1. (13 points)
   (a) (4 pts) What is the domain of \( y = \ln(5 - x) \)?
   (b) (4 pts) Evaluate \( \log_2(1/16) \).
   (c) (5 pts) Solve \( \ln x + \ln 3x = -1 \).

2. (14 points)
   (a) (5 pts) Solve \( 16^{2x+1} = 64^{x-2} \).
   (b) (9 pts) Suppose a population grows at an annual rate of 6%. Find the
time it would take for the population to double.

3. (12 points)
   (a) (4 pts) What is \( \sin(\pi/4) \)?
   (b) (4 pts) Find all values of \( x \) between 0 and \( 2\pi \) for which \( \tan x = 1 \).
   (c) (4 pts) What are the amplitude and period of \( h(x) = (-1/2)\sin(6\pi x) \)?

4. (12 points) Find the following limits. (4 points each)
   
   \( (a) \lim_{x \to 2} f(x) \) with \( f(x) = \begin{cases} 1 & \text{if } x \neq 2 \\ 5 & \text{if } x = 2 \end{cases} \)
   
   \( (b) \lim_{x \to -2} \frac{x^2 - x - 6}{x + 2} \)
   
   \( (c) \lim_{s \to \infty} E[1 - e^{-a(s-h)/E}] \).

   (In part (c), the letters \( E, a, h \) represent fixed positive real numbers; the function
was used in homework to model excitation of a nerve pathway.)

*** THERE ARE MORE QUESTIONS ON THE OTHER SIDE. ***
5. **(12 points)** Find the following limits. (4 points each.)
In part (b), assume \( f'(5) \) exists.

\[
\begin{align*}
(a) \quad & \lim_{x \to -2} \frac{|x + 2|}{x + 2} \\
(b) \quad & \lim_{x \to 5} \frac{(f(x) - f(5)) - (f'(5)(x - 5))}{x - 5} \\
(c) \quad & \lim_{x \to -\infty} \frac{3x^3 + 10x^2 - 1}{4x^2 + 5x + 2}
\end{align*}
\]

6. **(12 points)** Let position be measured in feet and let time be measured in seconds. Suppose the position of an object moving in a straight line is given by \( s(t) = 5t^2 + 3t + 2 \).

(a) (6 pts) What is the average velocity between \( t = 0 \) and \( t = 2 \)?
(b) (6 pts) What is the instantaneous velocity at \( t = 2 \)?

7. **(15 points)**

(a) (5 pts) Find the derivative at \( x = 4 \) of the function

\[ y = \frac{6}{\sqrt{x}}. \]

(b) (10 pts) Find an equation for the tangent line of the graph of

\[ y = x^3 + \frac{1}{x} + 1 \]

at the point \((1, 3)\).

8. **(10 points)** The radius of a blood vessel is 2 mm. A drug causes the radius to change to 1.8 mm. Find the approximate change in the area of a cross section of the vessel.

(Hint: use the differential, or equivalently the tangent line approximation for the area function.)