Problems 13.2, Page 108

3. $z_x = 2xy + 10x^4y$

4. $z_x = (\cos(5x^3y - 3xy^2))(15x^2y - 3y^2)$

5. $g_x(x, y) = (ye^{xy})^{-1}(y^2e^{xy}) = y$

14. $\dfrac{\partial}{\partial r}(\dfrac{2\pi r}{v}) = \dfrac{2\pi}{v}$

21. $u_E = \epsilon_0 E$

22. Because $f_0 = \dfrac{1}{2\pi\sqrt{C}}L^{-1/2}$, we have $\dfrac{\partial f_0}{\partial L} = -\dfrac{1}{4\pi\sqrt{C}}L^{-3/2}$.

26. $\dfrac{\partial \alpha}{\partial \beta} = \dfrac{(2y\beta+5)xe^{x\beta-3} - e^{x\beta-3}2y}{(2y\beta+5)^2} = \dfrac{((2y\beta+5)x - 2y)e^{x\beta-3}}{(2y\beta+5)^2}$

30. $\dfrac{\partial}{\partial w}\left(\dfrac{x^2yw - xy^3w^7}{w-1}\right)^{-7/2} = -\dfrac{7}{2}\left(\dfrac{x^2yw - xy^3w^7}{w-1}\right)^{-9/2} \dfrac{(w-1)(x^2y - 7xy^3w^6) - (x^2yw - xy^3w^7)}{(w-1)^2}$

31. $z_x = 7x^6 + yx^{y-1}$ and $z_y = 2^y \ln 2 + x^y \ln x$.

34. $\dfrac{\partial f}{\partial x} = x\dfrac{1}{y\cos x}(-y\sin x) + \ln(y\cos x) = -\dfrac{x\sin x}{\cos x} + \ln(y\cos x) = -x\tan x + \ln(y\cos x)$, so $\left.\dfrac{\partial f}{\partial x}\right|_{(\pi/3,1)} = -\frac{\pi}{3}\sqrt{3} + \ln\frac{1}{2} \approx -2.507$.

35. (b)

$x\backslash y$	0.9	1	1.1
1.9	4.42	4.61	4.82
2	4.81	5	5.21
2.1	5.22	5.41	5.62

so, approximating f_x and f_y by the average of the difference quotients to each side, we have:

$$\begin{aligned} f_x(2,1) &\approx \frac{1}{2}\left(\frac{4.61-5}{1.9-2} + \frac{5.41-5}{2.1-2}\right) = 4 \\ f_y(2,1) &\approx \frac{1}{2}\left(\frac{4.81-5}{.9-1} + \frac{5.21-5}{1.1-1}\right) = 2 \end{aligned}$$

(Instead of averaging two difference quotients, the solution book uses only the second one, so its approximations are 4.1 and 2.1 respectively.)
(c) $f_x(x,y) = 2x$, so $f_x(2,1) = 4$. And $f_y(x,y) = 2y$, so $f_y(2,1) = 2$.

36.

$$\begin{aligned} K\frac{\partial Q}{\partial K} + L\frac{\partial Q}{\partial L} &= K(b\alpha K^{\alpha-1}L^{1-\alpha}) + L(bK^{\alpha}(1-\alpha)L^{-\alpha}) \\ &= \alpha bK^{\alpha}L^{1-\alpha} + (1-\alpha)bK^{\alpha}L^{1-\alpha} \\ &= (\alpha + 1 - \alpha)bK^{\alpha}L^{1-\alpha} = Q \end{aligned}$$