Math 32BH
Homework 3 Solutions

I graded 4 of the problems:
Page 277: 20;
Page 285: 18, 22;
Page 295: 22.

The following are solutions to the homework problems and additional comments for the problems I graded. Note that solutions are often brief; if you need more detail please ask in section or office hours. I may well have made errors in my solutions so please let me know if I did. For grading information see my class webpage.

General Comments
The maximum number of points was 12. The high score was 12, the median was 12, and the mean was 10.7.

Page 277

4. $\int_0^1 \int_0^{1-z} \int_0^{1-z} z \, dx \, dy \, dz = \frac{1}{12}$.
6. $\int_0^1 \int_0^{1-x} \int_0^{1-x-y} (x - yz) \, dz \, dy \, dx = \frac{1}{30}$.
10. $\int_0^1 \int_{x^2}^{x} \int_0^{x} (2x - y) \, dz \, dy \, dx = \frac{7}{120}$.
13. Solution is in the back of the book.
15. Solution is in the back of the book.
20. $\int_0^2 \int_0^{\sqrt{z}} \int_0^{\sqrt{z-x^2}} dy \, dx \, dz = \frac{\pi}{2}$.

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2. (a) $(\sqrt{2}, \frac{3\pi}{4}, 1)$
   (b) $(\sqrt{5}, \tan^{-1} \frac{-1}{2}, 3)$
   (c) $(2, 0, -3)$
   (d) $(\sqrt{13}, \pi + \tan^{-1} \frac{-3}{2}, -1)$
   (e) $(\sqrt{5}, \tan^{-1} 2, -3)$
4. (a) $(\sqrt{3}, -1, 1)$
   (b) $(-1, -\sqrt{3}, 1)$
   (c) $(1, 0, 2)$
   (d) $(1, \sqrt{3}, -1)$
   (e) $(-\frac{3\sqrt{3}}{2}, \frac{3}{2}, -2)$
6. (a) $4r^2 \cos^2\theta + r^2 \sin^2\theta = 16$
   (b) $r^2 = 4z$
   (c) $3r^2 \cos^2\theta - 4r^2 \sin^2\theta - 12z^2 = 12$
   (d) $3r^2 - 5z^2 = 0$
7. (a) Solution is in the back of the book.
   (b) $x^2 + y^2 = 4x$
   (c) Solution is in the back of the book.
   (d) $2\sqrt{x^2 + y^2} - x = 6$
   (e) Solution is in the back of the book.
   (f) $x^2 + y^2 + z^2 = 9$

12. $\int_0^3 \int_0^{2\pi} \int_0^{9-r^2} r \; dz \; d\theta \; dr = \frac{81\pi}{2}$.

18. $\int_0^1 \int_0^{\pi} \int_0^{1-r} r^2 z \; dz \; d\theta \; dr = \frac{\pi}{60}$.

22. $\int_0^{\pi/2} \int_0^{2\cos\theta} \int_0^{r} r^2 \; dz \; dr \; d\theta = \frac{3\pi}{4}$.

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2. (a) $(\sqrt{14}, \cos^{-1} \frac{3}{\sqrt{14}}, \tan^{-1} \frac{-1}{2})$
   (b) $(\sqrt{14}, \cos^{-1} \frac{-1}{\sqrt{14}}, \tan^{-1} \frac{3}{2})$
   (c) $(\sqrt{14}, \cos^{-1} \frac{1}{\sqrt{14}}, \pi + \tan^{-1} \frac{3}{2})$
   (d) $(\sqrt{14}, \cos^{-1} \frac{-1}{\sqrt{14}}, \tan^{-1} \frac{-3}{2})$
   (e) $(\sqrt{14}, \cos^{-1} \frac{-2}{\sqrt{14}}, \tan^{-1} \frac{1}{2})$

4. (a) $(0, \sqrt{3}, 1)$
   (b) $(0, 3, 0)$
   (c) $(\frac{-1}{\sqrt{2}}, \frac{-1}{\sqrt{2}}, \sqrt{3})$
   (d) $(\frac{1}{\sqrt{2}}, \frac{\sqrt{3}}{\sqrt{2}}, -\sqrt{2})$
   (e) $(\frac{\sqrt{3}}{\sqrt{2}}, \frac{1}{\sqrt{2}}, \sqrt{2})$

6. (a) $2\rho - \rho\cos^2\phi - 6\cos\phi = 0$
   (b) $1 - 4\cos^2\phi = 0$
   (c) $\rho\sin^2\phi = \cos\phi$

8. (a) $x^2 + y^2 + z^2 = 2z$
   (b) $z = 8$
   (c) $x^2 + y^2 = 64$

11. Solution is in the back of the book.

12. $\int_0^{2\pi} \int_0^{\pi/3} \int_0^1 \rho^2 \sin\phi \; d\rho \; d\phi \; d\theta = \frac{\pi}{3}$.

18. $\int_0^{\pi/2} \int_0^{\pi/2} \int_0^1 \rho^3 \cos\phi \sin\phi \; d\rho \; d\phi \; d\theta = \frac{\pi}{16}$.

22. $\int_0^{2\pi} \int_0^{\pi} \int_0^{1-\cos\phi} \rho^3 \sin\phi \; d\rho \; d\phi \; d\theta = \frac{16\pi}{5}$.