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

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

p. 155, Exercise **1**. ... find a product of elementary matrices $E = \cdots E_2 E_1$ so that EA is in echelon form.

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

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**, line **5**. ... requires at most volume $A\delta$.

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

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

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

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: Use the equivalent definition **1** to write $M \cap W$ as a graph over the $x_1 \cdots x_k$-plane; write $\mathbf{g}(\mathbf{u}) = \begin{bmatrix} \mathbf{g}_1(\mathbf{u}) \\ \mathbf{g}_2(\mathbf{u}) \end{bmatrix} \in \mathbb{R}^k \times \mathbb{R}^{n-k}$, and note that $\mathbf{g}_1$ has a (local) smooth inverse.)

p. 352, add to **Remark**: Also, note that we are using the notation $\displaystyle\oint_C \omega$ 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 $U \subset \mathbf{C}$ is open, $f, g\colon U \to \mathbf{C}$ 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. 457, lines **11–12**. "Let $W = (\text{Span}\,(\mathbf{v}_1))^{\perp} \subset \mathbb{R}^n$" should precede the second sentence of the paragraph.

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**: $D\mathbf{g}(\mathbf{f}(\mathbf{x}_0)) = \dfrac{1}{2(x_0^2 + y_0^2)} \dots$

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