

Name: \_\_\_\_\_  
Period: \_\_\_\_\_

Date: \_\_\_\_\_  
Calculus Honors 2.3 Extra Practice

USE THE LIMIT THEOREMS TO FIND THE LIMIT, IF IT EXISTS.

$$1. \lim_{x \rightarrow \sqrt{2}} 15 = 15$$

$$2. \lim_{x \rightarrow -2} x = -2$$

$$3. \lim_{x \rightarrow 4} (3x-4) = 8$$

$$4. \lim_{x \rightarrow 2} \frac{x-5}{4x+3} = \frac{-7}{-5} = 7/5$$

$$5. \lim_{x \rightarrow 1} (-2x+5)^4 = 81$$

$$\begin{aligned} 6. \lim_{x \rightarrow 0} \frac{4 - \sqrt{16+x}}{x} &= \frac{(4 - \sqrt{16+x})(4 + \sqrt{16+x})}{x(4 + \sqrt{16+x})} \\ &= \lim_{x \rightarrow 0} \frac{16 - 16 - x}{x(4 + \sqrt{16+x})} = \lim_{x \rightarrow 0} \frac{-1}{4 + \sqrt{16+x}} = -1/8 \end{aligned}$$

$$\begin{aligned} 7. \lim_{x \rightarrow 1} \frac{x^2-1}{x-1} &= \lim_{x \rightarrow 1} \frac{(x+1)(x-1)}{(x-1)} = 2 \end{aligned}$$

$$\begin{aligned} 8. \lim_{x \rightarrow 0} \frac{(\sqrt{x^2+9}-3)(\sqrt{x^2+9}+3)}{x^2} &= \lim_{x \rightarrow 0} \frac{x^2+9-9}{x^2(\sqrt{x^2+9}+3)} \\ &= \lim_{x \rightarrow 0} \frac{1}{\sqrt{x^2+9}+3} = \frac{1}{6} \end{aligned}$$

$$\begin{aligned} 9. \lim_{x \rightarrow 2} \frac{x^2+x-6}{x-2} &= \lim_{x \rightarrow 2} \frac{(x-2)(x+3)}{(x-2)} = 5 \end{aligned}$$

$$\lim_{x \rightarrow 0} \frac{1}{\sqrt{x^2+9}+3} = \frac{1}{6}$$

$$\begin{aligned} 10. \lim_{x \rightarrow 0} \frac{(4+x)^2-16}{x} &= \lim_{x \rightarrow 0} \frac{x^2+8x+16-16}{x} \\ &= \lim_{x \rightarrow 0} \frac{x(x+8)}{x} = 8 \end{aligned}$$

$$\begin{aligned} 11. \lim_{x \rightarrow 1} \frac{x^3-1}{x^2-1} &= \lim_{x \rightarrow 1} \frac{(x-1)(x^2+x+1)}{(x-1)(x+1)} \\ &= 3/2 \end{aligned}$$

$$\begin{aligned} 12. \lim_{x \rightarrow 4} \frac{x^2-4x}{x^2-3x-4} &= \lim_{x \rightarrow 4} \frac{x(x-4)}{(x-4)(x+1)} = 4/5 \end{aligned}$$

$$\lim_{x \rightarrow 0} \frac{x(x+8)}{x} = 8$$

$$\begin{aligned} 13. \lim_{x \rightarrow 0} \frac{(2+x)^2-4}{x} &= \lim_{x \rightarrow 0} \frac{x^2+4x+4-4}{x} \\ &= \lim_{x \rightarrow 0} \frac{x(x+4)}{x} = 4 \end{aligned}$$

$$\begin{aligned} 14. \lim_{x \rightarrow 2} \frac{x^4-16}{x-2} &= \lim_{x \rightarrow 2} \frac{(x^2+4)(x-2)(x+2)}{(x-2)} \\ &= 32 \end{aligned}$$

$$\begin{aligned} 15. \lim_{x \rightarrow 1} \frac{x^2-1}{x-1} &= \lim_{x \rightarrow 1} \frac{(x+1)(x-1)}{(x-1)} = 2 \end{aligned}$$

$$16. \lim_{x \rightarrow -2} \frac{x^3 + 2x^2 - 1}{5 - 3x}$$

$$\lim_{x \rightarrow -2} \frac{-8 + 8 - 1}{5 + 6} = -\frac{1}{11}$$

$$17. \lim_{x \rightarrow 1} g(x) \quad g(x) = \begin{cases} x+1 & \text{if } x \neq 1 \\ \pi & \text{if } x = 1 \end{cases}$$

