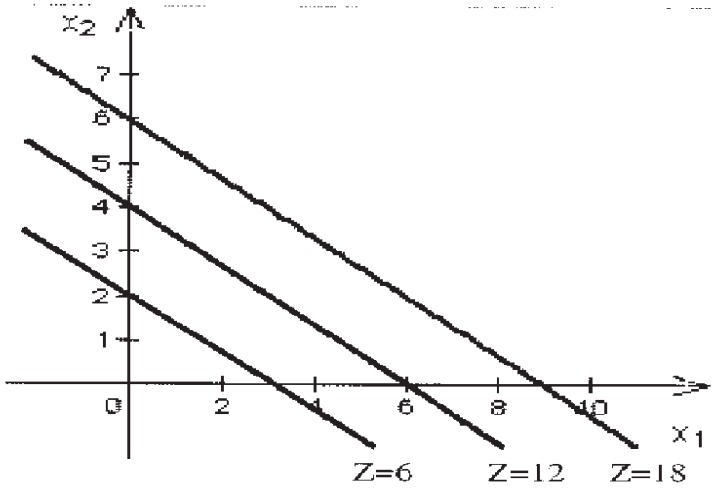
Math428 Solution Keys to Chapter 3 Assignments

3.1-2

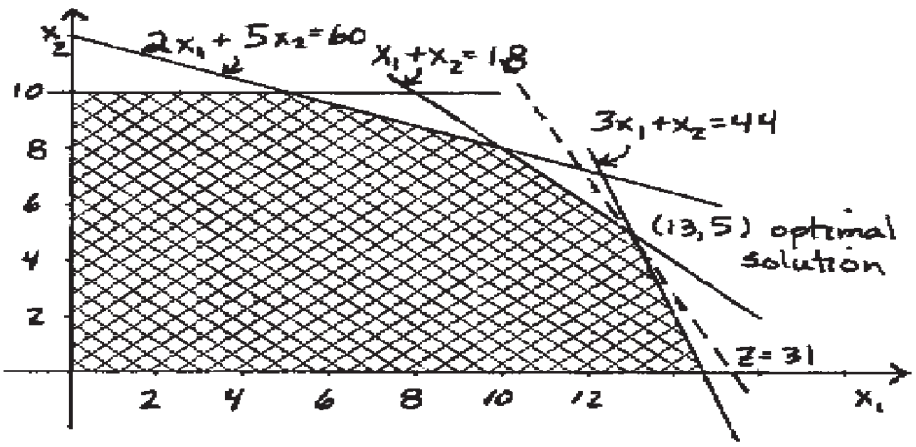
a)



b)

	slope-intercept form	slope	x_2 intercept
Z=6	$x_2 = -\frac{2}{3}x_1 + 2$	$-\frac{2}{3}$	2
Z=12	$x_2 = -\frac{2}{3}x_1 + 4$	$-\frac{2}{3}$	4
Z=18	$x_2 = -\frac{2}{3}x_1 + 6$	$-\frac{2}{3}$	6

