Math 111: Practice with derivatives

1. In each case find $\dfrac{dy}{dx}$

   (a) $y = \dfrac{x}{\sqrt{x^2 + 1}}$

   (b) $y = \sec^2(3x)$

   (c) $y = x^2 e^{\sqrt{x}}$

   (d) $y = (4^x + 1)^\pi$

   (e) $\sqrt{x + y} = 1 + x^2 y^2$

   (f) $e^{2y} \tan x = \cos xy$

   (g) $y = \log_{10}(x - 10^{-x})$

   (h) $y = \ln\left(\dfrac{x}{4e^{2x} + 3}\right)^3$

   (i) $y = \tan^{-1}\left(\sqrt{\dfrac{1 - x}{1 + x}}\right)$

2. The graph of $y = (x^2)^x$ has two horizontal tangent lines. Find equations for both of them.

3. The lateral surface area of a cone with radius r and height h is given by $A = \pi r \sqrt{r^2 + h^2}$. Find $\dfrac{dr}{dh}$ in terms of r and h when $A = 1500\pi$

4. The values of $f(x)$ and $f'(x)$ are given in the table.

x	-2	-1	0	1	2
$f(x)$	-8	-5	-2	-2	0
$f'(x)$	2	4	2	3	-3

   If $H(x) = f(f(x) + x)$, what is the value of $H'(1)$?

5. Suppose f with a graph that passes through the point $(1, 4)$ and that the line tangent to the graph at $(1, 4)$ is $y = 3x + 1$. If $g(x) = f(x^2)$, find $g(1)$ and $g'(1)$.