(2/25/18) **Page xii, last paragraph:** Allen Hatcher’s name is misspelled. (Sorry, Allen.)

(2/14/15) **Page 23, Exercise 2.6, first line:** Change “collection of topologies” to “nonempty collection of topologies.”

(6/24/19) **Page 26, just above Exercise 2.12:** Replace the last sentence of the paragraph by “Symbolically, this is denoted by \( x_i \to x \).”

(6/18/19) **Page 27, paragraph before Proposition 2.19:** Just before the last sentence of that paragraph, insert “(Continuity of the restriction of a function to an open subset is understood to be with respect to the topology described in Exercise 2.5.)”

(3/8/16) **Page 27, last line:** Change two occurrences of \( x \) to \( y \) in the displayed equation, so it reads

\[
(f|_{V_y})^{-1}(U) = \{ y \in V_x : f(y) \in U \} = f^{-1}(U) \cap V_x.
\]

(9/26/19) **Page 31, second paragraph below the section heading, second sentence:** Change “two points” to “two distinct points.”

(6/24/19) **Page 32, just above Exercise 2.38:** Insert the following sentence: “In view of the preceding proposition, in a Hausdorff space we can write \( p = \lim_{i \to \infty} p_i \) as an alternative notation for \( p_i \to p \).”

(5/17/12) **Page 37, three lines from the bottom:** Change “Exercise 2.49” to “Example 2.49.”

(11/26/15) **Page 53, part (c) of the proposition continued from the previous page:** Insert another “if” after “if and only.”

(7/14/18) **Page 58, second display:** Replace \( k \) by \( k/2 \) (twice) and \( l \) by \( l/2 \) (twice). [The tangent and cotangent functions have period \( \pi \), not \( 2\pi \).]

(9/26/19) **Page 60, last paragraph:** In this paragraph and in the first one on page 61, change all subscript \( k \)’s to \( n \)’s (a total of four times).

(9/26/19) **Page 61, Proposition 3.31, part (c):** Change \( X_k \) to \( X_n \).

(11/20/19) **Page 66, after the second line:** Add the following sentence: “We sometimes also say informally that \( Y \) is a quotient space of \( X \) when \( Y \) is a topological space that has the quotient topology with respect to some continuous map from \( X \) to \( Y \).”

(3/23/12) **Page 67, Example 3.52, second sentence:** Change this sentence to read “Let \( \sim \) be the equivalence relation on \( X \) such that \( a_1 \sim a_2 \) for all \( a_1, a_2 \in A \) and \( a \sim x \) for all other \( x \in X \); the partition . . . .”

(5/17/12) **Page 67, Example 3.53, last line:** Change \( \mathbb{B}^n \) to \( \mathbb{B}^{n+1} \).

(7/17/19) **Page 70, Example 3.66, first paragraph, next-to-last line:** Change \( \theta \) to \( \frac{1}{2\pi} \theta \).

(10/7/11) **Page 74, line 5:** Change this statement to read “As a set, \( X \cup fY \) is the disjoint union . . . .” [The topology on \( X \cup fY \) is not the disjoint union topology.]

(11/30/19) **Page 75, proof of Theorem 3.79, second line:** Change \( q(\partial M \cup \partial N) \) to \( q(\partial M) \cup \partial N \).

