Calculus 251:C3   Worksheet 16.2

(1) For each part, calculate $\int_C \vec{F} \cdot d\vec{r}$ for the given field $\vec{F}$ and curve C.

    (a) $\vec{F}(x, y) = \langle x, y \rangle$
       C is portion of the parabola $16y = x^2$ from $(4, 1)$ to the origin.

    (b) $\vec{F}(x, y) = \dfrac{\langle x, y \rangle}{(x^2 + y^2)^{3/2}}$
       C is the path $\vec{r}(t) = \langle t^2, 3t^2 \rangle$ for $1 \le t \le 2$

    (c) $\vec{F}(x, y, z) = \langle -y, x, z \rangle$
       C is the helix $\vec{r}(t) = \langle 2\cos(t), 2\sin(t), \frac{t}{2\pi} \rangle$ for $0 \le t \le 2\pi$

    (d) $\vec{F}(x, y, z) = \langle x + y, x - y, x \rangle$
       C is the line segment from $(1, 2, 4)$ to $(3, 8, 13)$

    (e) $\vec{F}(x, y) = \langle x^2, xy \rangle$
       C is a quarter circle with radius 3 centered at the origin from $(0, 3)$ to $(-3, 0)$

(2) Let C be the path $\vec{r}(t) = \langle \cos(t), \tan(t), t \rangle$ for $0 \le t \le \pi/4$. Calculate

$$\int_C \left(z \, dx + x^2 \, dy + y \, dz \right)$$

(3) A particle travels in the force field $\vec{F}(x, y, z) = \langle e^z, e^{x-y}, e^y \rangle$ along the piecewise linear path starting from the origin, then to $(0, 0, 1)$, then to $(0, 1, 1)$, and ending at $(-1, 1, 1)$. Calculate the work done by the force field on the particle