12.5.2 $4(x+1)+5(y-2)-(z+3)=0$

12.5.3 $(x-1)-(y-2)=0$

12.5.4 $2(x-1)-3y+2z=0$

12.5.5 $4(x-1)-6y=0$

12.5.6 $x+3y=0$

12.5.7 $\langle 1,0,3\rangle+t\langle 0,2,1\rangle$

12.5.8 $\langle 1,0,3\rangle+t\langle 1,2,-1\rangle$

12.5.9 $t\langle 1,1,-1\rangle$

12.5.10 $-2/5, 13/5$

12.5.12 neither

12.5.13 parallel

12.5.14 intersect at $(3,6,5)$

12.5.15 same line

12.5.19 $7/\sqrt{3}$

12.5.20 $4/\sqrt{14}$

12.5.21 $\sqrt{131}/\sqrt{14}$

12.5.22 $\sqrt{68}/3$

12.5.23 $6/\sqrt{42}$

12.5.24 $7/\sqrt{84}$

12.6.1 1. $(\sqrt{2},\pi/4,1), (\sqrt{3},\pi/4,\arccos(1/\sqrt{3}))$
  2. $(7\sqrt{2},7\pi/4,5), (\sqrt{123},7\pi/4,\arccos(5/\sqrt{123}))$
  3. $(1,1,1), (\sqrt{2},1,\pi/4)$
  4. $(0,0,-\pi), (\pi,0,\pi)$

12.6.2 $r^2+z^2=4$

12.6.3 $r\cos\theta=0$

12.6.4 $r^2+2z^2+2z-5=0$

12.6.5 $z=e^{-r^2}$

12.6.6 $z=r$

12.6.7 $\sin\theta=0$

12.6.8 $1=\rho\cos\phi$

12.6.9 $\rho=2\sin\theta\sin\phi$

12.6.10 $\cos\phi=1/\sqrt{2}$

12.6.12 $z=mr$; $\cot\phi=m$ if $m\neq 0$, $\phi=0$ if $m=0$

12.6.13 $x^2+(y-\frac{1}{2})^2+z^2=\frac{1}{4}$; a sphere with radius $1/2$, center at $(0,1/2,0)$.

12.6.14 $0<\theta<\pi/2, r>0, z>0; 0<\theta<\pi/2,$ $0<\phi<\pi/2, \rho>0$;

13.1.1 $z=y^2, z=x^2, z=0$, lines of slope 1

13.1.2 $z=|y|, z=|x|, z=2|x|$, diamonds

13.1.3 $z=e^{-y^2}\sin(y^2), z=e^{-x^2}\sin(x^2), z=e^{-2x^2}\sin(2x^2)$, circles

13.1.4 $z=-\sin(y), z=\sin(x), z=0$, lines of slope 1

13.1.5 $z=y^4, z=x^4, z=0$, hyperbolas

13.1.6 1. $\{(x,y)\mid |x|\leq 3 \text{ and } |y|\geq 2\}$
  2. $\{(x,y)\mid 1\leq x^2+y^2\leq 3\}$
  3. $\{(x,y)\mid x^2+4y^2\leq 16\}$

