1. Find exact equations of the following functions and explain how you arrived at each answer. Some information about each function is given. A solution based on graph-and-check will not be accepted.

(a) 

Information about \( f(x) \):

(i) \( \lim_{x \to -\infty} f(x) = 0 \)

(ii) \( \text{As} \ x \to \infty, \ y \to -\infty \)

(iii) The graph contains the points (0, -2) and (2, -6).

(b) 

Information about \( g(x) \):

(i) \( g(x) \) is a periodic function.

(ii) Maximum values of \( g \) occur at \( x = -\pi, \ x = 0, \ x = \pi \).
2. The median price of a home in Arizona rose from $50,000 in 1970 to $120,000 in 2000. Let \( t \) be the number of years since 1970. If housing prices have been rising exponentially, find the continuous rate of growth to the nearest tenth of a percent.

3. Complete the statements about the rational function given below.

\[ h(x) = \frac{3x^2 - 3a^2}{x - c} \quad \text{where} \quad a \quad \text{and} \quad c \quad \text{are constants.} \]

(a) The equation(s) of the vertical asymptotes is(are) ____________________________.

Explain.

(b) The equation(s) of the horizontal asymptote(s) is(are) ____________________________.

Explain.

(c) The zero(s) of this function is(are) ____________________________.

Explain.

(d) The y-intercept of this function is ____________________________.

Explain.

(e) The function ____________________________ (is, is not) continuous on the interval \([0, 2c]\).
4. The height of an object above the ground at time $t$ is given by
$$s = v_0 t - 0.5gt^2$$
where $v_0$ is the initial velocity and $g$ is the acceleration due to gravity.

(a) At what height is the object initially? Give explanation.

(b) How long is the object in the air before it hits the ground? Show how you determined this.

(c) When will the object reach its maximum height. Give explanation.

5. Find the inverse of the function $f(x) = e^{\frac{4}{3x-2}}$. Show all work.

6. Solve for $x$. Show all work and give exact answer.
$3^x = 10^{x-1}$
7. Use algebra to evaluate the following limit. Show all work.

(a) \[ \lim_{x \to 0} \frac{\frac{1}{2x} - 4}{x} \]

(b) \[ \lim_{x \to 0} \left( \frac{8}{2 + x} - 4 \right) \]

8. Use the definition of the derivative to find each of the following. Be sure to show all work.

(a) \( f''(3) \) in which \( f(x) = \log(x + 2) \) [Give answer to 6 decimal places]

(b) \( g'(-4) \) in which \( g(x) = \frac{3}{x^3} \)

[Use algebra to evaluate the limit and give exact answer.]

9. Given below is a graph of \( Q(p) \). On this graph, sketch a graph of \( Q'(p) \)