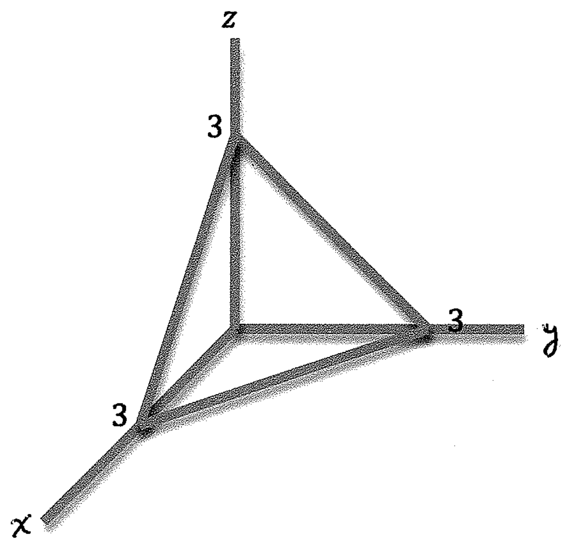
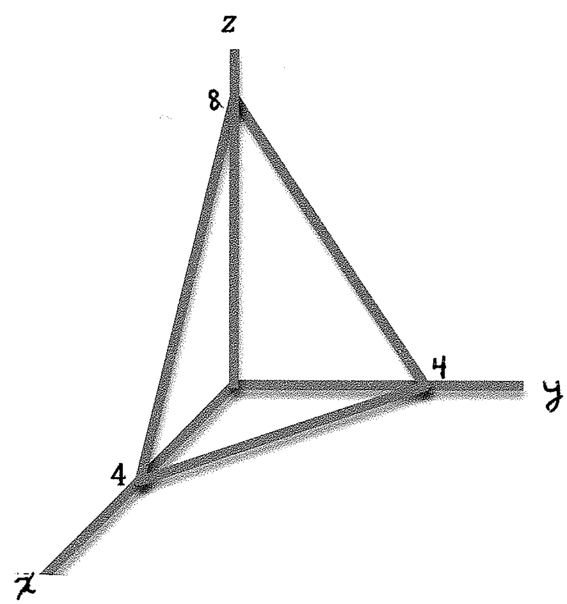
Text Answers Sections 23-27

Section 23

1. Intercepts $(3,0,0)$, $(0,3,0)$, $(0,0,3)$



2. Intercepts $(4,0,0)$, $(0,4,0)$, $(0,0,8)$



3. $2x+y+z-6=0$

4. $2x+3y+4z-12=0$

Section 24

1. (a) 2 (b) 2 (c) 3 (d) $a^2 - a + 6$
2. (a) $\sqrt{6}$ (b) $\sqrt{41}$ (c) $\sqrt{73}$ (d) $\sqrt{38}$
3. All real values of x and y ($\Re$ X $\Re$)
4. $\{(x,y): x \neq -\frac{6}{5}y\}$
5. $\{(u,v): u \neq v\}$
6. 150
7. (a) 9,000 (b) increase by 405 (c) increase by 50 (d) increase by 455
8. Don't spend time trying to simplify this one:

(a) $P(64,4) = 100\left(\frac{3}{5}\cdot 64^{-\frac{2}{3}} + \frac{2}{5}\cdot 4^{-\frac{2}{3}}\right)^{-3}$ (b) $P(100,64) = 100\left(\frac{3}{5}\cdot 100^{-\frac{2}{3}} + \frac{2}{5}\cdot 64^{-\frac{2}{3}}\right)^{-3}$

(c) $P(16,236) = 100\left(\frac{3}{5}\cdot 16^{-\frac{2}{3}} + \frac{2}{5}\cdot 236^{-\frac{2}{3}}\right)^{-3}$

