Exam 3 Review

1. $\int_0^{\frac{\pi}{2}} \int_0^{\frac{\pi}{2}} \sin(x+y)\, dx\, dy$

2. $\int_0^1 \int_0^1 xe^{xy}\, dx\, dy$

3. $\int_0^1 \int_x^{e^x} 3xy^2\, dy\, dx$

4. $\int_0^1 \int_{y^2}^1 y\sin(x^2)\, dx\, dy$

5. $\iint_D xy\, dA$ where D is bounded by $y^2 = x^3$ and $y = x$ in the first quadrant

6. $\iint_D y\, dA$ where D is in the first quadrant bounded by $xy = 16, y = x$ and $y = 2$

7. $\iint_D (x^2+y^2)^{\frac{3}{2}}\, dA$ where D is in the first quadrant bounded by $y = 0, y = \sqrt{3}x, x^2+y^2 = 9$

8. $\iint_D \sqrt{x^2+y^2}$ where D is the closed disk with radius 1 centered at (0,1)

9. $\iiint_G x^2 z\, dV, \quad G = \{(x,y,z)|0 \le x \le 2, 0 \le y \le 2x, 0 \le z \le x\}$

10. $\iiint_G z\, dV$, G is the solid in the first octant bounded by $x + y = 2, y^2 + z^2 = 4$

11. $\iiint_G z^3\sqrt{x^2+y^2+z^2}\, dV$ where G is the top half of the solid unit sphere

12. $\int_0^{\sqrt{\frac{3}{2}}} \int_{\frac{1}{\sqrt{3}}x}^{\sqrt{2-x^2}} \int_{\sqrt{x^2+y^2}}^{\sqrt{4-x^2-y^2}} (x^2+y^2+z^2)^3\, dz\, dy\, dx$

13. Find the volume above $z = x^2 + y^2$ and below $z = \sqrt{x^2+y^2}$

14. Rewrite $\int_{-1}^1 \int_{x^2}^1 \int_0^{1-y} f(x,y,z)\, dz\, dy\, dx$ in the other 5 integration orders

15. Find the tangent plane to the surface defined by $\mathbf{r}(u,v) = \langle v^2, -uv, u^2\rangle$ at the point (4, 6, 9)

16. Find the tangent plane to the surface defined by $\mathbf{r}(u,v) = \langle 2-u, (2-u)\cos v, (2-u)\sin v\rangle$ at the point $(2, -1, \sqrt{3})$

17. Find the surface area of the solid of intersection of $x^2 + z^2 = a^2, y^2 + z^2 = a^2$.

18. Find the surface area of the solid of intersection of $x^2 + z^2 = a^2, y^2 + z^2 = a^2, x^2 + y^2 = a^2$.

19. Find the surface area of $z = x^2 + y$ above the triangle (0, 0), (1, 0), (0, 2)

20. Find the centroid of the portion of the disk bounded by $x^2 + y^2 = a^2$ and in the first quadrant

21. Repeat the prior problem with $\delta(x, y) = xy^2$

22. Find the center of gravity of the solid cone $z = \sqrt{x^2 + y^2}$ below $z = a$, with the density at each point proportional to the distance from the origin.

23. Use the transformation $(x, y, z) = (u^2, v^2, w^2)$ to find the volume under $\sqrt{x} + \sqrt{y} + \sqrt{z} = 1$ in the first quadrant.

24. $\displaystyle\iint\limits_R \frac{x + 2y}{\cos(x - y)}\, dA$, where R is bounded by $y = x, y = x - 1, x + 2y = 0, x + 2y = 2$.

25. Find the area between $y = x, y = 2x, x = y^2, x = 4y^2$. Hint: A transformation of variables might be helpful.