

201-SH3-AB - Exercises #9: l'Hospital's Rule

Evaluate the following limits, using l'Hospital's rule where appropriate.

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|---|---|---|
| (1) $\lim_{x \rightarrow \infty} \frac{2x^3 + \sqrt{x}}{3 - 5x^3}$ | (8) $\lim_{x \rightarrow \infty} \frac{\sqrt{x+2} + 5\sqrt{x+3}}{\sqrt{4x+1}}$ | (15) $\lim_{x \rightarrow -1} \frac{x^3 + x^2 + 4x + 4}{x^3 + 3x^2 + 6x + 4}$ |
| (2) $\lim_{x \rightarrow 0} \frac{e^{-3x} + x^3 - 1}{1 - e^{5x}}$ | (9) $\lim_{x \rightarrow 0} \frac{6x^3 - 5x}{e^x - 1}$ | (16) $\lim_{x \rightarrow \infty} \frac{\sqrt{4x^2 + 3}}{9 - x}$ |
| (3) $\lim_{x \rightarrow 0} \frac{e^x - x^2 - 1}{\sin(2x)}$ | (10) $\lim_{x \rightarrow -2} \frac{3x^3 + 11x^2 + 8x - 4}{5x^3 + 21x^2 + 24x + 4}$ | (17) $\lim_{x \rightarrow 0} \frac{4x + 1 - e^{2x}}{4e^{3x} - 4}$ |
| (4) $\lim_{x \rightarrow 0} \frac{e^x - x^3 - 1}{\sin\left(\frac{x}{2}\right)}$ | (11) $\lim_{x \rightarrow 3} \frac{x^2 - 4x + 5}{3x^2 - 5x + 2}$ | (18) $\lim_{x \rightarrow 0} \frac{\tan(x)}{e^x + 1}$ |
| (5) $\lim_{x \rightarrow \infty} \frac{4e^{3x} - x^2}{1 + x + 6e^{3x}}$ | (12) $\lim_{x \rightarrow \infty} \frac{(3x - 4)^3}{9x^2 - 5x^3}$ | (19) $\lim_{x \rightarrow -\infty} \frac{x^2 - e^{3x}}{e^{2x} + 3x^2}$ |
| (6) $\lim_{x \rightarrow \infty} \frac{e^{2/x} - 3x^2}{4x^2 - e^{3/x}}$ | (13) $\lim_{x \rightarrow 2^+} \frac{2 - x - e^{x-2}}{x^2 - 4}$ | (20) $\lim_{x \rightarrow \infty} \frac{(2x - 1)^3}{(4x + 1)^3}$ |
| (7) $\lim_{x \rightarrow 2} \frac{\cos(x - 2) + 2x - 5}{x - 4 + 2e^{x-2}}$ | (14) $\lim_{x \rightarrow 0} \frac{x^2 - e^{2x} + \cos(x)}{3x^2 + \sin(3x)}$ | |
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ANSWERS:

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|------------|----------------|------------|
| (1) $-2/5$ | (8) 3 | (15) $5/3$ |
| (2) $3/5$ | (9) -5 | (16) -2 |
| (3) $1/2$ | (10) $7/9$ | (17) $1/6$ |
| (4) 2 | (11) $1/7$ | (18) 0 |
| (5) $2/3$ | (12) $-27/5$ | (19) $1/3$ |
| (6) $-3/4$ | (13) $-\infty$ | (20) $1/8$ |
| (7) $2/3$ | (14) $-2/3$ | |