find the mass of the wire along a curve:

$r = 3ti + 3t^2 j + 2t^3 k \quad , (0 \le t \le 1)$

if the density at $r(t)$ is $1+t$ grams/unit length

we have the limit $0 \le t \le 1$ and the function $f(r(t)) = 1+t$

we use:

$$\int_0^1 f(r(t))\, dS = \int_0^1 1+t\, ds$$

we then find dS with:

$$dS = \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\, dt =$$

$\frac{dx}{dt} = 3$ and $\frac{dy}{dt} = 6t$ and $\frac{dz}{dt} = 6t^2$

$$dS = \sqrt{3^2 + (6t)^2 + (6t^2)^2} = 9 + 36t^2 + 36t^4$$

we insert into the formula.

$$\int_0^1 (1+t)\cdot(9+36t^2+36t^4)\, dt$$

$$= \left[\frac{3t\sqrt{(1+2t^2)^2}\cdot(6+3t+4t^2+3t^3)}{6+12t^2} \right]_0^1$$

$$= \underline{\underline{8}}\ g$$