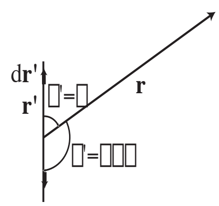
Corrections to the Instructor's Solution Manual
Cumulative, except does not *include September 1, 2004 installment.*
(September 15, 2009)
Introduction to Electrodynamics, 3rd ed.
by David Griffiths

- Page 16, Problem 1.53, line 1: the second equals sign should be a plus sign.
- Page 31, Problem 2.30(b), first line: change "$(2\pi R)l$" to "$\sigma(2\pi R)l$".
- Page 34, Problem 2.41: the answer (in the box) can also be written as

$$\frac{\sigma}{\pi\epsilon_0}\tan^{-1}\left(\frac{a^2}{4z\sqrt{z^2+(a^2/2)}}\right)$$

- Page 59, Problem 3.31(c), first $V \to W$.
- Page 62, Problem 3.38: change to read as follows.

Problem 3.38



Use multipole expansion (Eq. 3.95): $\rho\, d\tau' \to \lambda\, dr'$; $\lambda = \dfrac{Q}{2a}$; the r' integral breaks into two pieces:

$$V(\mathbf{r}) = \frac{1}{4\pi\epsilon_0}\sum_{n=0}^{\infty}\frac{1}{r^{n+1}}\left[\int_0^a (r')^n P_n(\cos\theta')\lambda\, dr' + \int_0^a (r')^n P_n(\cos\theta')\lambda\, dr'\right].$$

In the first integral $\theta' = \theta$ (see diagram); in the second integral $\theta' = \pi - \theta$, so $\cos\theta' = -\cos\theta$. But $P_n(-z) = (-1)^n P_n(z)$, so the integrals cancel when n is odd, and add when n is even.

$$V(\mathbf{r}) = 2\frac{1}{4\pi\epsilon_0}\frac{Q}{2a}\sum_{n=0,2,4,\ldots}^{\infty}\frac{1}{r^{n+1}}P_n(\cos\theta)\int_0^a x^n\, dx.$$

The integral is $\dfrac{a^{n+1}}{n+1}$, so

$$V = \frac{Q}{4\pi\epsilon_0}\frac{1}{r}\sum_{n=0,2,4,\ldots}\left[\frac{1}{n+1}\left(\frac{a}{r}\right)^n P_n(\cos\theta)\right].$$

- Page 64, Problem 3.41(a), second line below the equations: change "$\mathbf{E}_s$" to "$\mathbf{E}_\rho$".

- Page 64, Problem 3.41(b), in the equation: remove the hat from $\mathbf{r}$ (both times).
- Page 74, Problem 4.6(b): in the figure, the diagonal line should be labeled $2z$, instead of z.
- Page 78, Problem 4.17: in the third figure the two "ellipses" should have pointed ends. Also, add at the end "For more detailed figures see the solution to Problem 6.14 (page 117), reading **P** for **M**, **E** for **H**, and **D** for **B**."
- Page 79, Problem 4.19: separate off the last two columns of the table to make a separate box as follows:

	σ_b (top surface)	σ_f (top plate)
(a)	$-\frac{2(\epsilon_r-1)}{(\epsilon_r+1)}\frac{\epsilon_0 V}{d}$	$\frac{2\epsilon_r}{(\epsilon_r+1)}\frac{\epsilon_0 V}{d}$
(b)	$-(\epsilon_r-1)\frac{\epsilon_0 V}{d}$	$\epsilon_r\frac{\epsilon_0 V}{d}$ (left); $\frac{\epsilon_0 V}{d}$ (right)

- Page 81, Problem 4.24, under "*For* $l=1$," part (i): $A_1 2(b^3-a^3) \to A_1(b^3-a^3)$.
- Page 83, Problem 4.27, last paragraph, line 1: $r<R \to r>R$.
- Page 84, Problem 4.29(a): change the paragraph beginning "From Eq. 3.104" to read as follows:

  From Eq. 3.104: $\mathbf{E}_2 = \frac{1}{4\pi\epsilon_0}\frac{1}{r^3}\left[\frac{3(\mathbf{p}_2\cdot\mathbf{r})\mathbf{r}}{r^2}-\mathbf{p}_2\right]$, where $\mathbf{r} = x\,\hat{\mathbf{x}} + y\,\hat{\mathbf{y}} + z\,\hat{\mathbf{z}}$, $\mathbf{p}_2 = p_2\,\hat{\mathbf{z}}$, and hence $\mathbf{p}_2\cdot\mathbf{r} = p_2 z$.

$$\begin{aligned}
\mathbf{E}_2 &= \frac{p_2}{4\pi\epsilon_0}\left[\frac{3z(x\,\hat{\mathbf{x}}+y\,\hat{\mathbf{y}}+z\,\hat{\mathbf{z}})-(x^2+y^2+z^2)\,\hat{\mathbf{z}}}{(x^2+y^2+z^2)^{5/2}}\right] \\
&= \frac{p_2}{4\pi\epsilon_0}\left[\frac{3xz\,\hat{\mathbf{x}}+3yz\,\hat{\mathbf{y}}-(x^2+y^2-2z^2)\,\hat{\mathbf{z}}}{(x^2+y^2+z^2)^{5/2}}\right] \\
\frac{\partial\mathbf{E}_2}{\partial y} &= \frac{p_2}{4\pi\epsilon_0}\left\{-\frac{5}{2}\frac{2y}{r^7}[3xz\,\hat{\mathbf{x}}+3yz\,\hat{\mathbf{y}}-(x^2+y^2-2z^2)\,\hat{\mathbf{z}}]+\frac{1}{r^5}(3z\,\hat{\mathbf{y}}-2y\,\hat{\mathbf{z}})\right\};
\end{aligned}$$

$$\left.\frac{\partial\mathbf{E}_2}{\partial y}\right|_{(0,0)} = \frac{p_2}{4\pi\epsilon_0}\frac{3z}{r^5}\,\hat{\mathbf{y}}; \quad \mathbf{F}_1 = -p_1\left(\frac{p_2}{4\pi\epsilon_0}\frac{-3r}{r^5}\,\hat{\mathbf{y}}\right) = \boxed{\frac{3p_1p_2}{4\pi\epsilon_0 r^4}\,\hat{\mathbf{y}}.}$$

  But $\hat{\mathbf{y}}$ in these coordinates corresponds to $-\hat{\mathbf{z}}$ in the original system, so these results *are* consistent with Newton's third law: $\mathbf{F}_1 = -\mathbf{F}_2$.

