[1] *Differentiation.*

(a) $f'(x) = 3\sec^3 x \tan x = 3\sin x \cos^{-4} x$; the domain is the set of all real numbers x such that $x \neq \frac{(2n+1)\pi}{2}$ for $n = 0, \pm 1, \pm 2, \ldots$

(b) $\dfrac{d^2y}{dt^2} = \dfrac{-2t}{(1+t^2)^2}$.

(c) $f'(x) = -4\sin x \cos^3 x$ Note: there is an easy way and a hard way to get to this answer!

(d) $\dfrac{dy}{dx} = 3x^2 \cos(5^{x^2}) - 2(\ln 5)x^4 5^{x^2} \sin(5^{x^2})$

(e) $f'(0)$ is not defined; $f'(1) = 1$, $f'(e) = 2e^e$. Note: Give answers exactly (in terms of e, π, $\sqrt{2}$, etc.), not decimal approximations.

(f) $\dfrac{du}{dv} = \dfrac{b\sec^2 bv}{\tan bv} = b\sec(bv)\csc(bv)$ (either form, or any other equivalent form, is correct). What property of logarithms could have let you predict that a does not appear in the answer?

[2] $\sqrt{0.9} \approx 0.95$ and $\sqrt{0.99} \approx 0.995$; these are above the actual values, because the curve is concave down, so the tangent line is above the curve.

[3] *Integration.*

(a) $\dfrac{\pi}{24}$

(b) If $p = 0$, then the value of the integral is 1.
For all other values of p, the value is $\dfrac{2^{1-p} - 1}{1-p}$.

(c) $-3^{-2x}\left(\dfrac{x}{2\ln 3} + \dfrac{1}{(2\ln 3)^2}\right) + C$