1.

Ingredient	N_2	P_4	K
1	10	6	0
2	2	6	1

ingredient 1 → \$3 per pound
ingredient 2 → \$5 per pound

Let X_1 be no. of pounds of ingredient 1

& X_2 ————————————— 2

$Z_{min} = 3X_1 + 5X_2$

$10X_1 + 2X_2 \geqslant 20$

$6X_1 + 6X_2 \geqslant 36$

$X_2 \geqslant 2$

$X_1 \geqslant 0$

$10X_1 + 2X_2 + A_1 - S_1 = 20$

$\Rightarrow 6X_1 + 6X_2 + A_2 - S_2 = 36$

$X_1 + A_3 - S_3 = 2$

$Z_{min} = 3X_1 + 5X_2 + 0S_1 + 0S_2 + 0S_3 + MA_1 + MA_2 + MA_3$

	C_j	3	5	0	0	0	M	M	M
C_i	Var. Qty.	X_1	X_2	S_1	S_2	S_3	A_1	A_2	A_3
M	A_1 20	10	2	-1	0	0	1	0	0
M	A_2 36	6	6	0	-1	0	0	1	0
m	A_3 2	0	1	0	0	1	0	0	1
	Z_j 58M 16M	8m	-m	m	-M	m	m	m	
Z_j-C_j	16m-3	8m-5	-M	-M	-M	0	0	0	

A_1 is replaced с with X_1.

Cj	Var.	C_i Qty	3 X_1	5 X_2	0 S_1	0 S_2	0 S_3	m A_2	m A_3
3	X_1	2	1	1/5	-1/10	0	0	0	0
M	A_2	24	0	24/5	2/5	-1	0	1	0
M	A_3	2	0	1	0	0	-1	0	1
Z_j		6+26M	3	$\frac{3}{5}+\frac{22}{5}m$	$\frac{3}{5}m-\frac{3}{10}$	-M	-M	m	m
Z_j-C_j			0	$\frac{29}{5}m-\frac{22}{5}$	$\frac{3}{5}m-\frac{3}{10}$	-M	-M	0	0

A_3 is replaced with X_2.

Cj	Var.	C_j Qty	3 X_1	5 X_2	0 S_1	0 S_2	0 S_3	M A_2
3	X_1	8/5	1	0	-1/10	0	1/5	0
M	A_2	72/5	0	0	3/5	-1	24/5	1
5	X_2	2	0	1	0	0	-1	0
Z_j		$74/9+\frac{72}{5}m$	3	5	$\frac{3}{10}m-\frac{3}{10}$	-M	$\frac{24}{5}m-\frac{22}{5}$	M
Z_j-C_j			0	0	$\frac{3}{10}m-\frac{3}{10}$	-m	$\frac{24}{5}m-\frac{12}{5}$	0

S_3 is replaced with S_1.

Cj	BV.	C_j Qty	3 X_1	5 X_2	0 S_1	0 S_2	0 S_3
3	X_1	4	1	0	0	-1/6	1
0	S_1	24	0	0	1	-5/3	8
5	X_2	2	0	1	0	-5/h4	4
Z_j		22	3	5	0	-37/24	2
Z_j-C_j			0	0	0	-37/24	2

all Z_i-C_j values are negative hence optimal solⁿ is reached. $X_1=4$, $S_1=24$, $X_2=2$, $Z_{max}=22$

2.

Pdt	A_1	A_2	profit
1	10	7	6
2	10	3	4

No. of units in pdt $1 = X_1$
$2 = X_2$

$Z_{max} = 6X_1 + 4X_2$

$10X_1 + 10X_2 \leqslant 100$

$7X_1 + 3X_2 + S_2 \leqslant 42$

$\Rightarrow$

$10X_1 + 10X_2 + S_1 = 100$

$7X_1 + 3X_2 + S_2 = 100$

C_j	Var.	Qty	6 X_1	4 X_2	0 S_1	0 S_2
0	S_1	100	10	10	1	0
0	S_2	42	7	3	0	1
	Z_j	0	0	0	0	0
	$C_j - Z_j$		6	4	0	0

now S_2 is replaced with X_1

C_j	Var.	Qty	6 X_1	4 X_2	0 S_1	0 S_2
0	S_j	40	0	40/7	1	10/7
6	X_1	6	1	3/7	0	1/7
	Z_j	36	6	18/7	0	6/7
	$C_j - Z_j$		0	10/7	0	6/7

now S_1 is replaced with X_2.

C_j	Var.	Qty	6 x_1	4 x_2	0 S_1	0 S_2
4	x_2	7	0	1	7/40	1/4
6	x_1	3	1	0	-3/40	1/28
	z_j	46	6	4	Y4	1/4
	$C_j - z_j$		0	0	-1/4	-11/4

all $(C_j - z_j)$ values are either zero or negative hence optimal sol^n is reached.

$$x_2 = 7, \quad x_1 = 3, \quad z \, max = 46$$