There were two versions of the exam.

Version A - In problem 1, \( f(x, y) = \frac{9}{4}xy^2 + y^3 - x \).

1. There are two critical points: \((-4/9, 2/3)\) and \((4/9, -2/3)\) and they are both saddle points.

2. (a) \( \frac{1}{2}e^4 - \frac{3}{2}e^3 - \frac{1}{2}e + \ln 2 - \frac{9}{8} \) (b) \( \frac{1}{4} \sin 64 \)

3. \( 4\pi \)

4. \( t = \frac{1}{2} \sin^{-1} \frac{2}{33} \approx 0.32554929 \)

5. (a) \( z = 5x - 4y + 8 \) (b) There are infinitely many such pairs. One pair is \((1, 1, 0)\) and \((5, 0, 5)\).

Version B - In problem 1, \( f(x, y) = \frac{1}{4}xy^2 + y^3 - x \).

1. There are two critical points: \((-12, 2)\) and \((12, -2)\) and they are both saddle points.

2. (a) \( \frac{1}{2}e^4 - \frac{3}{2}e^3 - \frac{1}{2}e + \ln 2 - \frac{9}{8} \) (b) \( \frac{1}{6} \sin 144 \)

3. \( \pi \)

4. \( t = \frac{1}{2} \sin^{-1} \frac{2}{405} \approx 0.25824277 \)

5. (a) \( z = 7x - 3y + 8 \) (b) There are infinitely many such pairs. One pair is \((0, 0, 0)\) and \((1, -10/3, 3)\).