1.
$$\begin{bmatrix} 1 & 2 & 1 & 1 \\ -1 & 3 & 4 & -1 \\ 4 & 3 & 4 & 3 \\ 3 & 3 & 2 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$R_1 + R_2 \rightarrow R_2$
$$\begin{bmatrix} 1 & 2 & 1 & 1 \\ 0 & 5 & 5 & 0 \\ 4 & 3 & 4 & 3 \\ 3 & 3 & 2 & 1 \end{bmatrix}$$
$\frac{1}{5} R_2 \rightarrow R_2$
$$\begin{bmatrix} 1 & 2 & 1 & 1 \\ 0 & 1 & 1 & 0 \\ 4 & 3 & 4 & 3 \\ 3 & 3 & 2 & 1 \end{bmatrix}$$
$4R_1 - R_3$
$\rightarrow R_3$
$$\begin{bmatrix} 1 & 2 & 1 & 1 \\ 0 & 1 & 1 & 0 \\ 0 & 5 & 0 & 5 \\ 3 & 3 & 2 & 1 \end{bmatrix}$$

$\frac{1}{5} R_3 \rightarrow R_3$
$$\begin{bmatrix} 1 & 2 & 1 & 1 \\ 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 3 & 3 & 2 & 1 \end{bmatrix}$$
$3R_1 - R_4$
$\rightarrow R_4$
$$\begin{bmatrix} 1 & 2 & 1 & 1 \\ 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 0 & 3 & 1 & 2 \end{bmatrix}$$
$R_2 - R_3 \rightarrow R_3$
$$\begin{bmatrix} 1 & 2 & 1 & 1 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & -1 \\ 0 & 3 & 1 & 2 \end{bmatrix}$$

$3R_2 - R_4$
$$\begin{bmatrix} 1 & 2 & 1 & 1 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & -1 \\ 0 & 0 & 2 & -2 \end{bmatrix}$$
$2R_3 - R_4 \rightarrow R_4$
$$\begin{bmatrix} 1 & 2 & 1 & 1 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & -1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$x_4 = t$ $x_3 - t = 0 \therefore x_3 = t$ $x_2 + t = 0 \therefore x_2 = -t$ $x_1 - 2t + t + t = 0 \therefore x_1 = 0$

$\therefore x_1 = 0, \ x_2 = -t, \ x_3 = t, \ x_4 = t$

2. $2A = \begin{bmatrix} 2 & 4 & 6 \\ 0 & 2 & 0 \\ -2 & 2 & 2 \end{bmatrix}$ $3B = \begin{bmatrix} 0 & 3 & 0 \\ 18 & 21 & -3 \\ -6 & 0 & -3 \end{bmatrix}$

$2A - 3B = \begin{bmatrix} 2 & 1 & 6 \\ -18 & -19 & 3 \\ 4 & 2 & 5 \end{bmatrix} = 7X$ $\therefore X = \begin{bmatrix} \frac{2}{7} & \frac{1}{7} & \frac{6}{7} \\ -\frac{18}{7} & -\frac{19}{7} & \frac{3}{7} \\ \frac{4}{7} & \frac{2}{7} & \frac{5}{7} \end{bmatrix}$

3. $A = \begin{bmatrix} 0 & 1 & 2 \\ 0 & -1 & 1 \\ 1 & 5 & -4 \end{bmatrix}$

$A_{11} = (-1)^2 (-1) = -1$ $A_{12} = (-1)^3 (-1) = 1$ $A_{13} = (-1)^4 1 = 1$

$A_{21} = (-1)^3 (-14) = 14$ $A_{22} = (-1)^4 (2) = 2$ $A_{23} = (-1)^5 (-1) = 1$

$A_{31} = (-1)^4 \, 3 = 3$ $A_{23} = (-1)^5 0 = 0$ $A_{33} = (-1)^6 0 = 0$

$\therefore$ $adj(A) \begin{bmatrix} -1 & 1 & 1 \\ 14 & 2 & 1 \\ 3 & 0 & 0 \end{bmatrix}^T$ $\det(A) = 3$

$A^{-1} = \frac{1}{3} \begin{bmatrix} -1 & 14 & 3 \\ 1 & 2 & 0 \\ 1 & 1 & 0 \end{bmatrix} = \begin{bmatrix} -\frac{1}{3} & \frac{14}{3} & 1 \\ \frac{1}{3} & \frac{2}{3} & 0 \\ \frac{1}{3} & \frac{1}{3} & 0 \end{bmatrix}$

4. $\vec{h} = (2,3,-5)$

$\therefore 2(x+2)+3(y-1)-5(z-7) = 2x+4+3y-3-5z+35$

$\qquad\qquad\qquad\qquad\quad = 2x+3y-5z+36 = 0$

5. $\vec{a} = (1,1,2)$, $\vec{h}(a,b,c)$

$\vec{a} \cdot \vec{h} = a+b+2c = 0$
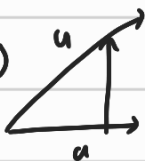
$a(x-1)+b(y-1)+c(z-2) = 0$ $\quad$ $t=0$ 대입 $\quad$ $x=0, y=1, z=-3$

$\Rightarrow -a-5c = 0 \quad a = -5c, \ b = 3c$

$\therefore \vec{h} = (-5,-3,1)$ $\qquad$ $\therefore$ 평면방정식 : $-5(x-1)-3(y+1)+(z-2) = 0$

$\qquad\qquad\qquad\qquad\qquad\qquad\quad = -5x+5-3y-3+z-2$

$\qquad\qquad\qquad\qquad\qquad\qquad\quad = 5x+3y-z = 0$

6. 1)

$proj_a u = \dfrac{a \cdot u}{|a|^2} a = \dfrac{-30}{30}(1,2,5) = (-1,-2,-5)$

2) $\vec{u} - proj_a u = (1,2,5) - (-1,-2,-5) = (2,4,10)$

7.
```
> (X <-matrix(c(1,-1,1,0,1,1,1,2),byrow=T,ncol=2))
      [,1] [,2]
[1,]    1   -1
[2,]    1    0
[3,]    1    1
[4,]    1    2
> (Y <- matrix(c(-2,5,3,2),byrow=T,ncol=1))
      [,1]
[1,]   -2
[2,]    5
[3,]    3
[4,]    2
> (XTX <- t(X)%*%X)
      [,1] [,2]
[1,]    4    2
[2,]    2    6
> (XTY <-t(X) %*% Y)
      [,1]
[1,]    8
[2,]    9
> library(MASS)
> (b_hat <- ginv(XTX) %*% XTY)
      [,1]
[1,]   1.5
[2,]   1.0
```

$\therefore y = 1.5 + x$

객관식

36. ② $\quad$ 37. ① $\quad$ 38. ④ $\quad$ 39. ③ $\quad$ 40. ④ $\quad$ 41. ④

42. ④ $\quad$ 43. ③ $\quad$ 44. ② $\quad$ 45. ①