Supplemental Problems: Line Integrals

1. $\displaystyle\int_C 3x^2yz\,ds$ where C is the curve parameterized by $\mathbf{X}(t) = \left(t, t^2, \frac{2}{3}t^3\right)$ and $0 \le t \le 1$.
2. $\displaystyle\int_C xy^4\,ds$ where C is the right half of the circle centered at the origin of radius 4.
3. $\displaystyle\int_C x^2z\,ds$ where C is the line segment from $(0, 6, -1)$ to $(4, 1, 5)$.
4. $\displaystyle\int_C \frac{x}{1+y^2}\,ds$ where C is the line segment $x = 1 + 2t$, $y = t$ where $0 \le t \le 1$.
5. $\displaystyle\int_C \frac{e^{-z}}{x^2+y^2}\,ds$ where C is the helix $\mathbf{X}(t) = (2\cos(t), 2\sin(t), t)$ and $0 \le t \le 2\pi$.
6. Find the centroid of the curve C: the upper-half of the unit circle plus the x-axis from -1 to 1. *Hint:* Use geometry and symmetry to compute 2 of the 3 line integrals.
7. Find the centroid of the helix C parameterized by $\mathbf{X}(t) = (2\sin(t), 2\cos(t), 3t)$ where $0 \le t \le 2\pi$.