AP Calculus AB
Unit 5 – Day 9 – Assignment

Name: Answer Key*

Use L'Hôpital's Rule to find each of the following limits.

1. $\lim\limits_{x\to 2} \dfrac{3x^2-4x-4}{x^2-4} = \dfrac{0}{0}$

$$\lim_{x\to 2} \frac{6x-4}{2x} = \frac{6(2)-4}{2(2)} = \frac{8}{4} = \boxed{2}$$

2. $\lim\limits_{x\to \infty} \dfrac{x^3-2x^2}{4x^3-x-3} = \dfrac{\infty}{\infty}$

$$\lim_{x\to \infty} \frac{3x^2-4x}{12x^2-1} = \frac{\infty}{\infty}$$

$$\lim_{x\to \infty} \frac{6x-4}{24x} = \frac{\infty}{\infty}$$

$$\lim_{x\to \infty} \frac{6}{24} = \boxed{\frac{1}{4}}$$

3. $\lim\limits_{\theta\to \frac{\pi}{2}} \dfrac{1-\sin\theta}{1+\cos(2\theta)} = \dfrac{0}{0}$

$$\lim_{\theta\to \pi/2} \frac{-\cos\theta}{-2\sin(2\theta)} = \frac{-\cos(\frac{\pi}{2})}{-2\sin(2\cdot\frac{\pi}{2})} = \frac{0}{0}$$

$$\lim_{\theta\to \pi/2} \frac{\sin\theta}{-4\cos(2\theta)} = \frac{\sin(\frac{\pi}{2})}{-4\cos(2\frac{\pi}{2})} = \frac{1}{-4(-1)} = \boxed{\frac{1}{4}}$$

4. $\lim\limits_{x\to 1} \dfrac{x-1}{\ln x-\sin(\pi x)} = \dfrac{0}{0}$

$$\lim_{x\to 1} \frac{1}{\frac{1}{x} - \pi\cos(\pi x)} = \frac{1}{\frac{1}{1} - \pi(\cos\pi)} = \frac{1}{1-\pi(-1)} = \boxed{\frac{1}{1+\pi}}$$

5. $\lim\limits_{x\to 0} \dfrac{5x\sin x}{x^2-\sin(2x)} = \dfrac{0}{0}$

$$\lim_{x\to 0} \frac{(5)(\sin x)+(5x)(\cos x)}{2x-2\cos(2x)}$$

$$= \frac{5\sin 0 + (5(0))\cos 0}{2(0)-2\cos(2(0))}$$

$$= \frac{0+0}{0-2} = \frac{0}{-2} = \boxed{0}$$

6. $\lim\limits_{x\to \infty} \dfrac{2x^2+3x}{x^3+x+1} = \dfrac{\infty}{\infty}$

$$\lim_{x\to \infty} \frac{4x+3}{3x^2+1} = \frac{\infty}{\infty}$$

$$\lim_{x\to \infty} \frac{4}{6x^2} = \frac{4}{\infty} = \boxed{0}$$

$(x+2)^{1/2}$

7. $\lim_{x\to 2} \frac{\sqrt{x+2}-2}{x-2} = \frac{0}{0}$

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

$= \frac{\frac{1}{2}(2+2)^{-1/2}}{1}$

$= \frac{1}{2\sqrt{4}} = \boxed{\frac{1}{4}}$

$(x+1)^{1/2}$

8. $\lim_{x\to 0} \frac{\sqrt{x+1}-1-\frac{1x}{2}}{x^2} = \frac{0}{0}$

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

$= \frac{\frac{1}{2}(0+1)^{-1/2}-\frac{1}{2}}{2(0)}$

$= \frac{\frac{1}{2\sqrt{1}}-\frac{1}{2}}{0} = \frac{0}{0}$

$\lim_{x\to 0} \frac{-\frac{1}{4}(x+1)^{-3/2}}{2} = \frac{-\frac{1}{4}(0+1)^{-3/2}}{2}$

$= \frac{-\frac{1}{4}(1)}{2} = -\frac{1}{4}\cdot\frac{1}{2} = \boxed{-\frac{1}{8}}$

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

$\lim_{x\to 1} \frac{(1)(\ln x) + \cancel{(x)}\cancel{(\frac{1}{x})}}{2x}$

$\frac{(1)(\ln 1)+1}{2(1)} = \frac{0+1}{2}$

$= \boxed{\frac{1}{2}}$

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

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

$= \frac{e^0}{2}$

$= \boxed{\frac{1}{2}}$