13.2.1 No limit; use $x=0$ and $y=0$

13.2.2 No limit; use $x=0$ and $x=y$

13.2.3 No limit; use $x=0$ and $x=y$

13.2.4 Limit is zero

13.2.5 Limit is 1

13.2.6 Limit is zero

13.2.7 Limit is -1

13.2.8 Limit is zero

13.2.9 No limit; use $x = 0$ and $y = 0$

13.2.10 Limit is zero

13.2.11 Limit is -1

13.2.12 Limit is zero

13.3.1 $-2xy\sin(x^2y)$, $-x^2\sin(x^2y) + 3y^2$

13.3.2 $(y^2 - x^2y)/(x^2 + y)^2$, $x^3/(x^2 + y)^2$

13.3.3 $2xe^{x^2+y^2}$, $2ye^{x^2+y^2}$

13.3.4 $y\ln(xy) + y$, $x\ln(xy) + x$

13.3.5 $-x/\sqrt{1 - x^2 - y^2}$, $-y/\sqrt{1 - x^2 - y^2}$

13.3.6 $\tan y$, $x\sec^2 y$

13.3.7 $-1/(x^2y)$, $-1/(xy^2)$

13.3.8 $z = -2(x - 1) - 3(y - 1) - 1$

13.3.9 $z = 1$

13.3.10 $z = 6(x - 3) + 3(y - 1) + 10$

13.3.11 $z = (x - 2) + 4(y - 1/2)$

13.3.12 $\mathbf{r}(t) = \langle 2, 1, 4 \rangle + t\langle 2, 4, -1 \rangle$

13.3.16 height

13.4.1 $4xt\cos(x^2 + y^2) + 6yt^2\cos(x^2 + y^2)$

13.4.2 $2xy\cos t + 2x^2t$

13.4.3 $2xyt\cos(st) + 2x^2s$, $2xys\cos(st) + 2x^2t$

13.4.4 $2xy^2t - 4yx^2s$, $2xy^2s + 4yx^2t$

13.4.5 x/z, $3y/(2z)$

13.4.6 $-2x/z$, $-y/z$

13.4.7   1. $V' = (nR - 0.2V)/P$

2. $P' = (nR + 0.6P)/2V$

3. $T' = (3P - 0.4V)/(nR)$

13.5.1 $9\sqrt{5}/5$

13.5.2 $\sqrt{2}\cos 3$

13.5.3 $e\sqrt{2}(\sqrt{3} - 1)/4$

13.5.4 $\sqrt{3} + 5$

13.5.5 $-\sqrt{6}(2 + \sqrt{3})/72$

13.5.6 $-1/5, 0$

13.5.7 $4(x - 2) + 8(y - 1) = 0$

13.5.8 $2(x - 3) + 3(y - 2) = 0$

13.5.9 $\langle -1, -1 - \cos 1, -\cos 1 \rangle$, $-\sqrt{2 + 2\cos 1 + 2\cos^2 1}$

13.5.10 Any direction perpendicular to $\nabla T = \langle 1, 1, 1 \rangle$, for example, $\langle -1, 1, 0 \rangle$

13.5.11 $2(x - 1) - 6(y - 1) + 6(z - 3) = 0$

13.5.12 $6(x - 1) + 3(y - 2) + 2(z - 3) = 0$

13.5.13 $\langle 2 + 4t, -3 - 12t, -1 - 8t \rangle$

13.5.14 $\langle 4 + 8t, 2 + 4t, -2 - 36t \rangle$

13.5.15 $\langle 4 + 8t, 2 + 20t, 6 - 12t \rangle$

13.5.16 $\langle 0, 1 \rangle$, $\langle 4/5, -3/5 \rangle$

13.5.18   1. $\langle 4, 9 \rangle$

2. $\langle -81, 2 \rangle$ or $\langle 81, -2 \rangle$

13.5.19 in the direction of $\langle 8, 1 \rangle$

13.5.20 $\nabla g(-1, 3) = \langle 2, 1 \rangle$

13.6.1 $f_{xx} = (2x^3y - 6xy^3)/(x^2 + y^2)^3$, $f_{yy} = (2xy^3 - 6x^3y)/(x^2 + y^2)^3$

13.6.2 $f_x = 3x^2y^2$, $f_y = 2x^3y + 5y^4$, $f_{xx} = 6xy^2$, $f_{yy} = 2x^3 + 20y^3$, $f_{xy} = 6x^2y$

13.6.3 $f_x = 12x^2 + y^2$, $f_y = 2xy$, $f_{xx} = 24x$, $f_{yy} = 2x$, $f_{xy} = 2y$

13.6.4 $f_x = \sin y$, $f_y = x\cos y$, $f_{xx} = 0$, $f_{yy} = -x\sin y$, $f_{xy} = \cos y$

13.6.5 $f_x = 3\cos(3x)\cos(2y)$, $f_y = -2\sin(3x)\sin(2y)$, $f_{xy} = -6\cos(3x)\sin(2y)$, $f_{yy} = -4\sin(3x)\cos(2y)$, $f_{xx} = -9\sin(3x)\cos(2y)$

13.6.6 $f_x = e^{x+y^2}$, $f_y = 2ye^{x+y^2}$, $f_{xx} = e^{x+y^2}$, $f_{yy} = 4y^2 e^{x+y^2} + 2e^{x+y^2}$, $f_{xy} = 2ye^{x+y^2}$

13.6.7 $f_x = \dfrac{3x^2}{2(x^3+y^4)}$, $f_y = \dfrac{2y^3}{x^3+y^4}$, $f_{xx} = \dfrac{3x}{x^3+y^4} - \dfrac{9x^4}{2(x^3+y^4)^2}$, $f_{yy} = \dfrac{6y^2}{x^3+y^4} - \dfrac{8y^6}{(x^3+y^4)^2}$, $f_{xy} = \dfrac{-6x^2y^3}{(x^3+y^4)^2}$

