( r(x) = \frac{x + 1}{x - 2} \)

(2 pt.) a. Find the equation of the vertical asymptote of the graph of \( r(x) \).

(2 pt.) b. Find the x and y intercept(s) of the graph of \( r(x) \).

(2 pt.) c. Find the equation of the horizontal asymptote of the graph of \( r(x) \).

(4 pt.) d. Sketch the graph of \( r(x) \).

7. Given \( f(x) = \cos(x) \) and \( g(x) = x^2 \), find the following.

(6 pt.) a. \((f \circ g)(x)\)

(4 pt.) b. \((g \circ f)(x)\)

(10 pt.) 8. Solve the equation. Leave your answer in exact form.

\[ \log(x) - \log(x - 48) = 1 \]

9. The number of bacteria on a certain culture increases exponentially over time. The number \( f(t) \) of bacteria after \( t \) hours is given by

\[ f(t) = 200e^{0.75t} \]

(2 pt.) a. What is the initial number of bacteria? (\( t=0 \))

(4 pt.) b. Estimate the number of bacteria in the culture after two hours. Round your answer to the nearest whole number.

(4 pt.) c. How long will it take for the number of bacteria to become 4000? Round your answer to the nearest whole number of hours.

(10 pt.) 10. Find the inverse function of \( f(x) = \frac{x - 2}{x + 3} \).
11. Solve the right triangle for angle $\beta$ and sides b and c, given that $\alpha = 32^\circ$ and side $a = 10.2$. Round sides to one decimal place. (angle 2 pt., sides 4 pt. ea.)

![Right Triangle Diagram]

12. Find the exact values of the following.

(4 pt.) a. $\sec\left(\frac{5\pi}{3}\right)$

(4 pt.) b. $\cos\left(\frac{7\pi}{6}\right)$

(2 pt.) c. $\tan(3\pi)$

13. Given the trigonometric function

$$f(x) = 2\sin\left(2\left(x - \frac{\pi}{2}\right)\right)$$

(2 pt.) a. Determine the amplitude of $f(x)$.

(2 pt.) b. Determine the period of $f(x)$.

(2 pt.) c. Determine the phase shift of $f(x)$.

(4 pt.) d. Sketch two periods of the graph of $f(x)$.

14. A ramp is to be built to access a porch that is 2 feet high. How long must the sloped part of the ramp be if it makes an $8^\circ$ angle with the ground?

(10 pt.) 15. Verify the following trigonometric identity.

$$\frac{\cos(t)}{1-\sin(t)} - \frac{\sin(t)}{\cos(t)} = \sec(t)$$
16. Solve the following equation in the interval \([0, 2\pi]\). State your answers correct to three decimal places.

\[7 \cos(x) - 1 = 0\]

17. Find all solutions to the following equation. Give your answers in exact form.

\[\cot(\theta) = 1\]

18. Find the exact value of the following expressions.

a. \[\cos\left(\tan^{-1}\left(\frac{9}{40}\right)\right)\]  

b. \[\sin^{-1}\left(-\frac{\sqrt{2}}{2}\right)\]

19. If \(\sin(\theta) = -\frac{4}{5}\), and \(\theta\) is an angle in quadrant III, find the exact value of the following.

a. \[\sin\left(\frac{\theta}{2}\right)\]

b. \[\cos(2\theta)\]

20. Refer to the figure below, depicting a triangle with sides shown.

\[\begin{array}{c}
7 \\
\quad \\
11 \\
\quad \\
14 \\
\end{array}\]

a. Find the angle (in degrees) opposite the longest side. State your answer to the nearest tenth.

b. Find the area of the triangle. State your answer to the nearest tenth.