(12/1/19) **Page 75, proof of Theorem 3.79, second paragraph:** Replace that paragraph with the following: “Suppose \( s \in S \), and let \( y_0 \in \partial N \) and \( x_0 = h(y_0) \in \partial M \) be the two points in the fiber \( q^{-1}(s) \). We can choose coordinate charts \( (U, \phi) \) for \( M \) and \( (V, \psi) \) for \( N \) such that \( x_0 \in U \) and \( y_0 \in V \), and let \( \tilde{U} = \phi(U) \), \( \tilde{V} = \psi(V) \subseteq \mathbb{H}^n \) (Fig. 3.13). It is useful in this proof to identify \( \mathbb{H}^n \) with \( \mathbb{R}^{n-1} \times [0, \infty) \) and \( \mathbb{R}^n \) with \( \mathbb{R}^{n-1} \times \mathbb{R} \). By shrinking \( U \) and \( V \) if necessary, we may assume that \( h(V \cap \partial N) = U \cap \partial M \). Then we can write the coordinate maps as \( \phi(p) = (\phi_0(p), \phi_1(p)) \) and \( \psi(p) = (\psi_0(p), \psi_1(p)) \) for some continuous maps \( \phi_0: U \to \mathbb{R}^{n-1} \), \( \phi_1: U \to [0, \infty) \), \( \psi_0: V \to \mathbb{R}^{n-1} \), \( \psi_1: V \to [0, \infty) \). Our assumption that \( x_0 \) and \( y_0 \) are boundary points means that \( \phi_1(x_0) = \psi_1(y_0) = 0 \), and there are open subsets \( U_0, V_0 \subseteq \mathbb{R}^{n-1} \) such that \( \phi_0(U \cap \partial M) = U_0 \), \( \psi_0(V \cap \partial M) = V_0 \). (Here we are again using the theorem on invariance of the boundary.) After replacing \( U \) and \( V \) by the preimages.
of $U_0 \times [0, \infty)$ and $V_0 \times [0, \infty)$, respectively, we can also assume that $\hat{U} \subseteq U_0 \times [0, \infty)$ and $\hat{V} \subseteq V_0 \times [0, \infty)$.

(6/18/19) Page 76, display in the middle of the page: Change $y^m$ to $y_n$ (twice).

(7/16/11) Page 76, last paragraph of the proof of Theorem 3.79: In the second line of the paragraph, change “embedding of $N$” to “embedding of $M$.” In the fourth line, change “embedding of $M$” to “embedding of $N$.”


(8/23/11) Page 87, Exercise 4.4: Insert another “if” after “if and only.”

(8/23/11) Page 88, proof of Proposition 4.9, fourth paragraph: In the first sentence of the paragraph, change “open subsets of $\bigcup_{\alpha \in A} B_\alpha$” to “open subsets of $X$ whose union contains $\bigcup_{\alpha \in A} B_\alpha$.”

(8/23/11) Page 97, line 10: Change $B_{n_{\max}}(a)$ to $B_{n_{\max}}(x)$.

(3/9/11) Page 98, line 3 from the bottom: Change “this proposition” to “this lemma.”

(6/21/20) Page 99, second paragraph: Delete the second sentence of the paragraph. [It’s not wrong; it’s just not needed.]

(6/21/20) Page 103, just above Exercise 4.58: After the word “illustrates,” insert “(using the theorem on invariance of the boundary).”

(11/11/13) Page 104, proof of Proposition 4.60: At the end of the first paragraph, change $B_{r(x)}(x) \subseteq \hat{U}_i$ to $B_{2r(x)}(x) \subseteq \hat{U}_i$. [Without this change, it might not be the case that $B$ covers $M$.]

(6/21/20) Page 106, proof of Theorem 4.68, last paragraph: After the first sentence of the paragraph, insert: “Begin by setting $W_0 = X$.” Then in the third and fourth lines of the paragraph, replace “Choosing $r_n < \min(\varepsilon_n, 1/n)$” by “Choosing $r_n < \min(\varepsilon_n, 1/n)$ and setting $W_n = B_{r_n}(x_n)$.”

(8/23/11) Page 106, line 3 from the bottom: Change “countable union” to “countable intersection.”

(8/23/11) Page 109, statement of Lemma 4.74: Insert another “if” after “if and only.”

(7/19/15) Page 110, next-to-last line: Change $M$ to $X$.

(8/23/11) Page 114, proof of Corollary 4.83: This proof is incorrect. Replace it with the following: “Given a closed subset $A \subseteq X$ and a neighborhood $U$ of $A$, Lemma 4.80 shows that there is a neighborhood $V$ of $A$ such that $V \subseteq U$. By Urysohn’s lemma, there exists a continuous function $f : X \to [0, 1]$ such that $f \equiv 1$ on $A$ and $f \equiv 0$ on $X \setminus V$. This function satisfies $\text{supp } f \subseteq \overline{V} \subseteq U$, so it is the bump function we seek.”

