Section 2

1. $\nabla_x f(x) = \frac{d}{dx}(Ax)^T \in \mathbb{R}^{1\times n}$

$= \frac{d}{dx} x^T A^T$

$= (A^T)^T$

$= A$

2. $(x^TAy)(x^TAy)^{-1} = (x^TAy)(x^Ty)^{-1}$

$= x^TAy\, y^{-1}(x^T)^{-1}$

$= x^T A \cdot I (x^T)^{-1} = x^T A (x^T)^{-1}$

We know that $x^T A (x^T)^{-1} = I$

then $(x^T)^{-1} x^T A (x^T)^{-1}(x^T) = (x^T)^{-1} I (x^T)$

$I \cdot A \cdot I = (x^T)^{-1}(x^T)$

$A = I$