

### 4.3 L'Hôpital's Rule

Calculus

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

CA #1

Find the following. Use L'Hôpital's when possible.

<p>1. <math>\lim_{x \rightarrow 2} \frac{x-2}{x^2-7x+10} = \frac{0}{0}</math></p> <p><math>= \lim_{x \rightarrow 2} \frac{1}{2x-7}</math></p> <p><math>= \frac{1}{2(2)-7}</math></p> <p><math>= \frac{1}{4-7}</math></p> <p><math>= \frac{1}{-3}</math></p>	<p>2. <math>\lim_{x \rightarrow 0} \frac{3x^2}{e^x-1} = \frac{0}{0}</math></p> <p><math>= \lim_{x \rightarrow 0} \frac{6x}{e^x-1} = \frac{0}{0}</math></p> <p><math>= \lim_{x \rightarrow 0} \frac{6}{e^x}</math></p> <p><math>= \frac{6}{e^0} = \frac{6}{1} = 6</math></p>	<p>3. <math>\lim_{x \rightarrow 3} \frac{x^2-2x+1}{x-3} = \text{dne}</math></p> <p><math>x^2-2x+1</math> doesn't factor. nothing cancels. VA @ <math>x=3</math>, thus dne</p>
<p>4. <math>\lim_{x \rightarrow 0} \frac{x^2}{1-\cos(3x)} = \frac{0}{0}</math></p> <p><math>= \lim_{x \rightarrow 0} \frac{2x}{3\sin(3x)} = \frac{0}{0}</math></p> <p><math>= \lim_{x \rightarrow 0} \frac{2}{9\cos(3x)}</math></p> <p><math>= \frac{2}{9 \cdot \cos(3 \cdot 0)}</math></p> <p><math>= \frac{2}{9 \cdot 1}</math></p> <p><math>= \frac{2}{9}</math></p>	<p>5. <math>\lim_{x \rightarrow 4} \frac{x^2+6x-40}{4-x} = \frac{0}{0}</math></p> <p><math>= \lim_{x \rightarrow 4} \frac{2x+6}{-1}</math></p> <p><math>= \frac{2(4)+6}{-1}</math></p> <p><math>= \frac{8+6}{-1}</math></p> <p><math>= \frac{14}{-1}</math></p> <p><math>= -14</math></p>	<p>6. <math>\frac{d}{dx} \frac{3x-2}{5x+1} = \frac{(3x-2)'(5x+1) - (3x-2)(5x+1)'}{(5x+1)^2}</math></p> <p><math>= \frac{3(5x+1) - (3x-2)(5)}{(5x+1)^2}</math></p> <p><math>= \frac{15x+3 - 15x+10}{(5x+1)^2}</math></p> <p><math>= \frac{13}{(5x+1)^2}</math></p>
<p>7. <math>\lim_{x \rightarrow 6} \frac{7-\sqrt{55-x}}{x-6} = \frac{0}{0}</math></p> <p><math>= \lim_{x \rightarrow 6} \frac{-\frac{1}{2}(55-x)^{-\frac{1}{2}} \cdot (-1)}{1}</math></p> <p><math>= \lim_{x \rightarrow 6} \frac{1}{2\sqrt{55-x}}</math></p> <p><math>= \frac{1}{2\sqrt{55-6}}</math></p> <p><math>= \frac{1}{2\sqrt{49}}</math></p> <p><math>= \frac{1}{2 \cdot 7} = \frac{1}{14}</math></p>	<p>8. <math>\lim_{x \rightarrow 0} \frac{x+1}{x^2-5x+3} = \frac{0+1}{(0)^2-5(0)+3}</math></p> <p><math>= \frac{1}{3}</math></p>	<p>9. <math>\lim_{x \rightarrow 0} \frac{2e^x-2-2x}{1-\cos x} = \frac{0}{0}</math></p> <p><math>= \lim_{x \rightarrow 0} \frac{2e^x-2}{\sin x} = \frac{0}{0}</math></p> <p><math>= \lim_{x \rightarrow 0} \frac{2e^x}{\cos x}</math></p> <p><math>= \frac{2e^{(0)}}{\cos(0)}</math></p> <p><math>= \frac{2}{1} = 2</math></p>
<p>10. <math>\frac{d}{dx} \frac{e^x}{\tan(3x)}</math></p> <p><math>= \frac{(e^x)' \tan(3x) - e^x [\tan(3x)]'}{[\tan(3x)]^2}</math></p> <p><math>= \frac{e^x \tan(3x) - e^x \sec^2(3x) \cdot 3}{\tan^2(3x)}</math></p> <p><math>= \frac{e^x \tan(3x) - 3e^x \sec^2(3x)}{\tan^2(3x)}</math></p> <p>or</p> <p><math>= e^x \cot(3x) - 3e^x \csc^2(3x)</math></p>	<p>11. <math>\lim_{x \rightarrow 1} \frac{5 \ln x^2}{x^2-1} = \frac{0}{0}</math></p> <p><math>= \lim_{x \rightarrow 1} \frac{5 \cdot \frac{2x}{x^2}}{2x}</math></p> <p><math>= \lim_{x \rightarrow 1} \frac{10}{x}</math></p> <p><math>= \lim_{x \rightarrow 1} \frac{10}{2x^2}</math></p> <p><math>= \lim_{x \rightarrow 1} \frac{5}{x^2} = \frac{5}{(1)^2} = \frac{5}{1} = 5</math></p>	<p>12. <math>\lim_{x \rightarrow 0} \frac{1-\cos(4x)}{\cos(3x)-1} = \frac{0}{0}</math></p> <p><math>= \lim_{x \rightarrow 0} \frac{4 \sin(4x)}{-3 \sin(3x)} = \frac{0}{0}</math></p> <p><math>= \lim_{x \rightarrow 0} \frac{16 \cos(4x)}{-9 \cos(3x)}</math></p> <p><math>= \frac{16 \cos(4 \cdot 0)}{-9 \cos(3 \cdot 0)}</math></p> <p><math>= \frac{16 \cdot 1}{-9 \cdot 1}</math></p> <p><math>= \frac{16}{-9}</math></p>

Answers to 4.3 CA #1

1. $-\frac{1}{3}$	2. 6	3. Does not exist	4. $\frac{2}{9}$	5. -14	6. $\frac{13}{(5x+1)^2}$
7. $\frac{1}{14}$	8. $\frac{1}{3}$	9. 2	10. $e^x \cot 3x - 3e^x \csc^2 3x$	11. 5	12. $-\frac{16}{9}$