(3.) (16 points) The graphs of two functions \( f \) and \( g \) are shown below. [Note that the scales on the axes are not the same.]

(a) If \( h(x) = f(g(x)) \), compute \( h'(1) \).

\[
h'(1) = f'(g(1)) \cdot g'(1) = f'(-2) \cdot g'(1) = 4 \cdot 2 = 8
\]

(b) If \( k(x) = f(x) \cdot g(x) \), compute \( k'(1) \).

\[
k'(1) = f'(1) \cdot g(1) + f(1) \cdot g'(1) = -2 \cdot (-2) + 2 \cdot 2 = 8
\]

(c) If \( q(x) = \frac{f(x)}{g(x)} \), compute \( q'(1) \).

\[
q'(1) = \frac{g(1) \cdot f'(1) - f(1) \cdot g'(1)}{g^2(1)} = \frac{-2(-2) - 2(2)}{(-2)^2} = 0
\]

(d) If \( t(x) = \ln(g(x)) \), compute \( t'(1) \).

\[
t'(1) = \frac{1}{g(1)} \cdot g'(1) = \frac{1}{-2} \cdot 2 = -1
\]

Note: \( \ln(g(x)) \) is only defined where \( g(x) \) is positive. Therefore \( t \) (and hence \( t' \)) are undefined at \( x = 1 \). This was an oversight of the test writer, but was caught during grading and graded correctly.