d) $T(n) = 7T\left(\frac{n}{3}\right) + n^3$

$a = 7,\ b = 3,\ k = \log_3 7 \approx 1.77$

we can apply the 3rd case of The masters thm.

i) for $\varepsilon \approx 1.23$; $f(n)$ is $\Omega(n^{1.77+\varepsilon}) = \Omega(n^3)$.

ii) $7\left(\frac{n}{3}\right)^3 = \frac{7}{27}n^3 \leq \frac{7}{27}n^3 \cdot c = \frac{7}{27} < 1$.

$\Rightarrow T(n)$ is $\Theta(n^3)$.

e) $T(n) = T\left(\frac{n}{2}\right) + n(2 - \cos n)$.

$a = 1,\ b = 2,\ k = \log_2 1 = 0$. $f(n) = n(2 - \cos n)$.

None of the cases apply.

i) for the 1st case,

$f(n)$ can't be $O(n^{\log_2 1 - \varepsilon})$ for any ε so because $\log_2 1 = 0$.

ii) for the second case there is no p s.t.

$n(2 - \cos n)$ is $\Theta(\log^p n)$.

iii) the first condition case can be satisfied, however.

the second condition.

if $\frac{n}{2}\left(2 - \cos\frac{n}{2}\right) \leq cn(2 - \cos n)$ can't be satisfied with $c < 1$. ~~(graph later~~

~~because for, x, cos n~~

because for some values for n, where n is near its max value, $\cos\frac{n}{2}$ is near its ~~min~~ minimum.

hence the multiplier c^2 will be larger > 1.

(graph after this page).