2. [7 pts.] The differentiable function g has the following properties:
$g(2) = 5$, $g'(2) = 3$, $g(0) = -2$, $g'(0) = 4$. Show your work below.

(a) If $f(x) = \ln(g(x))$, find $f'(2)$.

$$f'(2) = \frac{d}{dx}\left(\ln g(x)\right)\Big|_{x=2} = \frac{g'(2)}{g(2)} = \frac{3}{5}$$

Final answer to (a):

$f'(2) =$ $3/5$

(b) If $h(x) = \dfrac{g(x)}{x^2+1}$, find $h'(0)$.

$$h'(0) = \frac{d}{dx}\left[\frac{g(x)}{x^2+1}\right]\Big|_{x=0} = \frac{d}{dx}\left[g(x)\,(x^2+1)^{-1}\right]\Big|_{x=0}$$

$$= \left[g'(x)(x^2+1)^{-1} - 2x\,g(x)\,(x^2+1)^{-2}\right]\Big|_{x=0}$$

$$= \left[\frac{(x^2+1)\,g'(x) - 2x\cdot g(x)}{(x^2+1)^2}\right]\Big|_{x=0} = \frac{1\cdot 4 - 0\cdot(-2)}{1^2} = 1/4$$

Final answer to (b):

$h'(0) =$ $1/4$