**Q2**

*(a)* Using the substitution $u = t^2, du = 2tdt$:

$$\begin{aligned}
\int t \arctan(t^2)dt &= \frac{1}{2}\int \arctan(u)du \\
&= \frac{1}{2}\left(u\arctan(u) - \frac{1}{2}\ln|u^2+1|\right) + c \\
&= \frac{1}{2}\left(t^2\arctan(t^2) - \frac{1}{2}\ln|t^4+1|\right) + c
\end{aligned}$$

The antiderivative of $\arctan t$ is given by earlier proof.

*(b)* Using integration by parts:

$$u = u, \quad du = 1, \quad dv = f''(u), \quad v = f'(u)$$

Then

$$\int_0^1 uf''(u) = uf'(u) - f(u)\Big|_0^1 = -6$$