$a_n = 3n + 4$ — arithmetic sequence

$a_1 = 3 + 4 = 7$ $\quad +3$

$a_2 = 6 + 4 = 10$ $\quad +3$

$a_3 = 13$ $\quad +3$

$n \to \infty \qquad a_n \to \infty$

DIVERGES

$\lim\limits_{n \to \infty} a_n = L \quad \to$ CONVERGES

$\lim\limits_{n \to \infty} a_n = \text{DNE} \,/\, \infty \,/\, +\infty \quad \to$ DIVERGES

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$a_n = \dfrac{1}{3^n} \quad \to \quad \dfrac{1}{3}, \dfrac{1}{9}, \dfrac{1}{27}, \dfrac{1}{81}$

$n \to \infty \qquad a_n \to 0$ $\qquad$ <u>converges</u>

$$\lim_{n \to \infty} \frac{1}{3^n} = 0$$

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$a_n = \dfrac{8n}{3n - 5}$

$$\lim_{n \to \infty} \frac{8n}{3n-5} = \underline{\underline{\frac{8}{3}}} \quad \to \text{converges}$$

$a_n = \sin(n)$ $\qquad$ $\sin(n)$ always between 1 and -1

$$\lim_{n\to\infty} \sin(n) = DNE \quad \rightarrow \text{diverges}$$

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$$a_n = \cos\left(\frac{1}{n}\right)$$

$$\lim_{n\to\infty} \cos\left(\frac{1}{n}\right) = \cos(0) = \underline{\underline{1}} \quad \rightarrow \text{converges}$$

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$$a_n = \frac{\sin(n)}{n}$$

$$\lim_{n\to\infty} \frac{\sin(n)}{n} = \text{squeeze theorem:} \quad = 0$$

$$-1 \le \sin(n) \le 1 \qquad | \div n$$

$$-\frac{1}{n} \le \frac{\sin(n)}{n} \le \frac{1}{n}$$

$$0 \le \frac{\sin(n)}{n} \le 0$$

<u>converges</u>

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$$a_n = \frac{\ln(n^4)}{5n}$$

$$\lim_{n\to\infty} \frac{\ln(n^4)}{5n} = \lim_{n\to\infty} \frac{4\ln(n)}{5n} \overset{H}{=} \lim_{n\to\infty} \frac{4/n}{5} = \frac{4}{5} \lim_{n\to\infty} \frac{1}{n}$$

$$= \frac{4}{5} \cdot 0 = 0 \qquad \text{converges}$$

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$a_n = n \cdot \sin\left(\frac{1}{n}\right)$

$$\lim_{n\to\infty} n \cdot \sin\left(\frac{1}{n}\right) = \lim_{n\to\infty} \frac{1 \sin(1/n)}{1/n} \overset{H}{=} \lim_{n\to\infty} \frac{\cos(1/n) \cancel{1/n^2}}{\cancel{1/n^2}} =$$

$$\lim_{n\to\infty} \cos\left(\frac{1}{n}\right) = \cos(0) = \underline{1}$$ converges

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$$a_n = \frac{(n+1)!}{n!} = \frac{(n+1)\cancel{n!}}{\cancel{n!}} = (n+1)$$

$$\lim_{n\to\infty} (n+1) = \infty$$ diverges

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$$a_n = \frac{4n}{\sqrt{n^2+5}}$$

$$\lim_{n\to\infty} \frac{4n}{\sqrt{n^2+5}} = \frac{4n}{n} = 4$$ converges

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Increasing / Decreasing Seq.

if $f'(x)$ is negative $\rightarrow$ decreasing

if $f'(x)$ is positive $\rightarrow$ increasing