2. (20 points) Suppose f, g, and h are all differentiable functions of x , $f(x)$ and $g(x)$ are positive for all x, and that a, and b are positive constants. Your answers below will be in terms of f, g, h (and/or their derivatives) and perhaps the constants a or b.

(a) Find $\dfrac{dy}{dx}$ if $y = f(2) + \ln(f(x^2))$.

(b) Find $\dfrac{dy}{dx}$ if $y = f(x^a + 2x) + 2^{g(x)}$.

(c) Find $\dfrac{dy}{dx}$ if $y = \dfrac{h(bx)}{\cos(x) + 2}$.

(d) If $f'(x) = ag(x)$ and $g'(x) = -af(x)$, when is $y = f(x)g(x)$ increasing? [Refer to the instructions above for conditions on f, g and a.] Justify your answer.