Economics 703 : Final Exam

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Please be very explicit in your answers. Carefully state the appropriate definitions and theorems and argue how they apply. Also, make sure that every step in your argument follows logically and directly from the previous step.

Each question is worth 33 points, with one point given away for free.

1. Solve the problem: $Max\ (x_1 + x_2)$

   subject to:

$$\begin{aligned} -x_1^3 + 6\,x_1^2 - 9\,x_1 + x_2 - 10 &\leq 0 \\ -x_2 + 14 &\leq 0 \\ x_1 - 5 &\leq 0 \end{aligned}$$

2. Solve the problem: $Min\ (x_1 + x_2)$

   subject to:

$$\begin{aligned} (x_1 - 1)^2 + x_2^2 - 1 &= 0 \\ (x_1 - 3)^2 + x_2^2 - 4 &= 0 \end{aligned}$$

3. Let $f : \mathbb{R}^{n+m} \to \mathbb{R}^n$ be a linear function. What does the implicit function theorem say about the solution of the equation $f(x) = 0$?