Section 14.4

4. 1.3 **6.** 8.2

Section 14.5

6. $$\nabla g = \left\langle \frac{\partial g}{\partial x}, \frac{\partial g}{\partial y} \right\rangle = \left\langle \frac{y^2 - x^2}{(x^2 + y^2)^2}, \frac{-2xy}{(x^2 + y^2)^2} \right\rangle = \frac{1}{(x^2 + y^2)^2} \left\langle y^2 - x^2, -2xy \right\rangle$$

18. 6

25. Extra The unit vector in the direction of fastest increase is $\left\langle \frac{4}{5}, \frac{3}{5} \right\rangle$. The rate of fastest increase is $\frac{5}{145} = \frac{1}{29}$.

27. Extra The unit vector in the direction of fastest increase is $\langle 1, 0 \rangle$. The rate of fastest increase is 2.

29. Extra The unit vector in the direction of fastest increase is $\left\langle \frac{1}{\sqrt{5}}, 0, \frac{-2}{\sqrt{5}} \right\rangle$. The rate of fastest increase is $\sqrt{5}$.

Section 14.7

6. $(0, 0)$ is a saddle point; local minimum at $\left(\frac{1}{3}, \frac{1}{3} \right)$

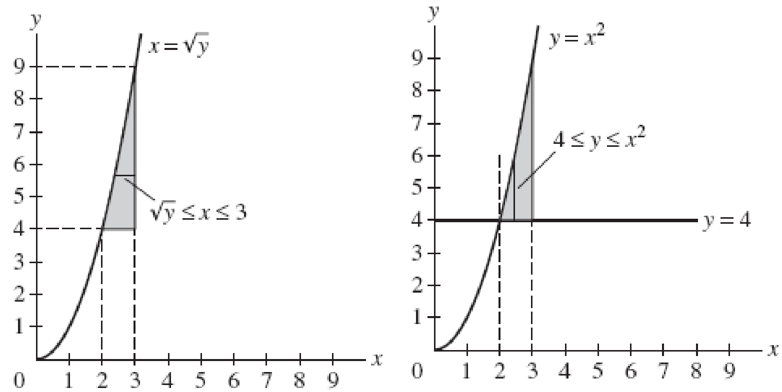
8. Local maximum at $(-2,-1)$; $\left(\frac{5}{3}, \frac{5}{6} \right)$ is a saddle point

Section 15.2

4. Vertically simple region $0 \le x \le 1, \quad 0 \le y \le 1 - x^2$

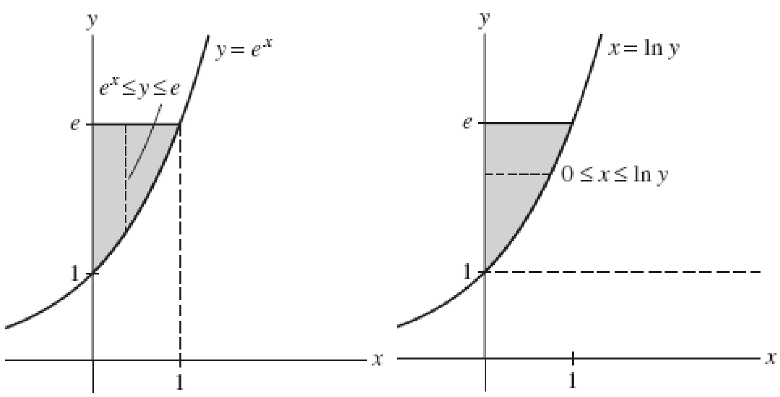
Horizontally simple region: $0 \le y \le 1, \quad 0 \le x \le \sqrt{1 - y}$

32.



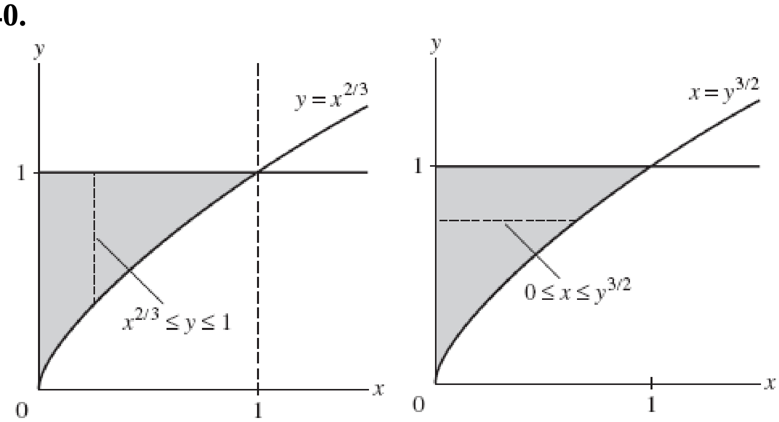
$$\int_4^9 \int_{\sqrt{y}}^3 f(x, y)\, dx\, dy = \int_2^3 \int_4^{x^2} f(x, y)\, dy\, dx$$

34.



$$\int_0^1 \int_{e^x}^e f(x, y)\, dy\, dx = \int_1^e \int_0^{\ln y} f(x, y)\, dx\, dy$$

40.



$$\frac{1}{8}(e-1)$$

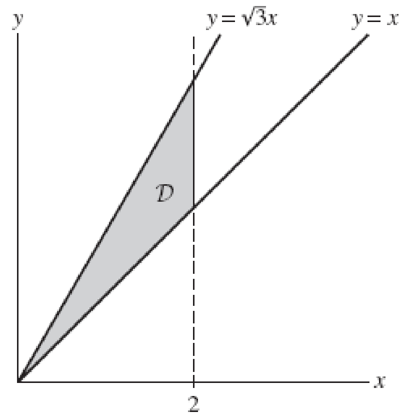
Section 15.3

18. The domain of integration is the part of the ball of radius 3, centered at $(0,0,0)$, that lies in the first octant**;** $\frac{243}{15}$**.**

Section 15.4

18.

$\mathcal{D}: 0 \le x \le 2,\ x \le y \le \sqrt{3}x$



$$\frac{8}{3}\left(\sqrt{3}-1\right)$$

34.

The inequalities describing $\mathcal{W}$ in cylindrical coordinates are thus

$$\mathcal{W}: 0 \le \theta \le 2\pi,\ 0 \le r \le 2,\ r^2 \le z \le 8 - r^2$$

The function in cylindrical coordinates is

$$f(x, y, z) = z\sqrt{x^2 + y^2} = zr$$

$$\frac{1024}{15}\pi$$