AP Calculus AB **Name** _____

9.2 L'Hospital's Rule Practice **Period** _____

Evaluate each limit expression. L'Hospital's rule can be used for many of these problems, but remember:

- **Ignore the conditions of L'Hospital's rule at your own peril.**
- **If L'Hospital's Rule fails to lead to a limit, nothing is learned about the original limit.**
- **More efficient strategies may exist for some problems even if L'Hospitals rule is effective.**

1. $\lim_{t\to\pi} \frac{\tan 3t}{\pi - t} \to \frac{0}{0}$ LR applies

$\lim_{t\to\pi} \frac{3\sec^2 3t}{-1}$

$= \frac{3(\sec 3\pi)^2}{-1} = \frac{3}{-1} = \boxed{3}$

2. $\lim_{p\to 0} \frac{\cos p}{p^2} = \frac{1}{0^2}$

NO LR

$\boxed{\infty}$

3. $\lim_{x\to 0} \frac{\sin 5x}{x} \to \frac{0}{0}$

LR or $\frac{\sin ax}{ax}$

$= \boxed{5}$

4. $\lim_{x\to\infty} \frac{5x^2 - 3x}{7x^2 + 1} \to \frac{\infty}{\infty}$

LR or End behavior

$= \boxed{5/7}$

5. $\lim_{b\to 3} \frac{b-3}{b^2-3} = \frac{3-3}{9-3} = \frac{0}{6}$

$= 0$

NO LR

6. $\lim_{x\to\infty} \frac{2x + \sin x}{3x} =$

LR or separate

$\boxed{2/3}$

7. $\lim_{x\to\frac{\pi}{2}} \frac{2x - \pi}{\cos x} \to \frac{0}{0}$

LR

$\lim_{x\to\frac{\pi}{2}} \frac{2}{-\sin x} = \frac{2}{-\sin\frac{\pi}{2}} = \frac{2}{-1} = \boxed{-2}$

8. $\lim_{x\to 1} \frac{x^3 - 1}{4x^3 - x - 3} \to \frac{0}{0}$

LR

$\lim_{x\to 1} \frac{3x^2}{12x^2 - 1} = \frac{3}{12-1} = \boxed{\frac{3}{11}}$

9. $\lim_{m\to -3} \frac{m+3}{m^2 - 9} \to \frac{0}{0}$

LR or Factor

$\boxed{-1/6}$

10. $\lim_{y\to 2} \frac{y^2 - y - 2}{y+1} = \frac{0}{3} = 0$

no LR

11. $\lim_{x\to 0} \frac{e^x - (1-x)}{x} \to \frac{0}{0}$

LR

$\lim_{x\to 0} \frac{e^x - 1 + x}{x}$

$\lim_{x\to 0} \frac{e^x + 1}{1} = \frac{2}{1} = \boxed{2}$

12. $\lim_{x\to 1} \frac{\ln x^2}{x^2 - 1} \to \frac{0}{0}$

LR

$\lim_{x\to 1} \frac{\frac{1}{x^2}\cdot 2x}{2x} = \boxed{1}$

13. $\lim_{x\to\infty} \frac{x^2}{e^x} \to \frac{\infty}{\infty}$

LR twice

$\lim_{x\to\infty} \frac{2x}{e^x} = \frac{\infty}{\infty}$

$\lim_{x\to\infty} \frac{2}{e^x} = \boxed{0}$

14. $\lim_{x\to\infty} \frac{x^3}{x+2} \to \frac{\infty}{\infty}$

LR or end behavior

$\lim_{x\to\infty} \frac{3x^2}{1} = \infty$

15. $\lim_{a\to\infty} \frac{e^a}{a^2} \to \frac{\infty}{\infty}$

LR twice

$\lim_{a\to\infty} \frac{e^a}{2a}$

$\lim_{a\to\infty} \frac{e^a}{2} = \boxed{\infty}$

16. $\lim_{y\to\infty} \frac{\ln y}{y^2} \to \frac{\infty}{\infty}$

LR or end behavior

$\lim_{y\to\infty} \frac{\frac{1}{y}}{2y} = \lim_{y\to\infty} \frac{1}{2y^2} = \boxed{0}$

17. $\lim_{x\to 0} \frac{\arcsin x}{x} \to \frac{0}{0}$

LR

$\lim_{x\to 0} \frac{\frac{1}{\sqrt{1-x^2}}}{1}$

$= \frac{1}{\sqrt{1-0}} = \boxed{1}$

18. $\lim_{x\to\infty} \frac{3x^2-2x+1}{2x^2+3} \to \frac{\infty}{\infty}$

LR or end behavior

$= \boxed{3/2}$

19. $\lim_{x\to\infty} \frac{x^2+2x+3}{x-1} \to \frac{\infty}{\infty}$

LR or end behavior

$\boxed{\infty}$

20. $\lim_{x\to 0} \frac{e^{2x}-1}{e^x} = \frac{0}{1}$

$= \boxed{0}$

no LR

21. $\lim_{x\to 3} \frac{2(x-3)}{x^2-9} \to \frac{0}{0}$

LR

$\lim_{x\to 3} \frac{2}{2x} = \frac{2}{2(3)} = \boxed{\frac{1}{3}}$

22. $\lim_{x\to 3} \frac{\sqrt{x+1}-2}{x-3} \to \frac{0}{0}$

LR

$\lim_{x\to 3} \frac{\frac{1}{2}(x+1)^{-1/2}\cdot 1}{1} = \frac{1}{2\sqrt{4}} = \boxed{\frac{1}{4}}$

23. $\lim_{x\to 0} \frac{\sqrt{x+3}-\sqrt{3}}{x} \to \frac{0}{0}$

LR

$\lim_{x\to 0} \frac{\frac{1}{2}(x+3)^{-1/2}}{1}$

$= \frac{1}{2}(3)^{-1/2} = \boxed{\frac{1}{2\sqrt{3}}}$

24. $\lim_{x\to 0} \frac{\cos x - 1}{x} \to \frac{0}{0}$

LR

$\lim_{x\to 0} \frac{-\sin x}{1} = \boxed{0}$

25. $\lim_{x\to 9} \frac{x-9}{\sqrt{x}-3} \to \frac{0}{0}$

LR or factor

$\lim_{x\to 9} \frac{1}{\frac{1}{2}x^{-1/2}} = 2\sqrt{9} = \boxed{6}$

26. $\lim_{x\to \frac{\pi}{2}} \frac{1-\sin x}{1+\cos 2x} \to \frac{0}{0}$

LR twice

$\lim_{x\to \frac{\pi}{2}} \frac{-\cos x}{-2\sin 2x} \quad \frac{0}{0}$

$\lim_{x\to \pi/2} \frac{+\sin x}{-4\cos 2x} = \boxed{\frac{+1}{4}}$

27. $\lim_{h\to 2} \frac{h^2-h-2}{h-2} \to \frac{0}{0}$

LR

$\lim_{h\to 2} \frac{2h-1}{1} = \boxed{3}$