

Show all work, including mental steps, in a clearly organized way that speaks for itself. Use proper mathematical notation, identifying expressions by their proper symbols (introducing them if necessary), and use arrows and equal signs when appropriate. Always simplify expressions. BOX final short answers. LABEL parts of problem. Keep answers EXACT (but give decimal approximations for interpretation when appropriate). Indicate where technology is used and what type (Maple, GC).

1. Consider the integral $\int_1^2 \int_0^{\sqrt{4-x^2}} 8xy \, dy \, dx = 9$.

- Make a diagram shading in the region of integration, and showing a typical cross-section with its directional arrow indicating the inner integration, labeling its endpoints properly. [Label axes, tickmarks, intercepts, etc.]
- Now make a similar new diagram indicating the corresponding situation for polar coordinate integration, showing the typical radial cross-section with properly labeled endpoints. State the range of r values in terms of θ .
- What is the angular range for θ ? Explain.
- Write down the new iterated double integral and evaluate it using technology (state which technology is used). Do you get the correct result? If not, can you find your error in setup?
- Now by hand perform the radial integration, reducing the evaluation to an angular integral. This may be done by hand with a simple u -substitution $u = \cos(\theta)$. Finish evaluating the integral. Did you get the same result as with technology?

► **solution**