13.6.8 $z_x = \dfrac{-x}{16z}$, $z_y = \dfrac{-y}{4z}$, $z_{xx} = -\dfrac{16z^2+x^2}{16^2 z^3}$, $z_{yy} = -\dfrac{4z^2+y^2}{16z^3}$, $z_{xy} = \dfrac{-xy}{64z^3}$

13.6.9 $z_x = -\dfrac{y+z}{x+y}$, $z_y = -\dfrac{x+z}{x+y}$, $z_{xx} = 2\dfrac{y+z}{(x+y)^2}$, $z_{yy} = 2\dfrac{x+z}{(x+y)^2}$, $z_{xy} = \dfrac{2z}{(x+y)^2}$

13.7.1 minimum at $(1,-1)$

13.7.2 none

13.7.3 none

13.7.4 maximum at $(1,-1/6)$

13.7.5 none

13.7.6 minimum at $(2,-1)$

13.7.7 $f(2,2) = -2$, $f(2,0) = 4$

13.7.8 a cube $1/\sqrt[3]{2}$ on a side

13.7.9 $65/3 \times 65/3 \times 130/3$

13.7.10 It has a square base, and is one and one half times as tall as wide. If the volume is V the dimensions are $\sqrt[3]{2V/3} \times \sqrt[3]{2V/3} \times \sqrt[3]{9V/4}$.

13.7.11 $\sqrt{100/3}$

13.7.12 $|ax_0 + by_0 + cz_0 - d|/\sqrt{a^2+b^2+c^2}$

13.7.13 The sides and bottom should all be 2/3 meter, and the sides should be bent up at angle $\pi/3$.

13.7.14 $(3,4/3)$

13.7.16 $|b|$ if $b \le 1/2$, otherwise $\sqrt{b-1/4}$

13.7.17 $|b|$ if $b \le 1/2$, otherwise $\sqrt{b-1/4}$

13.7.19 $1024/\sqrt{3}$

13.8.1 a cube, $\sqrt[3]{1/2} \times \sqrt[3]{1/2} \times \sqrt[3]{1/2}$

13.8.2 $65/3 \cdot 65/3 \cdot 130/3 = 2 \cdot 65^3/27$

13.8.3 It has a square base, and is one and one half times as tall as wide. If the volume is V the dimensions are $\sqrt[3]{2V/3} \times \sqrt[3]{2V/3} \times \sqrt[3]{9V/4}$.

13.8.4 $|ax_0 + by_0 + cz_0 - d|/\sqrt{a^2+b^2+c^2}$

13.8.5 $(0,0,1)$, $(0,0,-1)$

13.8.6 $\sqrt[3]{4V} \times \sqrt[3]{4V} \times \sqrt[3]{V/16}$

13.8.7 Farthest: $(-\sqrt{2},\sqrt{2},2+2\sqrt{2})$; closest: $(2,0,0)$, $(0,-2,0)$

13.8.8 $x = y = z = 16$

13.8.9 $(1,2,2)$

13.8.10 $(\sqrt{5},0,0)$, $(-\sqrt{5},0,0)$

13.8.11 standard $65, deluxe $75

13.8.12 $x = 9$, $\phi = \pi/3$

13.8.13 35, -35

13.8.14 maximum e^4, no minimum

13.8.15 5, $-9/2$

13.8.16 $3, 3, 3$

13.8.17 a cube of side length $2/\sqrt{3}$

14.1.1 16

14.1.2 4

14.1.3 $15/8$

14.1.4 $1/2$

14.1.5 $5/6$

14.1.6 $12 - 65/(2e)$

14.1.7 $1/2$

14.1.8 $\pi/64$

14.1.9 $(2/9)2^{3/2} - (2/9)$

14.1.10 $(1 - \cos(1))/4$

14.1.11 $(2\sqrt{2} - 1)/6$

14.1.12 $\pi - 2$

14.1.13 $(e^9 - 1)/6$

14.1.14 $\dfrac{4}{15} - \dfrac{\pi}{4}$

14.1.15 $1/3$

14.1.16 448

14.1.17 $4/5$

14.1.18 8π

14.1.19 2

14.1.20 $5/3$

14.1.21 $81/2$

14.1.22 $2a^3/3$

14.1.23 4π

14.1.24 $\pi/32$

14.1.25 $31/8$

14.1.26 $128/15$

14.1.27 1800π m^3

14.1.28 $\dfrac{(e^2 + 8e + 16)}{15}\sqrt{e+4} - \dfrac{5\sqrt{5}}{3} - \dfrac{e^{5/2}}{15} + \dfrac{1}{15}$

