(A) Prove $T(n) = 4n^3 + 2n + 4 \in \Omega(n)$

$$4n^3 + 2n + 4 \geq cn$$
$$n_0 = 1, c = 10$$
$$4n^3 + 2n + 4 \geq 10n \forall n \geq 1$$
$$\therefore T(n) \in \Omega(n)$$

(B) Is $O(n^2)$ a tight upper bound for $T(n)$? If not, what is the tight upper bound for $T(n)$?

$$\frac{4n^3 + 2n + 4}{n^2} \leq \frac{cn^2}{n^2}$$
$$\lim_{n \to \infty} 4n + \frac{2}{n} + \frac{4}{n^2} \geq c$$

$$\therefore T(n) \notin O(n^2)$$

A better tight upper bound is $O(n^3)$

$$\forall n \geq 1$$
$$T(n) \leq 10c^3$$
$$\therefore T(n) \in O(n^2)$$

(C) $T(n) \notin O(n^2) \therefore T(n) \notin \Omega(n^2)$