# M133: Series - Extra Problems: Limits of Sequences (Solutions)

1). $\lim\limits_{n\to\infty} \dfrac{6n^4+20n^2-1}{-2n^5+3} = \boxed{0}$

2). $\lim\limits_{n\to\infty} \dfrac{-4n^2+6n}{3n^2+3n+1} = \boxed{\dfrac{-4}{3}}$

3). $\lim\limits_{n\to\infty} \dfrac{10n^3-6n^2+n}{-3n^2+1} = \boxed{-\infty}$

4). $\lim\limits_{n\to\infty} \dfrac{6n^2+3}{n-100} = \boxed{\infty}$

5). $\lim\limits_{n\to\infty} \dfrac{-\sqrt{3n^5+20n+4}}{8\sqrt{n^5+3n^2-n}} = \boxed{\dfrac{-\sqrt{3}}{8}}$

6). $\lim\limits_{n\to\infty} \dfrac{n^2}{2\sqrt{n^5+3n^2-n}} = \boxed{0}$

7). $\lim\limits_{n\to\infty} \dfrac{(2n^2-n+4)^4}{6(-n^4+2)^2} = \dfrac{2^4}{6} = \boxed{\dfrac{8}{3}}$

8). $\lim\limits_{n\to\infty} \dfrac{\sqrt{3n^5+2n^2-1}}{-n^2} = \boxed{-\infty}$

9). $\lim\limits_{n\to\infty} \dfrac{-2\sqrt{n^{21}-7n^3+1}}{6n^{10}+2} = \boxed{-\infty}$

10). $\lim\limits_{n\to\infty} \dfrac{(-2n^2+6n-1)^3}{-12n^6-20} = \dfrac{(-2)^3}{-12} = \dfrac{-8}{-12} = \boxed{\dfrac{2}{3}}$

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11). $\lim\limits_{n\to\infty} \left(1+\dfrac{10}{n}\right)^n = \lim\limits_{n\to\infty} \Bigg[\underbrace{\left(1+\dfrac{1}{\frac{n}{10}}\right)^{\frac{n}{10}}}_{\xrightarrow{n\to\infty} e}\Bigg]^{10} = \boxed{e^{10}}$

12). $\lim\limits_{n\to\infty} \left(\dfrac{n}{n+1}\right)^{5n} = \lim\limits_{n\to\infty} \left(\dfrac{1}{\frac{n+1}{n}}\right)^{5n} = \lim\limits_{n\to\infty} \dfrac{1}{\left(1+\frac{1}{n}\right)^{5n}} = \lim\limits_{n\to\infty} \dfrac{1}{\Big[\underbrace{\left(1+\frac{1}{n}\right)^n}_{\xrightarrow{n\to\infty} e}\Big]^5} = \boxed{\dfrac{1}{e^5}}$

13). $\lim\limits_{n\to\infty} \dfrac{6n^2(4n-1)!}{(4n+1)!} = \lim\limits_{n\to\infty} \dfrac{6n^2}{4n(4n+1)} = \dfrac{6}{16} = \boxed{\dfrac{3}{8}}$

14). $\lim\limits_{n\to\infty} \dfrac{3^{n+3}}{8^n} = \lim\limits_{n\to\infty} 27\cdot\left(\dfrac{3}{8}\right)^n = \boxed{0}$

15). $\lim\limits_{n\to\infty} \left(\dfrac{3n+6}{3n+2}\right)^{10n+2} = \lim\limits_{n\to\infty} \left(1+\dfrac{1}{\frac{3n+2}{4}}\right)^{10n+2} = \lim\limits_{n\to\infty} \Bigg[\underbrace{\left(1+\dfrac{1}{\frac{3n+2}{4}}\right)^{\frac{3n+2}{4}}}_{\to e}\Bigg]^{\frac{4}{3n+2}(10n+2)}$

$\dfrac{4}{3n+2}(10n+2) \to \dfrac{10\cdot 4}{3} = \dfrac{40}{3}$

$= \boxed{e^{\frac{40}{3}}}$