Question 1 :

Q.1.a:

$$\log_{10}(n^2) \rightarrow O(\log_2(n))$$

$$\Rightarrow \log_{10}(n^2) \leq c \log_2(n)$$

c/n/ We assume the inequality is true:

$$\log_{10}(n^2) \lneq 2 \log_{10}(n)$$

$$\Rightarrow 2 \log_{10}(n) \leq c \log_2(n)$$

$$\boxed{2 \log_{10}(n) \leq 2 \log_2(n) \\ \left(c \cdot O(n)\right)}$$

Thus, $\log_{10}(n^2)$ is $O(\log_2(n))$ is true.

Q1 b:

$$n\left(10n^2 - 2\sqrt{n}\right) \geq n^5$$

$$10n^3 - 2n^{3/2} \geq n^5$$

$$9n^3 \geq 2n^{3/2}$$

$$\downarrow$$

$$\in (n^5)$$

So, because $9n^3$ is obviously bigger than $2n^{3/2}$
Thus, the function is $\Omega(n^5)$

~~$\dfrac{n^3}{n^{3/2}}$~~

~~$\dfrac{9n^3}{n^{3/2}}$~~

$$10n^3 - 2n^{5/2} = n^5$$
$$9n^3 - 2n^{2/5}$$
$$n^{2/5} = \frac{9}{2}n^5$$

~~$n^{2/3} \cdot \frac{9}{2}$~~ $\boxed{n^{3/2} - \frac{2}{5}}$

Q1c:

For the higher bound: it has to be $f(n) \geqslant cg(n)$
$\rightarrow$ We conclude that the condition isn't satisfied because $(n\sin(n))^2$ is a periodic function that tends to 100 when $(n\sin(n))^2 \rightarrow 0$

$C_2 > 0$ values can't result in $g(n) < f(n)$ (~~for all~~)
$\forall n_0$ such that $n_0 \leq n$.
Thus it's false.

Question 2 :

Q2a:

```
boolean oneEdit(String s1, String s2) {
// precondition s1.length() == s2.length()
  boolean foundDifference=false;     Θ(1)
  n = s1.length();     Θ(1)          Θ(1)
  for (i=0; i< n; i++) {    Θ(m)
      if (s1.charAt(i) != s2.charAt(i)){  Θ(1)
          if (foundDifference) {
              return false;
          }
          foundDifference=true;
      }
  }
  return true;    Θ(1)
}
```

$$\text{Best case}: \Theta(1) + \Theta(1) + \Theta(m)\Theta(1) + \Theta(1)$$

$$= \boxed{\Theta(n)}$$

```
boolean oneEdit(String s1, String s2) {
// precondition s1.length() == s2.length()
  boolean foundDifference=false;   Θ(1)
  n = s1.length();  Θ(1)
  for (i=0; i< n; i++) {  Θ(m)
      if (s1.charAt(i) != s2.charAt(i)){  Θ(1)
          if (foundDifference) {  Θ(1)
              return false;  Θ(1)
          }
          foundDifference=true;
      }
  }
  return true;
}
```

$$\text{Worst case}: \Theta(1) + \Theta(1) + \Theta(m)\Theta(1)\Theta(1)\Theta(1)$$

$$= \boxed{\Theta(n)}$$

Q2b:

```
oneEdit(s1, s2):
    foundDifference ← false
    n ← s1.length()
    counter ← 0
    for(i ← 0 to n)do:
        if(s1.charAt(i) ≠ s2.charAt(i)) then:
            counter ← counter + 1
        if(counter > 100):
            return false
    return true
```