(6/17/19) Page 119, statement of Proposition 4.93(b): Add the hypothesis that $Y$ is Hausdorff.

(10/24/19) Page 119, proof of Proposition 4.93, second paragraph: Change the first sentence to read “To prove (b), assume $X$ is a second countable Hausdorff space and $Y$ is Hausdorff, and suppose …” Then replace the sentence beginning “Suppose on the contrary” by the following: “Suppose on the contrary that $(x_i)$ is a sequence in $L$ with no convergent subsequence in $L$. Because $Y$ is Hausdorff, $K$ is closed and therefore so is $L$, which means that $(x_i)$ has no convergent subsequence in $X$.”

(8/23/11) Page 121, proof of Lemma 4.94: Replace the last two sentences of the proof with the following: “Thus $x$ lies in the closure of $A \cap K$ in $K$. Because $A \cap K$ is closed in $K$, it follows that $x \in A \cap K \subseteq A$.”

(8/23/11) Page 123, Problem 4.15(d): Change “every connected neighborhood” to “every neighborhood.”

(9/16/11) Page 126, Problem 4.30: Change $\{A_\alpha\}$ to $\{X_\alpha\}_{\alpha \in A}$.

(4/12/20) Page 126, Problem 4.31(c): In the last sentence, change “every element of $\mathcal{U}$” to “every nonempty element of $\mathcal{U}$.”

(4/12/20) Page 128, proof of Prop. 5.1: Insert before the first sentence of the proof: “The proposition is true by definition when $n = 0$, so assume that $n > 0$.”

(1/20/11) Page 133, proof of Proposition 5.7: This should refer to Problem 5.8, not 5.7.

(5/17/12) Page 136, four lines below the displayed equations: Change “both $X'_n$ and $X''_n$ are open” to “both $X'_n$ and $X''_n$ are open.”

(1/20/11) Page 137, statement of Lemma 5.13: Change “discrete” to “closed and discrete.”
(1/20/11) Page 137, proof of Lemma 5.13, first paragraph: In line 1, change “discrete” to “closed and discrete”; and in line 2, change “discrete subset” to “closed discrete subset.”

(1/20/11) Page 137, proof of Theorem 5.14, second paragraph: Change “infinite discrete subset” to “infinite closed discrete subset.”

(7/17/19) Page 140, displayed formulas: In both displayed formulas, change $\mathbb{R}$ to $[0, 1]$.

(4/12/20) Page 141, just above the displayed equation: In the line above the display and in the display itself, change $A$ to $B$ (four times), to avoid conflict with the use of $A$ as the index set for the open cover.

(4/12/20) Page 141, displayed equation: Change $D^*_n+1$ to $D^*_n \setminus \{0\}$.

(9/16/11) Page 141, line 5 from the bottom: Change $\tilde{U}^{n+1}_\alpha$ to $\tilde{U}^{n+1}_{\alpha i}$ (twice).

(2/5/13) Page 141, line 4 from the bottom: Change “the minimum” to “one-half the minimum.”

(2/5/13) Page 141, line 3 from the bottom: Change “supported in $\partial D^{n+1}_\gamma (\epsilon/2)$” to “supported in $\partial D^{n+1}_\gamma (\epsilon/2)$”

(7/17/19) Page 143, proof of Proposition 5.24, last paragraph: Change $U \cap e_0$ to $U \cap \bar{e}_0$.

(10/16/20) Page 144, three lines above Lemma 5.26: Change “the finite subcomplex $E_n$” to “the finite subcomplex $M_n$.”

(7/24/19) Page 145, second paragraph: Change $e_n$ to $e_k$ twice (once in the first line, and once in (5.1)).

(7/22/19) Page 146, Case 1, second paragraph: Change $Y_n$ to $Y_{v_n}$ (twice).

(4/12/20) Page 152, sentence after the proof of Prop. 5.38: Change $i = 1, \ldots, k$ to $i = 0, \ldots, k$.

(3/24/11) Page 156, Problem 5-4: add the hypothesis that $\dim M > 1$.