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$$18. \lim_{h \rightarrow 0} \frac{(3+h)^2 - 9}{h}$$

$$\lim_{h \rightarrow 0} \frac{h^2 + 6h + 9 - 9}{h}$$

$$\lim_{h \rightarrow 0} \frac{h(h+6)}{h} = 6$$

$$19. \lim_{t \rightarrow 0} \frac{(\sqrt{t^2+9} - 3)(\sqrt{t^2+9} + 3)}{t^2 (\sqrt{t^2+9} + 3)}$$

$$\lim_{t \rightarrow 0} \frac{t^2 + 9 - 9}{t^2 (\sqrt{t^2+9} + 3)}$$

$$\lim_{t \rightarrow 0} \frac{1}{\sqrt{t^2+9} + 3} = \frac{1}{6}$$

$$21. \lim_{x \rightarrow 7} \frac{(\sqrt{x+2} - 3)(\sqrt{x+2} + 3)}{x - 7 (\sqrt{x+2} + 3)}$$

$$\lim_{x \rightarrow 7} \frac{(x+2 - 9)}{(x-7)(\sqrt{x+2} + 3)}$$

$$22. \lim_{x \rightarrow -4} \frac{\frac{1}{4} + \frac{1}{x}}{4 + x}$$

$$\lim_{x \rightarrow -4} \frac{\frac{x+4}{4x}}{4+x}$$

$$\lim_{x \rightarrow -4} \frac{x+4}{4x} \cdot \frac{1}{x+4}$$

$$\lim_{x \rightarrow -4} \frac{1}{4x} = -\frac{1}{16}$$

$$23. \lim_{x \rightarrow 0} \frac{(4+x)^2 - 16}{x}$$

$$\lim_{x \rightarrow 0} \frac{x^2 + 8x + 16 - 16}{x}$$

$$\lim_{x \rightarrow 0} \frac{x(x+8)}{x} = 8$$

$$\lim_{x \rightarrow 7} \frac{x-7}{(x-7)(\sqrt{x+2} + 3)} =$$

$$\lim_{x \rightarrow 7} \frac{1}{\sqrt{x+2} + 3} = \frac{1}{6}$$

$$24. \lim_{t \rightarrow 2} \frac{t^2 - 3t + 2}{t^2 - 4}$$

$$\lim_{t \rightarrow 2} \frac{(t-2)(t-1)}{(t-2)(t+2)}$$

$$\lim_{t \rightarrow 2} \frac{t-1}{t+2} = \frac{1}{4}$$

$$25. \lim_{x \rightarrow 0} \frac{2+x}{x} \cdot \frac{2}{2}$$

$$\lim_{x \rightarrow 0} \frac{2-2-x}{2(2+x)}$$

$$\lim_{x \rightarrow 0} \frac{-x}{2(2+x)} \cdot \frac{1}{x}$$

$$\lim_{x \rightarrow 0} \frac{-1}{2(2+x)} = -\frac{1}{4}$$

$$26. \lim_{x \rightarrow 0} \frac{x + \sin x}{x}$$

$$\lim_{x \rightarrow 0} \left( \frac{x}{x} + \frac{\sin x}{x} \right)$$

$$\lim_{x \rightarrow 0} 1 + \lim_{x \rightarrow 0} \frac{\sin x}{x}$$

$$1 + 1 = 2$$

27. Given  $\lim_{x \rightarrow a} f(x) = -3$ ;  $\lim_{x \rightarrow a} g(x) = 0$ ;  $\lim_{x \rightarrow a} h(x) = 8$ , find

a.  $\lim_{x \rightarrow a} [f(x) + h(x)] = 5$

b.  $\lim_{x \rightarrow a} [f(x)]^2 = 9$

c.  $\lim_{x \rightarrow a} \sqrt[3]{h(x)} = 2$

d.  $\lim_{x \rightarrow a} \frac{f(x)}{g(x)} = \text{DNE}$