Quiz

1. Answer the following questions and provide a reason for your answer:
   a) Can you apply the Fundamental Theorem of line integrals to the function \( f(x, y, z) = xy \sin(z) \cos(x^2 + y^2) \) ?

   b) Can you apply the Fundamental Theorem of line integrals to the vector field \( \vec{F}(x, y) = <6xy^2 - 3x^2, 6x^2y + 3y^2 - 2x^3> \) ?

   c) Can you apply Green’s theorem to a curve \( C \), which is a straight line from \((0,0,0) \) to \((1,2,3)\)?

2. Evaluate the following integrals, using whatever method/shortcut you think is most appropriate (including Maple):
   a) \( \int_C \vec{F} \cdot d\vec{r} \) where \( \vec{F}(x, y) = <y, x^2> \) and \( C \) is the curve given by \( \vec{r}(t) = <4 - t, 4t - t^2>, \quad 0 \leq t \leq 3 \)

   b) \( \int_C \vec{F} \cdot d\vec{r} \) where \( \vec{F}(x, y) = <e^t \cos(y), -e^t \sin(y)> \) and \( C \) is the curve \( \vec{r}(t) = <2\cos(t), 2\sin(t)>, \quad 0 \leq t \leq 2\pi \)

   c) \( \int_C 2xyz \, dx + x^2z \, dy + x^2y \, dz \) where \( C \) is some smooth curve from \((0,0,0) \) to \((1,4,3)\)

   d) \( \int_C y^3 \, dx + (x^3 + 3xy^2) \, dy \) where \( C \) is the path from \((0,0) \) to \((1,1)\) along the graph of \( y = x^3 \) and from \((1,1)\) back to \((0,0)\) along the graph of \( y = x \).

   e) \( \int_C y \, dx + 2 \, x \, dy \) where \( C \) is the boundary of the square with vertices \((0,0), (0,2), (2,0), \) and \((2,2)\)