2. (20 points) Suppose f and g are differentiable functions with the following values:

$$f(0) = 3, \quad f'(0) = 4, \quad g(0) = -1, \quad \text{and} \quad g'(0) = 2.$$

Show your work on the following:

(a) Find $h'(0)$ given $h(x) = \dfrac{g(x)}{f(x)}$.

(b) i. Find $k'(0)$ given $k(x) = (g(x))^2 f(x)$.

ii. Determine the local linearization of $k(x)$ near $x = 0$, and use that to approximate $k(0.001)$.

(c) Find $m'(0)$ given $m(x) = \sin\left((f(x))^3\right)$.