ERRATA for T. Shifrin's *Multivariable Mathematics: Linear Algebra, Multivariable Calculus, and Manifolds*

p. 79, Exercise **4**. x should be $\mathbf{x}$ throughout.

p. 86, Exercise **12b**. Here $\mathbf{f}\colon \mathcal{M}_{n\times n} \to \mathbb{R}$.

p. 91, Example **5**. On the second line it should be $\mathbf{f}\colon \mathbb{R}^2 - \{y = 0\} \to \mathbb{R}^2$.

p. 92, Example **7**. The reference should be to Example **3** of Chapter 2, Section 3.

p. 103, Exercise **6**. The symbol for liter (l) looks too much like a 1. For clarity, it would help to change these to ℓ.

p. 103, Exercise **11**. Prove that a *differentiable* function f is homogeneous ...

p. 145, Exercise **12**. In (**b**) and (**d**) the vectors $\mathbf{b}$ and $\mathbf{b}_i$ should be nonzero.

p. 155, Exercise **1**. ... find a product of elementary matrices $E = \cdots E_2E_1$ so that EA is in echelon form.

p. 185, Exercise **6a**. nonzero matrix A.

p. 188, Figure **5.2**. The label should be $f(\mathbf{x}) = 0$.

p. 202, Lemma **2.1**. $Df(\mathbf{a}) = \mathrm{O}\ \dots$

p. 203, **Definition**. A critical point $\mathbf{a}$ is a saddle point if for every $\delta > 0$, there are points $\mathbf{x}, \mathbf{y} \in B(\mathbf{a}, \delta)$ with $f(\mathbf{x}) < f(\mathbf{a})$ and $f(\mathbf{y}) > f(\mathbf{a})$.

p. 207, Exercise **2**. The opposite corner should also be in the first octant, i.e., should have x, y, and z all positive.

p. 256, line **6**. Z is a neighborhood of $\begin{bmatrix}\mathbf{x}_0\\ \mathbf{0}\end{bmatrix}$. In Figure 2.4, Z should be slid to the right, containing $V \times \{\mathbf{0}\}$.

p. 261, Exercise **13a**. Suppose $f\begin{pmatrix}\mathbf{x}_0\\ t_0\end{pmatrix} = \dfrac{\partial f}{\partial t}\begin{pmatrix}\mathbf{x}_0\\ t_0\end{pmatrix} = 0$ and the matrix ... is nonsingular. Show that for some $\delta > 0$, there is a $\mathcal{C}^1$ curve $\mathbf{g}\colon (t_0 - \delta, t_0 + \delta) \to \mathbb{R}^2$ with $\mathbf{g}(t_0) = \mathbf{x}_0$ so that ...

p. 275, Exercise **10**. $R \subset \mathbb{R}^n$; line **5** ... requires at most volume $2A\delta$.

p. 276, Exercise **14b**. $D = \{\mathbf{x} \in R : f \text{ is discontinuous at } \mathbf{x}\}$.

p. 322, Exercise **10d**. The problem should ask only for an example when A and C do not commute. In fact, using the continuity of det, the astute reader should be able to check that the result of part c *does* hold whenever A and C commute.

p. 326, line **1**. In the proof of Theorem 6.4, the reduction to a rectangle is not valid. We have to cover Ω with a union R of rectangles (with rational sidelengths) contained in U. This can then be partitioned into cubes and the proof proceeds.

p. 328, line **1**. Section 3, not section 4.

p. 329, lines **13–15**. In the long inequality we should have $\varepsilon\,\mathrm{vol}\,(R)\big(1+Mn\big)$ and $\varepsilon\,\mathrm{vol}\,(R)\big(2^n+2^{n-1}Mn\big)$. Then let $\beta=\mathrm{vol}\,(R)\big(2^n+2^{n-1}Mn\big)$.

p. 345, lines **4–5**. We need the remark here that $\mathbf{g}_2^{-1}\circ\mathbf{g}_1$ is smooth. This can be proved by what should be an exercise in §6.3: Using the notation of part **3** of the Definition on p. 262 of a k-dimensional manifold, perhaps shrinking W, there is a smooth function $\mathbf{h}\colon W\to U$ whose restriction to $M\cap W$ is $\mathbf{g}^{-1}$. (Hint: Without loss of generality, assume $\mathbf{g}(\mathbf{u}_0)=\mathbf{p}$ and write $\mathbf{g}(\mathbf{u})=\begin{bmatrix}\mathbf{g}_1(\mathbf{u})\\ \mathbf{g}_2(\mathbf{u})\end{bmatrix}\in\mathbb{R}^k\times\mathbb{R}^{n-k}$, where $D\mathbf{g}_1(\mathbf{u}_0)$ is nonsingular.)

p. 352, add to **Remark**: Also, note that we are using the notation $\oint_C\omega$ to denote the integral of ω around the closed curve (or loop) C. This notation is prevalent in physics texts.

p. 355, lines $-$**2** and $-$**1**. a should be $\mathbf{a}$.

p. 368–369, Example **2**. In parts a and c, $D=(0,1)\times(0,2\pi)$.

p. 380, line **8**. Add: “parametrization $\mathbf{g}\colon U\to\mathbb{R}^n$ with $U\subset\mathbb{R}^k_+$ and”

p. 382, line **12**. Delete the last equality in the displayed string of equations.

p. 410, lines **4** and **5**. All the integrals should be over S^{2m}.

p. 411, Exercise **9**. Suppose $U\subset\mathbb{C}$ is open, $f,g\colon U\to\mathbb{C}$ are smooth, and $C\subset U$ is a closed curve. Suppose that on C we have $f,g\neq 0$ and $|g-f|<|f|$. Prove that ...

p. 433, line **5**. The 22 entry of $B-I$ should be 2.

p. 444, Example **7**, line **–3**. $\dot{x}_1=-x_2$.

p. 445, Example **8**. Delete the first “the” in the first line.

p. 454, Exercise **18c**. The result of Exercise 9.2.22 is needed to provide the suggested continuity argument, as well. We should insert a remark that the result of c holds even when the eigenvalues are complex. This is needed for #19.

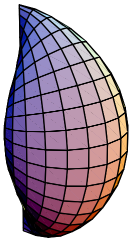
p. 457, lines **11–12**. “Let $W=(\mathrm{Span}\,(\mathbf{v}_1))^\perp\subset\mathbb{R}^n$” should precede the second sentence of the paragraph.

p. 476, #**2.2.13**. min should be max.

p. 480, #**4.5.11a**. $DF(\mathbf{x})$ has rank 2 at every point $\mathbf{x}\in M$: Either $x_1=x_2$ and $x_3=-x_4$ or $x_1=-x_2$ and $x_3=x_4$, so x_1x_2 and x_3x_4 have opposite signs unless they are both 0.

p. 482, #**6.2.1**: $D\mathbf{g}(\mathbf{f}(\mathbf{x}_0)) = \dfrac{1}{2(x_0^2 + y_0^2)} \ldots$

p. 483, #**7.3.12**: The picture is not correct.



—May, 2012