Math 3330 - Last Review

1 Polar

1. $\int_0^{\pi/2} \int_{-\theta}^{2\theta} e^{\theta^2}\, dr d\theta$

2. $\iint_R e^{x^2+y^2}\, dA$ where the R is the region inside the circle $x^2 + y^2 = 4$.

3. $\iint_R \frac{\ln(x^2+y^2)}{x^2+y^2}\, dA$ where the R is the region in the third quadrant between the circles $x^2 + y^2 = 9$ and $x^2 + y^2 = 16$.

4. $\iint_R \frac{\sqrt{x^2+y^2}}{\tan^{-1}(\frac{y}{x})}\, dA$ where the R is the region in the above the lines $y = x$ and $y = -x$ and inside the circle $x^2 + y^2 = 4$.

5. $\iint_R \frac{1}{x^2+y^2}\, dA$ where the R is the region in the first quadrant and inside the graph of $\sqrt{x^2+y^2} = 1 + \cos(\tan^{-1}(\frac{y}{x}))$.

6. $\iint_R \sqrt{x^2+y^2}\, dA$ where the R is the region in the circles $x^2+(y-1)^2 = 1$ and $(x-1)^2 + y^2 = 1$.

2 Line Integrals

2.1 dx or dy or ds

7. $\int_C x - y dx$ where C is the part of the parabola $y = 2x^2$ starting at $(-1, 2)$ and ending at $(2, 8)$.

8. $\int_C x - y dy$ where C is the line segment from the point $(1, 3)$ to the point $(2, 8)$.

9. $\int_C x - y ds$ where C is the line segment starting at $(1, -1)$ and ending at $(2, 2)$.

10. $\int_C x - y ds$ where C is the part of the circle $x^2 + y^2 = 9$ starting at $(0, 3)$ traveling counter-clockwise and ending at $(0, -3)$.

2.2 $d\mathbf{r}$

11. $\int_C \langle x+1, y-2x\rangle \cdot d\mathbf{r}$ where C is given by $\mathbf{r}(t) = \langle 2-t^2, 3t+1\rangle$ and $0 \le t \le 4$.

12. $\oint_C \langle x-y, x\rangle \cdot d\mathbf{r}$ where C is entire circle $x^2+y^2=4$.

13. $\oint_C \langle\rangle \cdot d\mathbf{r}$ where C is the outside of the triangle PQR with points $P(0,0)$, $Q(1,1)$ and $R(-2,1)$. For this problem travel clockwise.

3 Grene's Theorem

14. Compute the following line integrals. You may need Green's Theorem or maybe Green's Theorem is not possibvle to use.

    (a) $\oint_C \langle e^{x^2}+y^2, e^{y^2}-2x\rangle \cdot d\mathbf{r}$ where C is the outside of the triangle traveling counter-clockwise going thrgh the points $(1,2)$, $(1,5)$, $(-1,-1)$ and then returning to $(1,2)$.

    (b) $\oint_C \langle x+y^2, y-2x\rangle \cdot d\mathbf{r}$ where C is the entire circle $x^2+y^2=2$ starting at $(0,\sqrt{2})$ traveling counter-clockwise.

    (c) $\oint_C \langle \cos(x^2)-y, y-2x\rangle \cdot d\mathbf{r}$ where C is the part of the parabola $y^2=x$ starting at $(1,-1)$ and ending at $(1,1)$ and then traveling along the line segment from $(1,1)$ to $(1,-1)$.

    (d) $\int_C \langle 1, x-2y\rangle \cdot d\mathbf{r}$ where C is the part of the parabola $y^2=x$ starting at $(1,-1)$ and ending at $(1,1)$.