14.1.30 $16 - 8\sqrt{2}$

14.2.1 4π

14.2.2 $32\pi/3 - 4\sqrt{3}\pi$

14.2.3 $(2 - \sqrt{2})\pi/3$

14.2.4 $4/9$

14.2.5 $5\pi/3$

14.2.6 $\pi/6$

14.2.7 $\pi/2$

14.2.8 $\pi/2 - 1$

14.2.9 $\sqrt{3}/4 + \pi/6$

14.2.10 $8 + \pi$

14.2.11 $\pi/12$

14.2.12 $(1 - \cos(9))\pi/2$

14.2.13 $-a^5/15$

14.2.14 12π

14.2.15 π

14.2.16 $16/3$

14.2.17 21π

14.2.19 (c) 2π

14.3.1 $\bar{x} = \bar{y} = 2/3$

14.3.2 $\bar{x} = 4/5, \bar{y} = 8/15$

14.3.3 $\bar{x} = 0, \bar{y} = 3\pi/16$

14.3.4 $\bar{x} = 0, \bar{y} = 16/(15\pi)$

14.3.5 $\bar{x} = 3/2, \bar{y} = 9/4$

14.3.6 $\bar{x} = 6/5, \bar{y} = 12/5$

14.3.7 $\bar{x} = 14/27, \bar{y} = 28/55$

14.3.8 $(3/4, 2/5)$

14.3.9 $\left(\dfrac{81\sqrt{3}}{80\pi}, 0 \right)$

14.3.10 $\bar{x} = \pi/2, \bar{y} = \pi/8$

14.3.11 $M = \displaystyle\int_0^{2\pi} \int_0^{1+\cos\theta} (2+\cos\theta) r\,dr\,d\theta$

$M_x = \displaystyle\int_0^{2\pi} \int_0^{1+\cos\theta} \sin\theta(2+\cos\theta) r^2\,dr\,d\theta$

$M_y = \displaystyle\int_0^{2\pi} \int_0^{1+\cos\theta} \cos\theta(2+\cos\theta) r^2\,dr\,d\theta$

14.3.12 $M = \displaystyle\int_{-\pi/2}^{\pi/2} \int_0^{\cos\theta} (r+1) r\,dr\,d\theta$

$M_x = \displaystyle\int_{-\pi/2}^{\pi/2} \int_0^{\cos\theta} \sin\theta(r+1) r^2\,dr\,d\theta$

$M_y = \displaystyle\int_{-\pi/2}^{\pi/2} \int_0^{\cos\theta} \cos\theta(r+1) r^2\,dr\,d\theta$

14.3.13 $M = \displaystyle\int_{-\pi/2}^{\pi/2} \int_{\cos\theta}^{1+\cos\theta} r\,dr\,d\theta + \int_{\pi/2}^{3\pi/2} \int_0^{1+\cos\theta} r\,dr\,d\theta$

$M_x = $
$\displaystyle\int_{-\pi/2}^{\pi/2} \int_{\cos\theta}^{1+\cos\theta} r^2 \sin\theta\,dr\,d\theta + \int_{\pi/2}^{3\pi/2} \int_0^{1+\cos\theta} r^2 \sin\theta\,dr\,d\theta$

$M_y = $
$\displaystyle\int_{-\pi/2}^{\pi/2} \int_{\cos\theta}^{1+\cos\theta} r^2 \cos\theta\,dr\,d\theta + \int_{\pi/2}^{3\pi/2} \int_0^{1+\cos\theta} r^2 \cos\theta\,dr\,d\theta$

