1. (a) $y_3 \sim N_1(5, 9)$
(b) $2y_1 - 5y_2 + 3y_3 \sim N_1(32, 257)$
(c) \[
\begin{pmatrix} y_2 \\ 3y_1 + y_2 - 2y_3 \end{pmatrix} \sim N_2 \left( \begin{pmatrix} -3 \\ -10 \end{pmatrix}, \begin{pmatrix} 16 & 0 \\ 0 & 56 \end{pmatrix} \right)
\]
(d) \[
\begin{pmatrix} y_4 \\ y_1 + y_4 \end{pmatrix} \sim N_2 \left( \begin{pmatrix} -8 \\ -7 \end{pmatrix}, \begin{pmatrix} 25 & 19 \\ 19 & 17 \end{pmatrix} \right) \Rightarrow y_1|y_1 + y_4 \sim N(-\frac{79}{17}, \frac{64}{17})
\]
(e) (i) and (iii) are independent, while (ii) is not.

2. (a) $k_2 = -2.156$ the p-value < 0.05, so we reject $H_0$ for MVN.
(b) The data does not appear normal because the points do not follow a straight line. (It is ok if you say the data appears normal, but the reason should be consistent to the result you got.)
(c) $F \doteq 3.166 > f(5, 25) = 2.6$, so we reject $H_0$. i.e. $\mu \neq (515, 145, 30, 35, 345)$.
(d) The confidence intervals are $(514.7, 519.9), (143, 146.6), (28.95, 31.25), (34.9, 37.3), (343.7, 347.7)$ for $y_1, y_2, y_3, y_4, y_5$ respectively.
(e) The mles for mean and variance are 245.12 and 11.31 respectively.

3. (a) $MC^{-1} \doteq 7.957 < \chi^2_{95, 10} = 18.307$. So we can not reject $H_0$.
   The two variance-covariance matrices are equal.
(b) $F = 11.756 > f_{(95, 4, 19)} = 2.9$. So we reject $H_0$.
   The two means are different.
(c) Calculate either F or the confidence interval. The confidence interval is (-11.9, 40.7) contains 0. So we can not reject $H_0$.
   There is sufficient evidence to show that there is no difference between the initial cholesterol means for the two groups.
(d) $F = 11.16 > f_{(2, 21)} = 3.47$. So we reject $H_0$.
   The two medications are not parallel for 2, 4 and 6 months.