3.1-4



$(x_1, x_2) = (13,5)$ is optimal with $Z = 31$

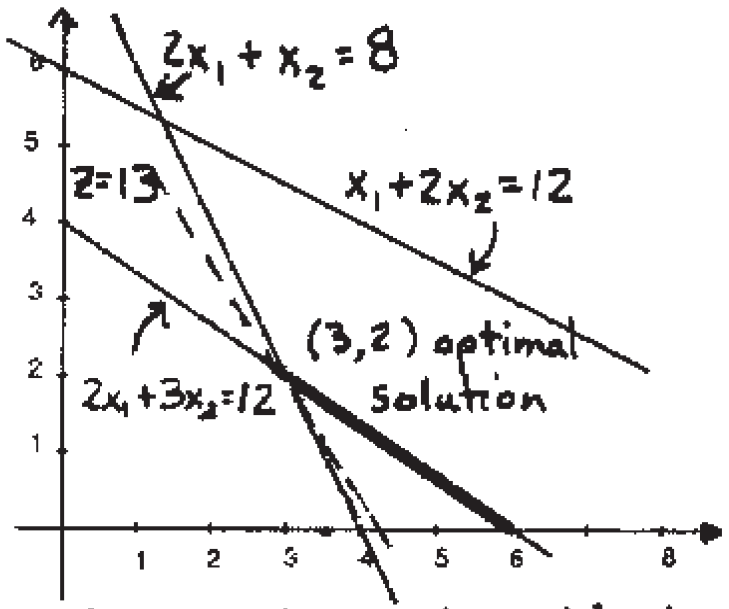
3.2-2

a) TRUE (eg. $\max z = -x_1 + 4x_2$)

b) TRUE (eg. $\max z = -x_1 + 3x_2$)

c) False (eg. $\max z = -x_1 - x_2$)

3.4-4.



$(x_1, x_2) = (3,2)$ is optimal with $z = 13$

3.4-9
a)

Let x_{ij} = the amount of space leased in month i for a period of j months

for $i = 1,...,5$ and $j = 1,...,6-i$.

Minimize $C = 650(x_{11} + x_{21} + x_{31} + x_{41} + x_{51}) + 1000(x_{12} + x_{22} + x_{32} + x_{42})$
$+1350(x_{13} + x_{23} + x_{33}) + 1600(x_{14} + x_{24}) + 1900x_{15}$

subject to $x_{11} + x_{12} + x_{13} + x_{14} + x_{15} \geq 30,000$

$x_{12} + x_{13} + x_{14} + x_{15} + x_{21} + x_{22} + x_{23} + x_{24} \geq 20,000$

$x_{13} + x_{14} + x_{15} + x_{22} + x_{23} + x_{24} + x_{31} + x_{32} + x_{33} \geq 40,000$

$x_{14} + x_{15} + x_{23} + x_{24} + x_{32} + x_{33} + x_{41} + x_{42} \geq 10,000$

$x_{15} + x_{24} + x_{33} + x_{42} + x_{51} \geq 50,000$

and $x_{ij} \geq 0$, for $i = 1,...,5$ and $j = 1,...,6-i$.

3.4-9 b)

	A	B	C	D	E	F	G	H	I
1		Contribution Toward Required Amount							
2	Month	1-1	1-2	1-3	1-4	1-5	2-1	2-2	2-3
3	1	1	1	1	1	1			
4	2		1	1	1	1	1	1	1
5	3			1	1	1		1	1
6	4				1	1			1
7	5					1			
8	Unit Cost	$ 650	$ 1,000	$ 1,350	$ 1,600	$ 1,900	$ 650	$ 1,000	$ 1,350
9	Solution	**0**	**0**	**0**	**0**	**30000**	**0**	**0**	**0**

	J	K	L	M	N	O	P	Q	R	S
1	Contribution Toward Required Amount									Resource
2	2-4	3-1	3-2	3-3	4-1	4-2	5-1	Totals		Available
3								30000	≥	30000
4	1							30000	≥	20000
5	1	1	1	1				40000	≥	40000
6	1		1	1	1	1		30000	≥	10000
7	1			1		1	1	50000	≥	50000
8	$ 1,600	$ 650	$ 1,000	$ 1,350	$ 650	$ 1,000	$ 650	**76499994**		
9	**0**	**10000**	**0**	**0**	**0**	**0**	**20000**			

Data cells: B3:P8 and S3:S7
Changing cells: B9:P9
Target cell: Q8
Output cells: Q3:Q7

	Q
3	=SUMPRODUCT(B3:P3,B9:P9)
4	=SUMPRODUCT(B4:P4,B9:P9)
5	=SUMPRODUCT(B5:P5,B9:P9)
6	=SUMPRODUCT(B6:P6,B9:P9)
7	=SUMPRODUCT(B7:P7,B9:P9)
8	**=SUMPRODUCT(B8:P8,B9:P9)**