14.4.1 $\pi a \sqrt{h^2 + a^2}$

14.4.2 $\pi a^2 \sqrt{m^2 + 1}$

14.4.3 $\sqrt{3}/2$

14.4.4 $\pi\sqrt{2}$

14.4.5 $\pi\sqrt{2}/8$

14.4.6 $\pi/2 - 1$

14.4.7 $\dfrac{d^2 \sqrt{a^2 + b^2 + c^2}}{2abc}$

14.4.8 $8\sqrt{3}\pi/3$

14.5.1 $11/24$

14.5.2 $623/60$

14.5.3 $-3e^2/4 + 2e - 3/4$

14.5.4 $1/20$

14.5.5 $\pi/48$

14.5.6 $11/84$

14.5.7 $151/60$

14.5.8 π

14.5.10 $\dfrac{3\pi}{16}$

14.5.11 32

14.5.12 $64/3$

14.5.13 $\bar{x} = \bar{y} = 0, \bar{z} = 16/15$

14.5.14 $\bar{x} = \bar{y} = 0, \bar{z} = 1/3$

14.6.1 $\pi/12$

14.6.2 $\pi(1 - \sqrt{2}/2)$

14.6.3 $5\pi/4$

14.6.4 0

14.6.5 $5\pi/4$

14.6.6 $4/5$

14.6.7 $256\pi/15$

14.6.8 $4\pi^2$

14.6.9 $\dfrac{3\pi}{16}$

14.6.10 $\pi k h^2 a^2/12$

14.6.11 $\pi k h a^3/6$

14.6.12 $\pi^2/4$

14.6.13 $4\pi/5$

14.6.14 15π

14.6.15 $9k\pi(5\sqrt{2}-2\sqrt{5})/20$

14.7.1 $4\pi\sqrt{3}/3$

14.7.2 0

14.7.3 $2/3$

14.7.4 $\dfrac{e^2-1}{2e^2}$

14.7.5 36

14.7.6 $32(\sqrt{2}+\ln(1+\sqrt{2}))/3$

14.7.7 $3\cos(1)-3\cos(4)$

14.7.8 $\pi(1-\cos(1))/24$

14.7.10 $(4/3)\pi abc$

15.1.5 $\langle 3\cos t, 3\sin t, 2-3\sin t\rangle$

15.1.6 $\langle 0, t\cos t, t\sin t\rangle$

15.2.1 $\langle 2t,0,1\rangle$, $\mathbf{r}'/\sqrt{1+4t^2}$

15.2.2 $\langle -\sin t, 2\cos 2t, 2t\rangle$, $\mathbf{r}'/\sqrt{\sin^2 t + 4\cos^2(2t)+4t^2}$

15.2.3 $\langle -e^t\sin(e^t), e^t\cos(e^t), \cos t\rangle$, $\mathbf{r}'/\sqrt{e^{2t}+\cos^2 t}$

15.2.4 $\langle \sqrt{2}/2, \sqrt{2}/2, \pi/4\rangle + t\langle -\sqrt{2}/2, \sqrt{2}/2, 1\rangle$

15.2.5 $\langle 1/2, \sqrt{3}/2, -1/2\rangle + t\langle -\sqrt{3}/2, 1/2, 2\sqrt{3}\rangle$

15.2.6 $2/\sqrt{5}/\sqrt{4+\pi^2}$

15.2.7 $7\sqrt{5}\sqrt{17}/85$, $-9\sqrt{5}\sqrt{17}/85$

15.2.9 $\langle 0, t\cos t, t\sin t\rangle$, $\langle 0, \cos t - t\sin t, \sin t + t\cos t\rangle$, $\mathbf{r}'/\sqrt{1+t^2}$, $\sqrt{1+t^2}$

15.2.10 $\langle \sin t, 1-\cos t, t^2/2\rangle$

15.2.11 $t=4$

15.2.12 $37, 1$

15.2.13 $\langle t^2/2, t^3/3, \sin t\rangle$

15.2.16 $(1,1,1)$ when $t=1$ and $s=0$; $\theta = \arccos(3/\sqrt{14})$; no

15.2.17 $-6x+(y-\pi)=0$

15.2.18 $-x/\sqrt{2}+y/\sqrt{2}+6z=0$

15.2.19 $(-1,-3,1)$

15.2.20 $\langle 1/\sqrt{2}, 1/\sqrt{2}, 0\rangle + t\langle -1, 1, 6\sqrt{2}\rangle$