(5/27/17) Page 158, second sentence: Replace this sentence by “More generally, suppose $K$ is a finite Euclidean simplicial complex and $w$ is a point in $\mathbb{R}^n$ such that each ray starting at $w$ intersects $|K|$ in at most one point.”

(4/12/20) Page 158, Problem 5-18(b): In the hint, change “simplex” to “cell.”

(11/7/19) Page 165, Example 6.7: After the second sentence, add “(The disks should be chosen so that their closures are disjoint.)”

(4/12/20) Page 167, line 5 from the bottom: Insert “the” before “sum.”

(9/16/11) Page 172, first paragraph, next-to-last line: Change $P'_1 \sqcup Q$ to $P_1 \sqcup Q$.

(9/16/11) Page 176, Fig. 6.21: The label $b$ near the lower right should be $c$, and the label $w$ near the middle of the right-hand side should be $x$.

(5/20/18) Page 180, Proposition 6.20: In the statement of the proposition, change “compact surface” to “connected compact surface.” Then in the second sentence of the proof, change both occurrences of “surface” to “connected compact surface.”

(11/5/17) Page 181, first full paragraph: Replace the sentence starting with “However” by “However, we will prove in Chapter 10 that a compact surface cannot have both an oriented presentation and a nonoriented one.”

(2/26/18) Page 181, Problem 6-4: Replace the first sentence by “Suppose $M$ is a compact 2-manifold that contains a subset $B \subseteq M$ that is homeomorphic to the Möbius band, and whose interior is homeomorphic to the Möbius band minus its boundary.”

(9/16/11) Page 190, line 3 from the bottom: Change $\Phi_\xi(f)$ to $\Phi_\xi[f]$.

(1/20/11) Page 193, proof of Proposition 7.16, second paragraph, line 2: Change “$H_1 = f$” to “$H_1 = \tilde{f}$.”

(8/3/18) Page 201, Corollary 7.38: This corollary should be moved after the statement of Theorem 7.40.

(11/25/12) Page 211, line 6: Delete redundant “each.”

(7/9/15) Page 215, Problem 7-9: Change “connected” to “path-connected.”

(5/31/16) Page 221, Theorem 8.4: Remark: This theorem is true without the assumption that $B$ is locally connected, and the proof is not really any more difficult; see, for example, the proof of Theorem 1.7 in [Hat02].

(7/22/19) Page 222, first paragraph: Change $\{J_1, \ldots, J_k\}$ to $\{J_1, \ldots, J_m\}$.

(1/20/11) Page 224, two lines above the subheading: Change $f_0(1)$ to $f_1(0)$. 
Page 228, displayed equations (8.4): Replace these equations by
\[
\deg \varphi = \deg (p \varphi \circ \varphi)_*, \\
\deg \psi = \deg (p \psi \circ \psi)_*.
\] (8.4)

Page 230, Problem 8-5: Replace the last sentence of the hint by the following: “Prove that \( p_n \mid S^1 \) and \( p_n(z) = z^n \) are homotopic as maps from \( S^1 \) to \( \mathbb{C} \setminus \{0\} \). If \( p \) has no zeros, use degree theory to derive a contradiction.”

Page 231, Problem 8-10(c): Change “index of \( V \) around the loop \( \omega \)” to “winding number of \( V \) around the loop \( \omega \).”

Page 239, fourth line below the section heading: Change “generated by \( G \)” to “generated by \( S \).”

Page 241, middle of the page: Change the definition of \( \text{group presentation} \) as follows: “We define a \( \text{group presentation} \) to be an ordered pair, denoted by \( (S|R) \), where \( S \) is an arbitrary set and \( R \) is a set of words formed from the elements of \( S \).”

Page 241, just below the last displayed equation: Replace “where \( \bar{R} \) is the \( \text{normal closure of} \ R \) in \( F(S) \)” by “where now we interpret \( R \) as a set of elements of the free group \( F(S) \), and \( \bar{R} \) is the \( \text{normal closure of} \ R \) in \( F(S) \).”

Page 244, fourth line below the section heading: Change \( n \in \mathbb{Z} \) to \( n \in \mathbb{N} \).