3.4-14 a)

Let x_1 = amount of Alloy 1 used,
x_2 = amount of Alloy 2 used,
x_3 = amount of Alloy 3 used,
x_4 = amount of Alloy 4 used,
x_5 = amount of Alloy 5 used.

$$\text{Minimize } C = 22x_1 + 20x_2 + 25x_3 + 24x_4 + 27x_5$$

subject to
$$60x_1 + 25x_2 + 45x_3 + 20x_4 + 50x_5 = 40$$
$$10x_1 + 15x_2 + 45x_3 + 50x_4 + 40x_5 = 35$$
$$30x_1 + 60x_2 + 10x_3 + 30x_4 + 10x_5 = 25$$
$$x_1 + x_2 + x_3 + x_4 + x_5 = 1$$

and $x_1 \geq 0,\ x_2 \geq 0,\ x_3 \geq 0,\ x_4 \geq 0,\ x_5 \geq 0.$

3.4-14 b)

	Contribution Toward Required Amount							Required
Requirement	Alloy 1	Alloy 2	Alloy 3	Alloy 4	Alloy 5	Totals		Amount
% tin	60	25	45	20	50	40	=	40
% zinc	10	15	45	50	45	35	=	35
% lead	30	60	10	30	10	25	=	25
% total	1	1	1	1	1	1	=	1
Unit Cost	22	20	25	24	27	**$ 23.46**		
Solution	**0.0435**	**0.2826**	**0.6739**	**0**	**3E-15**			

3.4-7 a)

Minimize $C = 4S + 2P$,

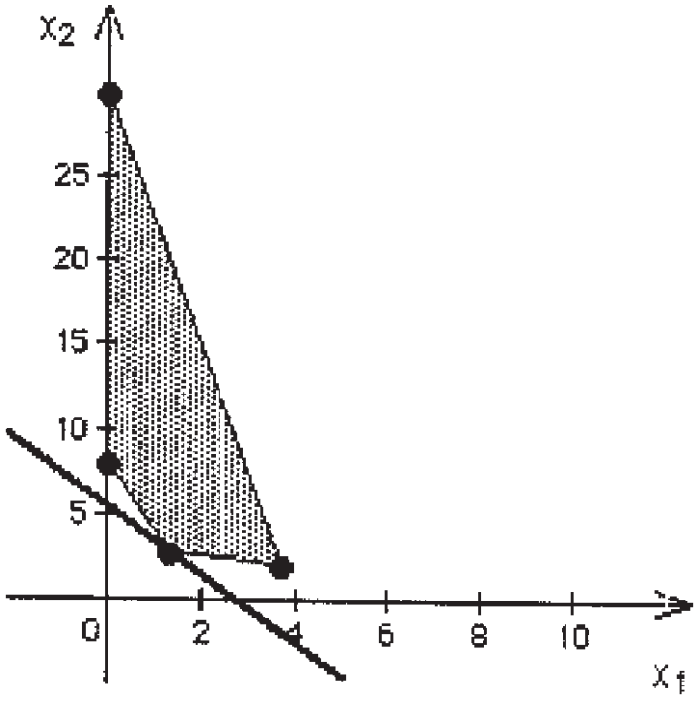
subject to $5S + 15P \geq 50$

$20S + 5P \geq 40$

$15S + 2P \leq 60$

and $S \geq 0, \quad P \geq 0.$

b) Optimal Solution: $(S,P) = (x_1, x_2) = (1.3, 2.9)$ and $C = 10.91$.



c)

	Contribution Per Unit				
	Steak	Potato	Totals		Level
Carbohydrate	5	15	50	≥	50
Protein	20	5	40	≥	40
Fat	15	2	24.91	≤	60
Unit Cost	4	2	**$ 10.91**		
Solution	**1.3**	**2.9**			