Line Integrals of Vector Fields- HW Problems

Let $\vec{V}(x,y,z) = y\vec{i} + x\vec{j} + z\vec{k}$. Evaluate the integral of $\vec{V}$ along each of the curves below.

1. $\vec{c}(t) =< t, 2t, 3t >; \quad 0 \le t \le 1$
2. $\vec{c}(t) =< \sin(t), \cos(t), 0 >; \quad 0 \le t \le 2\pi$
3. $\vec{c}(t) =< t, t^2, t^3 >; \quad 0 \le t \le 1$

Let $\vec{F}(x,y) = x\vec{j}$. Evaluate the integral of $\vec{F}$ over the following curves.

4. $\vec{c}(t) =< \cos(t), \sin(t) >; \quad 0 \le t \le 2\pi$
5. $\vec{c}(t) =< -\cos(t), \sin(t) >; \quad 0 \le t \le 2\pi$
6. $\vec{c}(t) =< \cos(2t), \sin(2t) >; \quad 0 \le t \le \pi$

Evaluate the following line integrals.

7. $\int_c ydx + x^2dy$; where c is the line segment from $(1,-1)$ to $(4,5)$

8. $\int_c y^2dx + z^2dy + x^2dz$; where c is the curve $x = z^2$, $y = 2$ where $-1 \le z \le 2$

9. $\int_c xydx + yzdy + xzdz$; where $\vec{c}(t) =< t, t^2, t^{\frac{1}{2}} >; \quad 0 \le t \le 1$

10. $\int_c xydx + yzdy + xzdz$; where c is the triangle oriented by starting at the vertex $(2,0,0)$, then going to the vertex $(0,2,0)$, then to the vertex $(0,0,2)$, and then back to $(2,0,0)$.

11. $\int_c (x-y)dx + ydy$; where c is the curve $y = \sin(x)$; $0 \le x \le \pi$

12. Consider the force field $\vec{F}(x,y,z) =< y, -2x, 2 >$. Find the work done to move a particle along a curve given by $\vec{c}(t) =< t, t^2, t^3 >$ from the point $(1,1,1)$ to the point $(2,4,8)$.

13. Evaluate $\int_c x^2dx + xdy$; where c is the circle $x^2 + y^2 = 4$ oriented counterclockwise.

14. Evaluate $\int_c 3x^2dx + 3y^2dy$; where c is a smooth closed curve (Note: If $\vec{F}(x,y,z) = (3x^2)\vec{\imath} + (3y^2)\vec{\jmath} + (0)\vec{k}$ then $\vec{F} = \nabla f$, where $f(x,y,z) = x^3 + y^3$).