

Name _____ Date _____

Instructions: Please show all of your work as partial credit will be given where appropriate, **and** there may be no credit given for problems where there is no work shown. All answers should be completely simplified, unless otherwise stated.

1. (10 pts each) Evaluate the integrals.

(a)
$$\int_{-2}^0 \int_1^x (3x^2 - 5y^3) dy dx$$

Answer 1(a): _____

(b)
$$\int_0^{\frac{\pi}{3}} \int_0^{1-\cos \theta} r \tan \theta dr d \theta$$

Answer 1(b): _____

(Note: This is #1 continued!)

$$(c) \int_0^1 \int_0^{x^2} \int_0^{x-y} 4x \, dz \, dy \, dx$$

Answer 1(c): _____

2. (12 pts) Find the area of the region inside the circle $r = 8 \sin \theta$ and outside the circle $r = 4$.

Answer 2: _____

3. (12 pts) If $R = \{(x, y) : 0 \leq x \leq 6, 0 \leq y \leq 4\}$ and P is the partition of R into six equal squares by the lines $x = 2$, $x = 4$, and $y = 2$. Approximate $\iint_R f(x, y) dA$ by calculating the corresponding Riemann sum $\sum_{k=1}^6 f(\bar{x}_k, \bar{y}_k) \Delta A_k$, assuming that (\bar{x}_k, \bar{y}_k) are the centers of the six squares. Take $f(x, y) = \sqrt{x+y}$.

Answer 3: _____

4. (12 pts) Find the volume of the solid in the first octant bounded by the plane $x+z=2$ and $y=6-x^2$.

Answer 4: _____

5. For the integral $V = \int_0^2 \int_3^{7-y^2} \int_0^{\sqrt{7-y^2-z}} dx dz dy$, do the following.

(a) (8 pts) Rewrite it, changing the order of integration to $dz dy dx$. (Don't evaluate it, just set it up.)

Answer 5(a): _____

(b) (7 pts) Rewrite it using cylindrical coordinates. (Don't evaluate it, just set it up.)

Answer 5(b): _____

6. (7 pts) For the integral $V = \int_0^{\sqrt{65}} \int_4^{\sqrt{81-y^2}} \int_0^{\sqrt{81-y^2-z^2}} dx dz dy$, rewrite it using spherical coordinates. (Don't evaluate it, just set it up.)

Answer: _____

7. (12 pts) Find the surface area of the part of the cone $z = \sqrt{x^2 + y^2}$ that is cut off by (and underneath) the plane $z = 4$.

Answer: _____

Extra Credit (5 pts): Calculate $\int_{-\infty}^{\infty} e^{-x^2} dx$. Note that you must show your calculation, you cannot just state the answer.

Extra Credit Answer: _____