1. (0, 4, −2) and (4, 0, 6), see Midterm 1, Question 7.

2. GBHXXEFXCA or XHXBEACGFX (X stands for ‘no match’)

3. \[ \frac{\partial z}{\partial y} = -\frac{6xy+z}{x^2+y} \]

4. Note that \[ x^2 - 4xy + 5y^2 - 8y = (x - 2y)^2 + (y - 4)^2 - 16 \] and write \[ u = x - 2y, \quad v = y. \] The level sets of the paraboloid \[ z = u^2 + (v - 4)^2 - 16 \] are circles \[ u^2 + (v - 4)^2 = k. \] In \( uv \)-plane, the domain is a triangular region with vertices \((0, 0), (3, 0), (-3, 3)\). The smallest level circle touching this triangle meets it at \( u = -1, v = 2 \) and the largest level circle touching this triangle meets it at \( u = 3, v = 0 \). Hence \( f \) has an absolute minimum of \(-11\) at \( x = 3, y = 2 \) and an absolute maximum of \( 9 \) at \( x = 3, y = 0 \).

5. Since \( \mathbf{r}_u = \langle 1, \cos v, \sin v \rangle \), \( \mathbf{r}_v = \langle 0, -u \sin v, u \cos v \rangle \), we have \( \mathbf{r}_u \times \mathbf{r}_v = u \langle 1, -\cos v, -\sin v \rangle \) and \( \| \mathbf{r}_u \times \mathbf{r}_v \| = u\sqrt{2} \). This gives the surface area \( A = \int_0^{2\pi} dv \int_0^u u\sqrt{2} du = 4\sqrt{2}\pi. \)

Alternatively, the surface area in question is that of a circular sector of radius \( R = 2\sqrt{2} \) and angle \( \theta = 4\pi/R \). Thus \( A = \frac{\theta}{2\pi} \times \pi R^2 = 4\sqrt{2}\pi. \)

6. \( R \) is the triangular region with vertices \((0, 1)\) and \((\pm 2, 3)\). Hence \( 1 \leq y \leq 3 \) and \( 1 - y \leq x \leq y - 1 \), or \(-2 \leq x \leq 2 \) and \( 1 + |x| \leq y \leq 3 \).

7. \[ \int_0^\pi \int_0^2 r^3 \ r dr d\theta = 6.4\pi \]

8. \( x = r \cos \theta = \rho \sin \varphi \cos \theta \) should multiply the appropriate Jacobian.

\[
\int_0^3 \int_{-\sqrt{3}}^{\sqrt{3}} \int_{-\sqrt{3-x^2}}^{\sqrt{3-x^2}} x \ dxdydz = \int_0^3 \int_{-\sqrt{3}}^{\sqrt{3}} \int_{\sqrt{3-x^2}}^{\sqrt{3+x^2}} x \ dxdydx
\]

\[
\int_0^2 \int_0^{2\pi} r^2 \cos \theta dr d\theta dz = \int_0^2 \int_0^{\pi/3} r^2 \cos \theta dz d\theta d\theta
\]

\[
\int_0^\pi \int_{-\sqrt{3}}^{\sqrt{3}} \int_{\sqrt{3-x^2}}^{\sqrt{3+x^2}} \rho^3 \sin^2 \varphi \cos \theta dp d\theta d\varphi
\]

9. \( J = x_uy_v - x_vy_u = -\frac{1}{2u} \)

\[ \int\int_R xy dxdy = \int_1^3 \int_{-\frac{1}{2u}}^{\frac{1}{2u}} dudv = \frac{1}{2} \int_1^3 du \int_1^2 vdv = \frac{3}{4} \ln 3 \]