Math 223 Final

Name _____

I.D. # _____

11. (16 pts) Decide whether or not the given vector fields are path-independent. Give a justification for your answer.

(a) $\overrightarrow{F}(x,y) = x^2 e^{y^3}\overrightarrow{i} + y^2 e^{x^3}\overrightarrow{j}$

(b) $\overrightarrow{F}(x,y) = x^2y^3\overrightarrow{i} + (x^3y^2 + y^3e^{y^4})\overrightarrow{j}$

12. (28 pts) Evaluate the line integral $\int_C \overrightarrow{F}\cdot d\overrightarrow{r}$, where

(a) $\overrightarrow{F}(x,y) = x\overrightarrow{i} + xy\overrightarrow{j}$ and C is path from (0,0) to $(1,0)$ and then from $(1,0)$ to (1,1).

(b) $\overrightarrow{F}(x,y) = x\overrightarrow{i} + xy\overrightarrow{j}$ and C is part of the curve $y = x^2$ from (0,0) to (1,1).

(c) $\overrightarrow{F}(x,y) = xy^2\overrightarrow{i} + x^2y\overrightarrow{j}$ and C is part of the curve $y = x^{10}e^{x^4}$ from (0,0) to (1,e).

(d) $\overrightarrow{F}(x,y) = 2y\overrightarrow{i} - x\overrightarrow{j}$ and C is a unit circle, oriented clockwise.

13. (24 pts) Compute the flux of the following vector field $\overrightarrow{F}(x,y,z)$ through the surface S.

(a) $\overrightarrow{F}(x,y,z) = \overrightarrow{i} + 2\overrightarrow{j} + 3\overrightarrow{k}$ and S is the rectangle with vertice $(1,0,0)$, $(1,1,0)$, $(0,1,1)$, and $(0,0,1)$, oriented upward.

(b) $\overrightarrow{F}(x,y,z) = 2x\overrightarrow{i} + y^2\overrightarrow{j} + z\overrightarrow{k}$ and S is the rectangle with vertice $(1,0,0)$, $(1,1,0)$, $(0,1,1)$, and $(0,0,1)$, oriented upward.

(c) $\overrightarrow{F}(x,y,z) = x\overrightarrow{i} + 2y\overrightarrow{j} + 3z\overrightarrow{k}$ and S is the sphere $x^2 + y^2 + z^2 = 4$, oriented outward.