Section 9.1

4.) $f(x,4) = \dfrac{\sqrt{9x+54}}{\log x}$
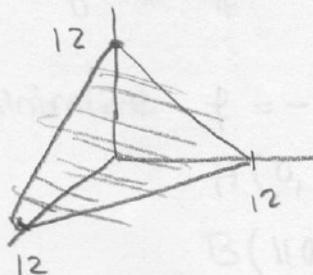
a. $f(10,2) = \dfrac{\sqrt{90+10}}{\log 10} = 10$

b. $f(100,1) = \dfrac{\sqrt{905}}{\log 100}$
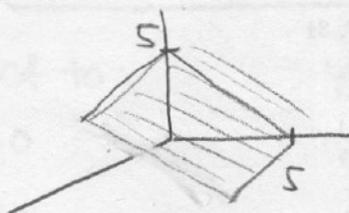
c. $f(1000,0) = \dfrac{\sqrt{}}{0} = $ no solution, not in the domain

d. $f\left(\tfrac{1}{10},5\right) = \dfrac{\sqrt{\tfrac{9}{10}+25}}{\log 5}$

6.) $x+y+z=12$

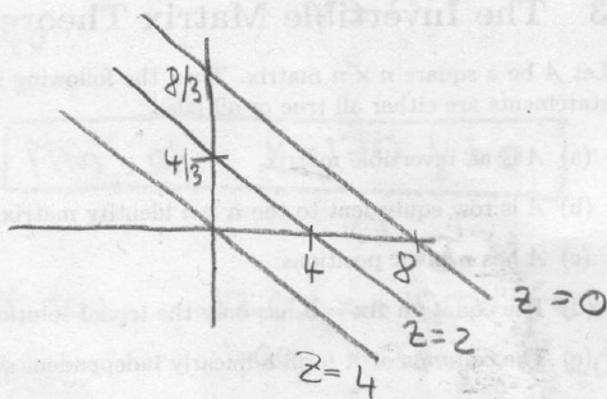14) $x+3y+2z=8$

$z=0 \quad z=2 \quad z=4$

$z=0 \quad y=-\tfrac{1}{3}x+\tfrac{8}{3}$

$z=2 \quad y=-\tfrac{1}{3}x+\tfrac{4}{3}$

$z=4 \quad y=-\tfrac{1}{3}x$

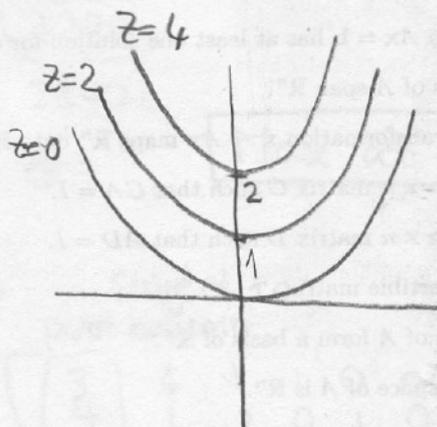16.) $2y-\dfrac{x^2}{8}=z$

$z=0 \quad z=2 \quad z=4$

$z=0 \quad y=\tfrac{1}{6}x^2$

$z=2 \quad y=\tfrac{1}{6}x^2+1$

$z=4 \quad y=\tfrac{1}{6}x^2+2$

10.) $y+z=5$

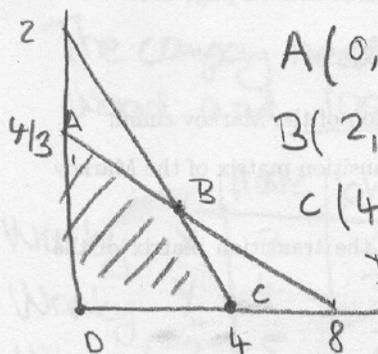

21. c
22. f
23. e
24. a
25. b
26. d

Linear Programming

1) maximize $f = x - 4y$ Subject to: $y \leq -\frac{1}{2}x + 2$

$A(0, 4/3) \Rightarrow f_A = -16/3$ $y \leq -\frac{1}{6}x + \frac{4}{3}$

$B(2, 1) \Rightarrow f_B = -2$ $x \geq 0$
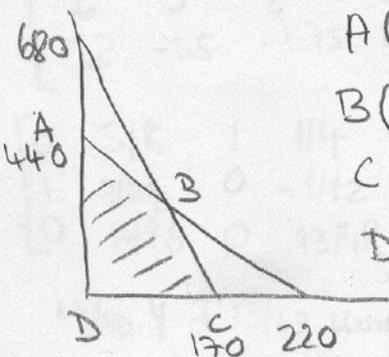
$C(4, 0) \Rightarrow f_C = 4$ $y \geq 0$

$D(0,0) \Rightarrow f_D = 0$

$\boxed{\text{Max at } \quad X = 4 \quad Y = 0}$

2) minimize $f = -2x + y$ Subject to: $y \leq -2x + 440$

$A(0, 440) \quad f_A = 440$ $y \leq -4x + 680$

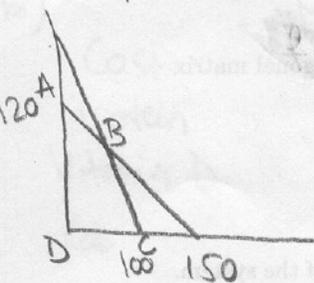$B(110, 200) \quad f_B = 20$ $x \geq 0$

$C(170, 0) \quad f_C = -340$ $y \geq 0$

$D(0,0) \quad f_D = 0$

$\boxed{\text{Min at} \quad X = 170 \quad Y = 0}$

3) maximize $f = 28x + 25y$ Subject to: $12{,}000x + 15{,}000y \leq 1{,}800{,}000$