Section 25

1. $f_x = 16x^3 + 2$ $f_y = -3y^2$
2. $f_x = 5(x + xy + y)^4(1 + y)$ $f_y = 5(x + xy + y)^4(x + 1)$
3. $f_x = ye^{xy+1}$ $f_y = xe^{xy+1}$
4. $f_x = \dfrac{4x^3(x^2 - y^2) - 2x(x^4 + y^4)}{(x^2 - y^2)^2}$ $f_y = \dfrac{4y^3(x^2 - y^2) + 2y(x^4 + y^4)}{(x^2 - y^2)^2}$
5. $f_x = \dfrac{-2}{3y^8 - 2x}$ $f_y = \dfrac{24y^7}{3y^8 - 2x}$
6. $\dfrac{\partial^2 f}{\partial x^2} = 0$ $\dfrac{\partial^2 f}{\partial y^2} = 0$ $\dfrac{\partial^2 f}{\partial x \partial y} = -3$ $\dfrac{\partial^2 f}{\partial y \partial x} = -3$
7. $\dfrac{\partial^2 f}{\partial x^2} = 8e^y$ $\dfrac{\partial^2 f}{\partial y^2} = 4x^2e^y$ $\dfrac{\partial^2 f}{\partial x \partial y} = 8xe^y$ $\dfrac{\partial^2 f}{\partial y \partial x} = 8xe^y$

8. $\frac{\partial C}{\partial x} = 6$ If you change (increase or decrease) the number of bicycles manufactured by 1, the cost will correspondingly change by \$6.

$\frac{\partial C}{\partial y} = 20$ If you change (increase or decrease) the number of tricycles manufactured by 1, the cost will correspondingly change by \$20.

9. (a) 80 (b) 180 (c) 110 (d) 360

Section 26

1. relative max at $(0,0)$
2. Only critical point is $(0,0)$. Since $D_{(0,0)} = 0$ there is no conclusion from the test.
3. relative min at $\left(-1, -\frac{1}{2}\right)$
4. relative min at $(0, 0)$ and saddle points at $(1, 1), (1, -1), (-1, 1), (-1, -1)$
5. relative min at $(2, 1)$
6. relative min at $(1, 1)$, saddle point at $\left(1, -\frac{1}{3}\right)$
7. relative min at $\left(\frac{9}{2}, \frac{3}{2}\right)$, saddle point at $(0, 0)$
8. relative min at $\left(\sqrt[19]{\left(\frac{3}{4}\right)^4}, \sqrt[19]{\frac{4}{3}}\right)$
9. relative min at $(0,0)$
10. saddle point at $\left(8, \frac{1}{64}\right)$
11. minimum cost is \$59, occurring when $x = 4$ and $y = 5$
12. Critical point is approximately $(1218.49, 1168.07)$. Since x and y must be integers, check closest integer valued points for maximum value of profit. Check (1218, 1168), (1219, 1168), (1218, 1169) and (1219, 1169) in profit function. The maximum profit is \$21,605.04, which occurs at both (1218, 1168) and (1219, 1168). As long as you understand this concept of using the closest integer valued points, it probably isn't worth your time to do the actual calculations.

Section 27

1. Maximum value is 72. It occurs at the point $(6, 6)$.
2. Minimum value is $\frac{3}{4}$. It occurs at the point $\left(-\frac{3}{4}, \frac{1}{4}\right)$.
3. Minimum value is -4. It occurs at the points $(0,2)$ and $(0,-2)$.
   (FYI: The maximum value is 4. It occurs at the points $(2,0)$ and $(-2,0)$).
4. Maximum value is $-\frac{355}{100}$. It occurs at the point $\left(\frac{14}{10}, \frac{23}{10}\right)$.

5. Maximum value is 90. It occurs at the point $(10,-1)$.

6. Maximum value is 5. It occurs at the point $(0,-1)$.
   Minimum value is -3. It occurs at the point $(0,1)$.

7. 1 x 1 x 2 (length x width x height)

8. $x = 6$ widgets and $y = 4$ bidgets

9. 80 x 40 (80 parallel to the river, 40 perpendicular to the river)

10. Minimum cost occurs using $x = 150$ and $y = 120$.
    Maximum cost occurs using $x = 100$ and $y = 80$.

11. 4 x 4 x 2 (length x width x height)