Page 247, Example 9.22, last line: The formula for \( G_{\text{tot}} \) should be \( G_{\text{tot}} = \{0\} \times \mathbb{Z}/k_1 \times \cdots \times \mathbb{Z}/k_m \).

Page 249, Problem 9-4(b): Change “a subset of the free group \( F(S_i) \)” to “a set of words in the elements of \( S_i \).”

Page 249, Problem 9-5: Change “subsets of the free group \( F(S) \)” to “sets of words in the elements of \( S \).”

Page 252, just above diagram (10.2): Change “the following diagram commutes” to “the right half of the following diagram commutes.”

Page 256, statement of Theorem 10.7: Change “spaces” to “path-connected spaces.”

Page 257, last paragraph, second sentence: Change that sentence to read “If two or more edges are incident with the same two vertices, or if two or more self-loops are incident with the same vertex, they are called \( \text{multiple edges} \).”

Page 263, line 2: Change \( U \cap \bar{V} \) to \( q(D \setminus \{z\}) \).

Page 268, lines 2 & 3: Change “preceding corollary” to “preceding theorem.”

Page 268, statement of Corollary 10.24: Change the statement to “A compact surface cannot have both an oriented presentation and a nonoriented one.”

Page 269, line below equation (10.7): Insert missing comma after “surjective.”

Page 271, line 3: Replace the phrase “the endpoints of the paths \( a_i \) in this product are of the form \( i/n \)” by “the paths \( a_i \) in this product are defined on subintervals whose endpoints are integral multiples of \( 1/n \).”

Page 275, Problem 10-21(c): Delete “with nonempty intersection.”

Page 278, second line below the heading: Before “disjoint union,” insert “nonempty.”

Page 279, second line: Change “Theorem 4.15” to “Proposition 4.13.”

Page 282, Theorem 11.13: Remark: This theorem, like Theorem 8.4, is true without the assumption that \( B \) is locally connected.

Page 302, Problem 11-5, first line: Change “dimension \( n \)” to “dimension \( n \geq 2 \).”

Page 303, Problem 11-9: Add the hypothesis that the spaces are nonempty.

Page 303, Problem 11-12(c): Change “\((1,0)\) or \((-1,0)\)” to “1 or \(-1\)” [to be consistent with the complex notation used elsewhere for \( S^1 \)].

Page 305, Problem 11-20: At the end of the problem, add: “For the counterexample, you may use without proof the fact that \( S^2 \) is not contractible. (This follows, for example, from Corollary 13.11 and Theorem 13.23.)”

Page 312, last sentence of the paragraph after Exercise 12.13: Allen Hatcher’s name is misspelled.
Page 315, paragraph above the displayed diagram: After “$Q$ is a normal covering map,” insert “and $\hat{H} = \text{Aut}_Q(E)$.”

Page 315, just below the displayed diagram: Replace the last two paragraphs on page 315 and the first (partial) paragraph on page 316 with the following:

We have to show that $q$ is a covering map. Let $x \in X$ be arbitrary, and let $U$ be a neighborhood of $x$ that is evenly covered by $q$. We will show that $U$ is also evenly covered by $\hat{q}$. Given a component $U_i$ of $q^{-1}(U)$, let $\hat{U}_i = Q(U_i) \subseteq \hat{E}$; then $\hat{U}_i$ is connected, and it is open in $\hat{E}$ because $Q$ is an open map (Proposition 11.1). Suppose $\hat{U}_i = Q(U_i)$ and $\hat{U}_j = Q(U_j)$ are any two such sets. If they have a point $\hat{e}$ in common, then $\hat{e} = Q(e_i) = Q(e_j)$ for some $e_i \in U_i$ and $e_j \in U_j$. Since $Q$ identifies points of $E$ if and only if they are in the same $\hat{H}$-orbit, there is some $e_i \in E$ such that $e_j = e_i \in E$. Then $\phi(U_i) = U_j$ by Proposition 12.1(c), so $Q(U_i) = \phi(U_i) = Q(U_j)$. This shows that any such sets $\hat{U}_i, \hat{U}_j$ are either disjoint or equal. Since $Q$ is surjective, $q^{-1}(U)$ is equal to the disjoint union of the connected open sets $\hat{U}_i$ as $U_i$ ranges over the components of $q^{-1}(U)$.

