1. Compute

1. $\sum_{i=-10}^{n}(\frac{1}{2})^i + \sum_{i=200}^{n^2}(3)^i$

$$\begin{aligned}
\sum_{i=-10}^{n}(\frac{1}{2})^i + \sum_{i=200}^{n^2}(3)^i &= \sum_{i=-10}^{-1}(\frac{1}{2})^i + \sum_{i=0}^{n}(\frac{1}{2})^i + \sum_{i=0}^{n^2}(3^i) - \sum_{i=0}^{199}(3^i) \\
&= \sum_{i=-10}^{0}(\frac{1}{2})^i - \sum_{i=0}^{0}(\frac{1}{2})^i + \sum_{i=0}^{n^2}(3^i) - \sum_{i=0}^{199}(3^i) \\
&= -\sum_{i=0}^{10}(\frac{1}{2})^i - 1 + \frac{3^{n^2+1}-1}{3-1} - \frac{3^{200}-1}{3-1} \\
&= -\frac{(\frac{1}{2})^{11}-1}{\frac{1}{2}-1} - 1 + \frac{3^{n^2+1}-1}{3-1} - \frac{3^{200}-1}{3-1}
\end{aligned}$$

2. $7^{log_2 log_2 4} + log_3 log_2^2 8$

$$\begin{aligned}
7^{log_2 log_2 4} + log_3 log_2^2 8 &= 7^{log_2 2} + log_3 9 \\
&= 7 + 2 \\
&= 9
\end{aligned}$$

2. Use L'Hopital's rule to determine the limit of

$$lim_{x\to\infty}\frac{xlnx^2+3x}{\sqrt{4x^2-1}}$$

$$\begin{aligned}
lim_{x\to\infty}\frac{xlnx^2+3x}{\sqrt{4x^2-1}} &= lim_{x\to\infty}\frac{2\cdot x\cdot lnx + 3\cdot x}{\sqrt{4\cdot x^2-1}} \\
&= lim_{x\to\infty}\frac{2\cdot lnx+3}{\frac{1}{2}(4\cdot x^2-1)^{-\frac{1}{2}}}\cdot 8\cdot x \\
&= \infty
\end{aligned}$$

3. What is the growth of the below function

$$f(n) = 8^{log_2 n} + \sqrt{n^6 log_2 n} + nlog_2^8 n + log_2 n^{2^{log_2 n}}$$

1. $\Theta(n^3)$

2. $\Theta(n^3 log_2 n)$
3. $\Theta(n^3 \sqrt{log_2 n})$
4. $\Theta(n log_2 n)$
5. Neither!

$$\begin{aligned} f(n) &= 8^{log_2 n} + \sqrt{n^6 log_2 n} + n \cdot log_2^8 n + log_2 n^{2^{log_2 n}} \\ &= 2^{log_2 n^3} + n^3 \cdot \sqrt{log_2 n} + n \cdot log_2^8 n + n \cdot log_2 n \\ &= n^3 + n^3 \cdot \sqrt{log_2 n} + n \cdot log_2^8 n + n \cdot log_2 n \end{aligned}$$

Which is $\Theta(n^3 \sqrt{log_2 n})$.