15.3.1 $2\pi\sqrt{13}$

15.3.2 $(-8+13\sqrt{13})/27$

15.3.3 $\sqrt{5}/2 + \ln(\sqrt{5}+2)/4$

15.3.4 $(85\sqrt{85}-13\sqrt{13})/27$

15.3.5 $\int_0^5 \sqrt{1+e^{2t}}\,dt$

15.4.1 $2\sqrt{2}/(2+4t^2)^{3/2}$

15.4.2 $2\sqrt{2}/(1+8t^2)^{3/2}$

15.4.3 $\sqrt{3600t^{10}+400t^6+36t^2}/(1+9t^4+25t^8)^{3/2}$

15.4.4 $12\sqrt{17}/289$

15.5.1 $\langle 5t^4, 4t, 1\rangle$, $\langle 20t^3, 4, 0\rangle$, $a_T = 100t^7 + 16t/\sqrt{25t^8+16t^2}$, $a_N = \sqrt{3600t^8+400t^6-16}/\sqrt{25t^8+16t^2}$

15.5.2 $\langle -\sin t, \cos t, 2t\rangle$, $\langle -\cos t, -\sin t, 2\rangle$, $4t/\sqrt{4t^2+1}$, $\sqrt{4t^2+5}/\sqrt{4t^2+1}$

15.5.3 $\langle -\sin t, \cos t, e^t\rangle$, $\langle -\cos t, -\sin t, e^t\rangle$, $e^{2t}/\sqrt{e^{2t}+1}$, $\sqrt{2e^{2t}+1}/\sqrt{e^{2t}+1}$

15.5.4 $\langle e^t, \cos t, e^t\rangle$, $\langle e^t, -\sin t, e^t\rangle$, $(2e^{2t}-\cos t\sin t)/\sqrt{2e^{2t}+\cos^2 t}$, $\sqrt{2}e^t|\cos t + \sin t|/\sqrt{2e^{2t}+\cos^2 t}$

15.5.5 $\langle -3\sin t, 2\cos t, 0\rangle$, $\langle 3\cos t, 2\sin t, 0\rangle$

15.5.6 $\langle -3\sin t, 2\cos t + 0.1, 0\rangle$, $\langle 3\cos t, 2\sin t + t/10, 0\rangle$

15.5.7 $\langle -3\sin t, 2\cos t, 1\rangle$, $\langle 3\cos t, 2\sin t, t\rangle$

15.5.8 $\langle -3\sin t, 2\cos t + 1/10, 1 \rangle, \langle 3\cos t, 2\sin t + t/10, t \rangle$

16.2.1 $-1, 0$

16.2.2 $0, a+b$

16.2.3 $(2b-a)/3, 0$

16.2.4 $0, 1$

16.2.5 $-2\pi, 0$

16.2.6 $0, 2\pi$

16.3.1 $13\sqrt{11}/4$

16.3.2 0

16.3.3 $3\sin(4)/2$

16.3.4 $2e^3$

16.3.5 128

16.3.6 $(9e-3)/2$

16.3.7 $e^{e+1} - e^e - e^{1/e-1} + e^{1/e} + e^4/4 - e^{-4}/4$

16.3.8 $1 + \sin(1) - \cos(1)$

16.3.9 $3\ln 3 - 2\ln 2$

16.3.10 $3/20 + 10\ln(2)/7$

16.3.11 $2\ln 5 - 2\ln 2 + 15/32$

16.3.12 1

16.3.13 0

16.3.14 $21 + \cos(1) - \cos(8)$

16.3.15 $(\ln 29 - \ln 2)/2$

16.3.16 $2\ln 2 + \pi/4 - 2$

16.3.17 $1243/3$

16.3.18 $\ln 2 + 11/3$

16.3.19 $3\cos(1) - \cos(2) - \cos(4) - \cos(8)$

16.3.20 $-10/3$

16.3.22 no f

16.3.23 $x^4/4 - y^5/5$

16.3.24 no f

16.3.25 no f

16.3.26 $y\sin x$

16.3.27 no f

16.3.28 xyz

16.3.29 414

16.3.30 6

16.3.31 $1/e - \sin 3$

16.3.32 $1/\sqrt{77} - 1/\sqrt{3}$

16.4.1 1

16.4.2 0

16.4.3 $1/(2e) - 1/(2e^7) + e/2 - e^7/2$

16.4.4 $1/2$

16.4.5 $-1/6$

16.4.6 $(2\sqrt{3} - 10\sqrt{5} + 8\sqrt{6})/3 - 2\sqrt{2}/5 + 1/5$

16.4.7 $11/2 - \ln(2)$

16.4.8 $2 - \pi/2$

16.4.9 $-17/12$

16.4.10 0

16.4.11 $-\pi/2$

16.4.12 12π

16.4.13 $2\cos(1) - 2\sin(1) - 1$