master's theorm.

If $f(n) \in \Theta(n^k)$ or $f(n) = c^* n^d$ where $d \geq 0$ in recurrence

$T(n) = aT(n/b) + f(n)$ then.

$$T(n) \in \begin{cases} \Theta(n^k) & \text{, if } (a < b^d) \\ \Theta(n^k \log n) & \text{, if } (a = b^d) \\ \Theta(n^{\log_b a}) & \text{, if } (a > b^d) \end{cases}$$

1) $T(n) = 8T(n/2) + 1000n^2$.

$a = 8$ $\quad b = 2$ $\quad f(n) = 1000n^2 = c^* n^d$ $\therefore d = 2$.

$b^d = 2^2 = 4$

Hence $a > b^d$

$T(n) \in \Theta(n^{\log_b a})$. $\quad \boxed{\log_b a = \log_2 8 = 3}$

$\therefore T(n) \in \Theta(n^3)$.

2) $T(n) = 2T(n/2) + n^2$.

$a = 2$ $\quad b = 2$ $\quad d = 2$.

$b^d = 2^2 = 4$.

Hence $a < b^d$. $T(n) \in \Theta(n^d)$

$\Rightarrow T(n) \in \Theta(n^2)$

3) $T(n) = 2T(n/2) + 10n$

$a = 2$ $\quad b = 2$ $\quad d = 1$

$b^d = 2^1 = 2$

Hence, $a = b^d$.

$T(n) \in \Theta(n^d \log n)$.

$\Rightarrow T(n) \in \Theta(n \log n)$