HW 2

Question 1:

(a) $5n^3 + 2n^2 + 3n = O(n^3)$

$5n^3 + 2n^2 + 3n < 5n^3 + 2n^3 + 3n^3$ for $n > 1$

$5n^3 + 2n^3 + 3n^3 = 10n^3$, $n > 1$

$10n^3 < cn^3$, $n > 1$

$\boxed{c \geq 11, n > 1 ; g(n) = n^3}$

(b) $\sqrt{7n^2+2n-8} = \Theta(n)$

O:

$\sqrt{7n^2+2n-8} < \sqrt{7n^2+2n}$

$\sqrt{7n^2+2n} < \sqrt{7n^2+2n^2}$ for $n > 1$

$\sqrt{7n^2+2n^2} = \sqrt{9n^2}$ for $n > 1$

$= 3n$ for $n > 1$

$3n < cn$, $n > 1$

$\boxed{c \geq 4, n > 1 ; g(n) = n}$

Ω:

$\sqrt{7n^2+2n-8} > \sqrt{7n^2}$ for $n > 4$

$= \sqrt{7} \cdot n$ for $n > 4$

$\sqrt{7}\, n \geq cn$, $n > 4$

$\boxed{c \leq 3, n > 4 ; g(n) = n}$

(c) $d(n) = O(f(n))$ → constants 'a' and 'b'

$e(n) = O(g(n))$ → constants 'h' and 'i'

$e(n) \cdot d(n) \leq (a \cdot h) f(n) g(n)$ for $n \geq (b+i)$

$\boxed{d(n)e(n) = O[f(n)g(n)]}$

Question 2:

```
def example1(lst):
    n=len(lst)
    total=0
    for j in range(n):
        for k in range(1+j):
            total+=lst[k]
return total
```

n × n

$\boxed{\hookrightarrow \Theta(n^2)}$

```
def example2(lst):
    n=len(lst)
    prefix=0
    total=0
    for j in range(n):
        prefix += lst[j]
        total += prefix
    return total
```

n

↳ $\Theta(n)$

```
def example3(n):
    i=1
    sum=0
    while (i < n*n):
        i *= 2
        sum += i
    return sum
```

n^2

log

↳ $\Theta(\log(n^2))$

```
def example4(n):
    i=n
    sum=0
    while (i>1):
        for j in range(i):
            sum += i*j
        i //= 2
    return sum
```

n

x n iterations

↳ $\Theta(n^2)$