- Page 88, Problem 4.40(a): the statement of the problem in the text skips a step:

$$\langle u\rangle = \frac{\int u e^{-u/kT}\,d\Omega}{\int e^{-u/kT}\,d\Omega}$$

  where $d\Omega = \sin\theta\,d\theta\,d\phi$ and the integral is over all orientations, $\theta(0\to\pi)$ and $\phi(0\to 2\pi)$. Setting the polar axis along $\mathbf{E}$, $\mathbf{p}\cdot\mathbf{E} = pE\cos\theta = -u$, so $\sin\theta\;d\theta = du/pE$. Doing the (trivial) ϕ integral, we obtain the expression in the book.

- Page 88, Problem 4.40(a): in the 4th line of equations, change "$\mathbf{P}\cdot\mathbf{E}$" to "$\mathbf{p}\cdot\mathbf{E}$"; on the graph, the vertical axis should be labeled "P/Np" (capital N) and the horizontal axis should be labeled "pE/kT" (capital E).

- Page 95, Problem 5.25(a), line 1: change "$\mathbf{A}$ points in the same direction as $\mathbf{I}$" to "$\mathbf{A}$ is parallel (or antiparallel) to $\mathbf{I}$".
- Page 105, Problem 5.50: this is part (b). For part (a):

$$\mathbf{B} = \frac{\mu_0}{4\pi}\int \frac{\mathbf{J}\times\hat{\boldsymbol{\scriptr}}}{\scriptr^2}\,d\tau \quad\Rightarrow\quad \mathbf{A} = \frac{1}{4\pi}\int \frac{\mathbf{B}\times\hat{\boldsymbol{\scriptr}}}{\scriptr^2}\,d\tau.$$

- Page 118, Problem 6.16: in the box at the end of the second line, change $r = b$ to $s = b$.
- Page 119, Problem 6.21(c), end of first line: change minus to plus, so it reads $\cos\theta_1\cos\theta_2 + \sin\theta_1\sin\theta_2$.
- Page 133, Problem 7.36: the analysis is slightly different for a *superconducting* loop, but the conclusion is the same.
- Page 148, Problem 8.4(a): in the figure, switch x and y labels on the axes.
- Page 149, Problem 8.6: this problem, and the solution given, are misleading, at best, and the solution to part (c) is incorrect. See Babson, et al., Am. J. Phys. **77**, 826 (2009).
- Page 151, Problem 8.9(b): in the box, change $\hat{\mathbf{r}}$ to $\hat{\mathbf{s}}$.
- Page 152, Problem 8.9(b): in the first line of equations, change I_n to I_r and the final dx to dz.
- Pages 154-155, Problem 8.13: note that if angular velocity is defined with respect to the z axis, then ω_b is a *negative* number.
- Page 164, top line: change the second $\alpha\beta < 1$ to $\alpha\beta > 1$.
- Page 164, Problem 9.16: in the figure, change the apparent minus signs on the vertical axis to decimal points.
- Page 165, Problem 9.18(a), end of line 2: $\Omega\, m \to (\Omega\, m)^{-1}$.
- Page 165, Problem 9.18(c), beginning of line 4: remove ¿.
- Page 170, Problem 9.29: in the first line,

$$\frac{1}{2\mu_0}(\tilde{\mathbf{E}}\times\tilde{\mathbf{B}}^*) \quad \text{should read} \quad \frac{1}{2\mu_0}\mathrm{Re}(\tilde{\mathbf{E}}\times\tilde{\mathbf{B}}^*)$$

  and in lines 9-11 the $\hat{\mathbf{x}}$ and $\hat{\mathbf{y}}$ terms should be removed (together with the plus sign that follows).
- Pages 182-183, Problem 10.9: r should be s throughout (I count 71 occurrences).
- Page 189, Problem 10.22: in the lower left circle, change $\nabla\cdot\mathbf{B}$ to $\nabla\cdot\mathbf{A}$.
- Page 199, Problem 11.10, right before the final box: in the denominator, change 0.02 to 0.01.
- Page 210, Problem 11.25: This problem raises several awkward questions:
  1. If you calculate the dipole moment (about the center point on the plane) in the *actual* configuration (not the image configuration), the charge on the conductor contributes nothing, so the dipole moment should perhaps be qz (not $2qz$). Shouldn't the answer be divided by 4?

2. Since the fields below the plane are zero, shouldn't the answer be divided by 2?
3. What do we even *mean* by "radiation", in this case, where half the "big sphere at infinity" is excluded, and power may be absorbed by the plane itself?
4. Are we sure the image method works, in the time-dependent case? In particular, even if it gets the electric field right, how do we know it gets the *magnetic* field right (does it satisfy the right boundary conditions at the surface)?

- Page 222, Problem 12.14(b), at the end (after closing the square bracket), add "This is how the velocity vector of an *individual photon* transforms. But the beam as a whole is a snapshot of many *different* photons at one instant of time, and *it* transforms the *same* way the mast does."