$A(0, 120) \quad f(A) = 3000$ $400x + 300y \leq 40{,}000$

$B(25, 100) \quad f(B) = \boxed{3200}$ $x \geq 0$

$C(100, 0) \quad f(C) = 2800$ $y \geq 0$

$D(0, 0) \quad f(D) = 0$

$\boxed{\text{Max at} \quad X = 25 \quad Y = 100}$

4) maximize $f = 16x + 16y + 16z$ Subject to:

$x, y, x, z \geq 0$

$3x + 6y + z + u = 800$

$4x + y + 2z + v = 400$

$2x + y + 2z + w = 100$

$-16x - 16y - 6z + p = 0$

pivot column

$$\begin{bmatrix} 3 & 6 & 1 & 1 & 0 & 0 & 0 & 800 \\ 4 & 1 & 2 & 0 & 1 & 0 & 0 & 400 \\ 2 & 1 & 2 & 0 & 0 & 1 & 0 & 100 \\ -16 & -16 & -6 & 0 & 0 & 0 & 1 & 0 \end{bmatrix} \rightsquigarrow$$

$$\begin{bmatrix} 0 & 912 & -2 & 1 & 0 & -312 & 0 & 650 \\ 0 & -1 & -2 & 0 & 1 & -2 & 0 & 250 \\ 1 & 112 & 1 & 0 & 0 & 112 & 0 & 50 \\ 0 & -8 & 10 & 0 & 0 & 8 & 1 & 800 \end{bmatrix} \rightsquigarrow \begin{bmatrix} -9 & 0 & -11 & 1 & 0 & -6 & 0 & 200 \\ 2 & 0 & 0 & 0 & 1 & -1 & 0 & 300 \\ 2 & 1 & 2 & 0 & 0 & 1 & 0 & 100 \\ 16 & 0 & 26 & 0 & 0 & 16 & 1 & 1600 \end{bmatrix}$$

Max profit = \$1600

$$16X + 26Z + 16W + P = 1600$$

$$\boxed{X = 0 \quad Z = 0 \quad W = 0 \quad Y = 100}$$

The company needs 600 units of metal, 100 units of wood and 100 of plastic to produce 100 cabinets.

5.)

		Plastic	labor	£
Wacky	X	3	6	2
Wonky	Y	4	3	1.50
Wicked	Z	5	2	1.75

$$f = 2x + 1.5y + 1.75z$$

$$3x + 4y + 5z + u = 1000$$

$$6x + 3y + 2z + V = 1200$$

$$-2x - 1.5y - 1.75z + P = 0$$

$$\begin{bmatrix} 3 & 4 & 5 & 1 & 0 & 0 & 1000 \\ 6 & 3 & 2 & 0 & 1 & 0 & 1200 \\ -2 & -1.5 & -1.75 & 0 & 0 & 1 & 0 \end{bmatrix} \sim \begin{bmatrix} 0 & 5/2 & 4 & 1 & -1/2 & 0 & 400 \\ 1 & 1/2 & 1/3 & 0 & 1/6 & 0 & 200 \\ 0 & -1/2 & -13/12 & 0 & 1/3 & 1 & 400 \end{bmatrix} \sim$$

$$\begin{bmatrix} 0 & 5/8 & 1 & 1/4 & -1/8 & 0 & 100 \\ 1 & 7/24 & 0 & -1/12 & 5/24 & 0 & 166.7 \\ 0 & 17/96 & 0 & 13/48 & 18/96 & 1 & 508.3 \end{bmatrix}$$

$$\boxed{\begin{array}{l} f = 508.33 \\ X = 166.67 \\ Z = 100 \\ Y = 0 \end{array}}$$

$$17/96\, Y + 13/48\, u + 18/96\, V + W = 508.3$$

$$Y = 0 \quad u = 0 \quad V = 0$$

6.)

	Milk (0.5 cup)	Corn Flakes (1 ounce)
Cost	7.5 ¢	5 ¢
Protein	4 g	2 g
Vitamin D	$\frac{1}{8}$ RDA	$\frac{1}{10}$ RDA
Ca	$\frac{1}{6}$ RDA	0

minimize cost: $C = 7.5x + 5y$

subject to:

$$4x + 2y \geq 9$$

$$\frac{1}{8}x + \frac{1}{10}y \geq \frac{1}{3}$$

$$\frac{1}{6}x \geq \frac{1}{4}$$

$$x \geq 0$$

$$y \geq 0$$

$$1 \leq \frac{y}{x/2} \leq 3$$

$$-3x + 2y \leq 0$$

using Mathematica:

$$\boxed{\begin{array}{l} \text{minimized cost} = \$18.61 \\ X = 1.55 \\ Y = 1.39 \end{array}}$$