Math2E - Practice Midterm 1

1. Find the gradient field corresponding to f, $f(x, y, z) = \sqrt{x^2 + y^2 + z^2}$.

2. Evaluate $\int\int_R (y+3x)^2 dA$, where R is bounded by $y = 1-3x, y = 3-3x, y = x-1,$ and $y = x-3$.

3. (a): Evaluate $\int_C 3xds$, where C is the line segment from $(0,0)$ to $(1,0)$, followed by the quarter circle to $(0,1)$;
   (b): Evaluate $\int_C 2xdx$, where C is the quarter circle $x^2+y^2=4$ from $(2,0)$ to $(0,2)$.

4. Evaluate $\int_C \mathbf{F} \cdot d\mathbf{r}$, where $\mathbf{F}(x, y, z) = (z, y, 0)$, C is the line segment from $(1, 0, 2)$ to $(2, 4, 2)$.

5. $\mathbf{F}(x, y) = (x^2 + 1, y^3 - 3y + 2)$
   (a): Find a function f such that $\mathbf{F} = \nabla f$;
   (b): Evaluate $\int_C \mathbf{F} \cdot d\mathbf{r}$, where C is the top half circle from $(-4, 0)$ to $(4, 0)$.