Question 1  Note that $u(25, 9) = 5 + 9 = 14$. Therefore, $x_2$ must be chosen such that $u(4, x_2) = 14$, i.e, $2 + 3\sqrt{x_2} = 14$. Thus, $x_2 = 16$.

Question 2  If $\Delta x_1 = -1$ then $\Delta x_2 = 2$. Thus, if $\Delta x_2 = -1$ then $\Delta x_1 = 0.5$. Therefore $x_1 = 5.5$.

Alternatively, the equation of the budget line is $2x_1 + x_2 = 11$. Therefore $x_1 = 5.5$.

Question 3

(a) The MRS at $(7,10)$ is $-2$.

(b) The consumer currently has 12 units of good 1 and 5 units of good 2. In order to acquire an additional unit of good 1, he is willing to give up at most $\frac{1}{3}$ units good 2.

(c) Use the symbols “≺, ⩾, ∼” to indicate the relationship between the following consumption choices.

- $(18, 3) ≺ (12, 8)$
- $(3, 13) ⩾ (15, 1)$
- $(0, 8) ∼ (6, 1)$
- $(10, 5) ≺ (8, 9)$

(c) Assume that $(12, 5)$ is an optimal consumption choice. Assume that $p_2 = 8$. Then $p_1 = \frac{8}{3} = 2.667$.

Question 4

(a) MRS = $-4$ implies $20 = 4x_A + 8$. Therefore, $x_A = 3$. The budget line equation is $4x_A + x_B = m$. Therefore, $x_B = m - 12$.

(b) $\bar{m} = 12$. For $m < \bar{m}$ George only buys apples. His demand is therefore, $x_A = m/4$ and $x_B = 0$. 
Question 5  At an optimal choice $2x_1 = x_2$. The budget line equation is $x_1 + 3x_2 = 91$. The solution is $x_1 = 13$ and $x_2 = 26$.

Question 6  Increasing $x_2$ decreases consumption. Therefore $x_1 = 10$ and $x_2 = 0$ is optimal.

Question 7

(a) Assume that sum of the two scores determine the grade. Then

- Nancy will study $70$ hours for the first exam and $0$ hours for the second exam.
- Nancy final score (i.e., the sum of the score on the two exams) is $98$.

(b) Now assume that the lowest score is dropped, i.e., the final score is the maximum of the scores on the two exams. Then

- Nancy will study $70$ hours for the first exam and $0$ hours for the second exam.
- Nancy final score (i.e., the higher exam score) is $70$.

(c) Now assume that the highest score is dropped, i.e., the final score is the minimum of the scores on the two exams. Then

- Nancy will study $40$ hours for the first exam and $30$ hours for the second exam.
- Nancy final score (i.e., the minimum of the two scores) is $40$.

Question 8

\[
\frac{\partial u}{\partial x_1} = 2(x_2 + 3) \quad \frac{\partial u}{\partial x_1} = 2x_1 + 2.
\]

Therefore,

\[
\text{MRS} = -\frac{2x_2 + 6}{2x_1 + 2} = -\frac{x_2 + 3}{x_1 + 1}.
\]

\[
\text{MRS}(3, 4) = -\frac{7}{4} = -1.75
\]