More on limits, continuity, and differentiability

1. Discuss the continuity of the function $R(t) = t^2 \cdot e^{1/t}$. In particular, if there is a discontinuity, determine if it is removable or essential and show algebraic work.

2. Determine if the following function is continuous at $x = 1$. If so, determine if it is differentiable at $x = 1$.

$$f(x) = \begin{cases} \ln(x) & x > 1 \\ (1.7)^x - 1.7 & x \le 1 \end{cases}$$

3. Determine the values of *A* and *B* so that the function $g(r)$ is continuous.

$$g(r) = \begin{cases} \dfrac{r \log\left(r^2\right)}{r+1} & r \neq 0, -1 \\ A & r = 0 \\ B & r = -1 \end{cases}$$

4. The analysis of blood flow through the heart leads to a function of the form
$f(r) = -2|r| + \sqrt{1 - 4r^2 + 4|r|}$.

A. Investigate the differentiability of $f(r)$ at $r = 0$ graphically.

B. Rewrite $f(r)$ without absolute values.

C. Use your equation in part B to find the slope of $f(r)$ for $r > 0$ and for $r < 0$.

D. What do your answers to part C tell you about the differentiability of $f(r)$ at $r = 0$?