It remains only to show that for any such set $\hat{U}_i$, the restricted map $\hat{q} : \hat{U}_i \to U$ is a homeomorphism. The following diagram commutes:

\[
\begin{array}{ccc}
U_i & \xrightarrow{Q} & \hat{U}_i \\
\downarrow & & \downarrow \hat{q} \\
q & & q \\
\end{array}
\]

(12.3)

Since $q = \hat{q} \circ Q$ is injective on $U_i$, so is $Q$; and $Q : U_i \to \hat{U}_i$ is surjective by definition. Because $Q$ is an open map, it follows that $Q : U_i \to \hat{U}_i$ is a homeomorphism. Since $q$ and $Q$ are homeomorphisms in (12.3), so is $\hat{q}$.

Page 318, statement of Proposition 12.21, second line: Insert “on” after “acting.”

Page 320, paragraph after the proof of Prop. 12.24, first line: Before “locally,” insert “nonempty.”

Page 321, line 4: Change $E \times E$ to $E$.

Page 329, paragraph just below the diagram: Change every occurrence of $\bar{p}$ to $\bar{q}$ (five times).

Page 330, just below the bulleted list: Change $\bar{p}$ to $\bar{q}$.

Page 332, first full paragraph, second line: Change $\bar{p}$ to $\bar{q}$.

Page 332, second full paragraph, lines 6 and 7: Change $\bar{p}$ to $\bar{q}$ (twice).

Page 335, Problem 12-10: Interchange the definitions of $G$ and $H$ in the sixth and seventh lines. (Otherwise, part (c) is false as stated.)

Page 337, Problem 12-19: Replace the first sentence of the problem with the following: “Suppose we are given a continuous action of a metrizable topological group (e.g., a discrete group) $G$ on a first countable Hausdorff space $E$.”

Page 349, line 3: Change $\Delta_p$ to $\Delta_{p+1}$.

Page 352, lines 3 and 4: Change $c_p$ to $c_q$ (twice), and change $p$ to $q$ (twice).

Page 352, next-to-last line: Change $c_p$ to $c_q$ (twice), and change $p$ to $q$ (once).

Page 354, paragraph above the last display: Insert “of some reparametrization” after “extension of the circle representative.”

Page 360, proof of Lemma 13.20: In the second line of the displayed equation, change $F_{i,p}$ to $\bar{F}_{i,p+1}$.

Page 361, first line of text: Change “$\in \mathbb{R}^n$” to “$\subseteq \mathbb{R}^n$.”

Page 370, line 5 from the bottom: Change “It follows . . . .” to “Assuming $X$ is path-connected, it follows . . . .”

Page 371, at the end of the first (partial) paragraph: Insert “If $X$ is not path-connected, just apply this argument to the path component containing the image of $\varphi$, and use Proposition 13.5.”
(9/26/17) **Page 371, statement of Theorem 13.34(e):** Change “dimension $n$” to “dimension $n \geq 2$,” and change “the zero map” to “not injective.”

(9/26/17) **Page 372, proof of Theorem 13.34, last paragraph:** Change “if $\varphi_* = 0$” to “if $\varphi_*$ is injective.”

(9/26/17) **Page 372, Example 13.35(b), last line:** Change “the zero map” to “noninjective.”

(9/29/17) **Page 372, Example 13.35(c):** Replace the last sentence by “The image of $\varphi_*$ is the infinite cyclic group generated by $\gamma(a_1^2 \ldots a_n^2)$, so $\varphi_*$ is injective and $H_2(M) = 0$.”

(9/26/19) **Page 399, next-to-last line:** Change $x \in X$ to $x \in M_1$.

(12/26/18) **Page 401, line 4 from the bottom:** Change “subset” to “nonempty subset.”

(10/7/19) **Page 402, Exercise C.1:** Change “any subset” to “any nonempty subset.”

(6/6/18) **Page 411, near the middle of the page:** The index entry for $\overline{R}$ should read “(normal closure of a subset).”

(2/25/18) **Page 422:** The index entry for “Hatcher, Allen” is misspelled.