Problems 13.6, Page 140

2.
$$\frac{dz}{dt} = (\sin y + y\cos x)(2t) + (x\cos y + \sin x)\frac{1}{t} = 2t(\sin(\ln t) + (\ln t)\cos t^2) + \frac{t^2\cos(\ln t) + \sin t^2}{t}$$

3.
$$\frac{dz}{dt} = \frac{1}{x^2+y^2}(2x)(-t^{-2}) + \frac{1}{x^2+y^2}(2y)(\frac{1}{2}t^{-1/2}) = \frac{-2t^{-3}}{t^{-2}+t} + \frac{1}{t^{-2}+t} = \frac{-2+t^3}{t+t^4}$$

4.
$$\begin{aligned}\frac{dz}{dt} &= (\cos(x/y))(1/y)(2) + (\cos(x/y))(-xy^{-2})(-2t)\\ &= \left(\frac{2}{1-t^2} + \frac{4t^2}{(1-t^2)^2}\right)\cos\left(\frac{2t}{1-t^2}\right) = \left(\frac{2+2t^2}{(1-t^2)^2}\right)\cos\left(\frac{2t}{1-t^2}\right)\end{aligned}$$

6.
$$\frac{dz}{dt} = e^y(2) + [(x+y)e^y + e^y](-2t) = 2e^{1-t^2}(1 - t[2t+1-t^2+1]) = 2e^{1-t^2}(t^3 - 2t^2 - 2t + 1)$$

7. I decided not to assign this one, but after typing the solution in all its gory detail, I couldn't bring myself to delete it:
$$\begin{aligned}\frac{\partial z}{\partial u} &= (e^{-y} - ye^{-x})(\sin v) + (-xe^{-y} + e^{-x})(-v\sin u)\\ &= (e^{-v\cos u} - (v\cos u)e^{-u\sin v})(\sin v) + (-(u\sin v)e^{-v\cos u} + e^{-u\sin v})(-v\sin u)\\ \frac{\partial z}{\partial v} &= (e^{-y} - ye^{-x})(u\cos v) + (-xe^{-y} + e^{-x})(\cos u)\\ &= (e^{-v\cos u} - (v\cos u)e^{-u\sin v})(u\cos v) + (-(u\sin v)e^{-v\cos u} + e^{-u\sin v})(\cos u)\end{aligned}$$

10.
$$\begin{aligned}\frac{\partial z}{\partial u} &= e^y\frac{1}{u} + [(x+y)e^y + e^y]0 = \frac{e^v}{u}\\ \frac{\partial z}{\partial v} &= e^y(0) + [(x+y)e^y + e^y]1 = e^v[\ln u + v + 1]\end{aligned}$$

11.
$$\begin{aligned}\frac{\partial z}{\partial u} &= e^y(2u) + xe^y(2u) = 2ue^{u^2-v^2}(1 + u^2 + v^2)\\ \frac{\partial z}{\partial v} &= e^y(2v) + xe^y(-2v) = 2ve^{u^2-v^2}(1 - u^2 - v^2)\end{aligned}$$

14.
$$\begin{aligned}\frac{\partial z}{\partial u} &= \frac{1}{1+(x/y)^2}(1/y)(2u) + \frac{1}{1+(x/y)^2}(-xy^{-2})(2u)\\ &= \frac{y}{y^2+x^2}(2u) + \frac{-x}{y^2+x^2}(2u) = \frac{y-x}{y^2+x^2}(2u)\\ &= 2u\frac{u^2-v^2-u^2-v^2}{u^4-2u^2v^2+v^4+u^4-2u^2v^2+v^4} = \frac{-4uv^2}{2u^4+2v^4} = \frac{-2uv^2}{u^4+v^4}\\ \frac{\partial z}{\partial v} &= \frac{y}{y^2+x^2}(2v) + \frac{-x}{y^2+x^2}(-2v)\\ &= \frac{y+x}{y^2+x^2}(2v) = 2v\frac{2u^2}{2u^4+2v^4} = \frac{2u^2v}{u^4+v^4}\end{aligned}$$