3-A) $f = 1+4n^2$ $\qquad g = n^2$

$$\lim_{n\to\infty} \frac{1+4n^2}{n^2} \div \frac{n^2}{n^2} = \lim_{n\to\infty} \frac{\frac{1}{n^2}+4}{1} = \underline{\underline{4}}$$

Since the limit exists then the statement is "True" $\quad f = O(g) \to 1+4n^2 = O(n^2)$

3-B) $f = n^2 - 2n$ $\qquad g = n$

$$\lim_{n\to\infty} \frac{f}{g} = \lim_{n\to\infty} \frac{n^2-2n}{n} = \lim_{n\to\infty} 1-2n = -\infty$$

Since the limit is not defined then f is NOT $O(n)$

3-C) $f = \log n$ $\qquad g = n$

Since $\lim_{n\to\infty} \frac{\log n}{n} = \frac{\infty}{\infty} \to$ use l'hopital's Rule

$$\lim_{n\to\infty} \frac{\frac{1}{n}}{1} = 0 \to \therefore \log n = \underset{\text{little oh}}{o}(n)$$

3-D) $f = n$ $\qquad g = n$

$$\lim_{n\to\infty} \frac{f}{g} = 1 \to \text{Not Zero}$$

So n is NOT $o(n)$

(3-A) Another way

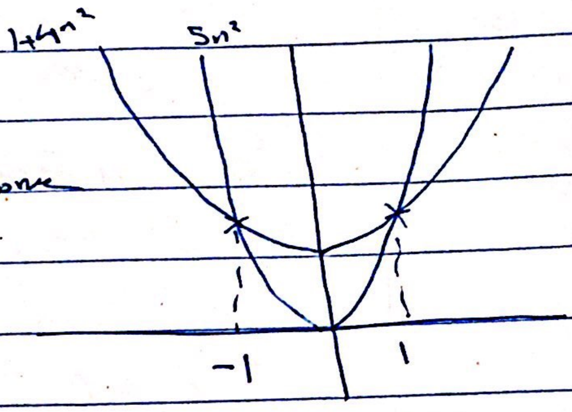
$f = 1 + 4n^2$ $\qquad\qquad$ $5g = 5n^2$

we need to get a constant

c that makes cg

eventually overtakes f at some

start point n_0



for $c = 5$

$$5n^2 = 1 + 4n^2$$

$$n^2 = 1$$

$$n = \pm 1$$

So for $c = 5$ and $n_0 = 1$

$$f \leq cg$$

Then $f = O(g)$

$$1 + 4n^2 = O(n^2)$$

3-B) Another way

$f = n^2 - 2n$ $\qquad\qquad$ $g = n$

Because f is of higher order than g

there is no constant that can make

cn eventually overtakes $n^2 - 2n$

So $n^2 - 2n$ is Not $O(n)$