WebAssign

3.11 Hiperbólicas y 4.4 Regla de L'Hospital (Homework)

David Corzo

Diferencial, section B, Spring 2019

Instructor: Christiaan Ketelaar

Current Score: 45 / 37 Due: Friday, April 19, 2019 11:59 PM CSTLast Saved: n/a Saving... ()

The due date for this assignment is past. Your work can be viewed below, but no changes can be made.

Important! Before you view the answer key, decide whether or not you plan to request an extension. Your Instructor may not grant you an extension if you have viewed the answer key. Automatic extensions are not granted if you have viewed the answer key.

Request Extension

1. 1.5/1.5 points | Previous Answers SCalcET8 3.11.008.

Prove the identity.

$$\cosh(-x) = \cosh(x)$$

(This shows that cosh is an even function.)

$$\frac{1}{2} \begin{bmatrix}
 $\$e(-x)$ \\
 \hline
 & e^{-x} + e^{-(-x)}\end{bmatrix}$$

$$\frac{1}{2} \begin{bmatrix}
 $\$e - x \\
 \hline
 & * e^{-x} + e^{x}\end{bmatrix}$$

$$\$ \cos h(x)$$

$$= \begin{bmatrix}
 \cos h(x)
\end{bmatrix}$$

Solution or Explanation

2. 1.5/1.5 points | Previous Answers SCalcET8 3.11.009.

Prove the identity.

$$\cosh(x) + \sinh(x) = e^{x}$$

$$\frac{1}{2} \left(e^{x} + e^{-x} \right) + \frac{1}{2} \left(\frac{1}{2} \left(e^{x} - e^{-x} \right) \right)$$

$$\frac{1}{2} \left(\frac{1}{2} \left(\frac{1}{2} \left(e^{x} - e^{-x} \right) \right) \right)$$

$$\frac{1}{2} \left(\frac{1}{2} \left(e^{x} - e^{-x} \right) \right)$$

$$\frac{1}{2} \left(e^{x} - e^{-x} \right)$$

Solution or Explanation

$$\cosh(x) + \sinh(x) = \frac{1}{2}(e^x + e^{-x}) + \frac{1}{2}(e^x - e^{-x}) = \frac{1}{2}(2e^x) = e^x$$

3. 0/2 points | Previous AnswersSCalcET8 3.11.024.

Prove the formulas given in <u>this table</u> for the derivatives of the functions cosh, tanh, csch, sech, and coth. Which of the following are proven correctly? (Select all that apply.)

$$\frac{d}{dx}(\coth(x)) = \frac{d}{dx}\left(\frac{\sinh(x)}{\cosh(x)}\right) = \frac{\cosh(x)\cosh(x) - \sinh(x)\sinh(x)}{\cosh^2(x)} = \frac{\cosh^2(x) - \sinh^2(x)}{\cosh^2(x)} = -\frac{1}{\cosh^2(x)} = -\cosh^2(x)$$

$$\frac{d}{dx}(\operatorname{csch}(x)) = \frac{d}{dx}\left(\frac{1}{\sinh(x)}\right) = -\frac{\cosh^2(x)}{\sinh^2(x)} = -\frac{1}{\sinh(x)} \cdot \frac{\cosh^2(x)}{\sinh(x)} = -\operatorname{csch}(x) \coth(x)$$

$$\frac{d}{dx}(\cosh(x)) = \frac{d}{dx} \left[\frac{1}{2} (e^x - e^{-x}) \right] = \frac{1}{2} (e^x + e^{-x}) = \sinh(x)$$



Solution or Explanation

Click to View Solution

4. 1/1 points | Previous Answers SCalcET8 3.11.030.

Find the derivative.

$$f(x) = e^{x} \cosh(x)$$

$$f'(x) =$$

$$\$ \exp(x) + \exp(x)$$

$$e^{2x}$$

Solution or Explanation

The notation $\stackrel{PR}{\Rightarrow}$ indicates the use of the Product Rule.

$$f(x) = e^x \cosh(x)$$
 $\stackrel{\mathsf{PR}}{\Rightarrow}$ $f'(x) = e^x \sinh(x) + (\cosh(x))e^x = e^x(\sinh(x) + \cosh(x))$, or $e^x(e^x) = e^{2x}$.

5. 1/1 points | Previous Answers SCalcET8 3.11.031.

Find the derivative.

$$f(x) = \tanh(\sqrt{x})$$

$$f'(x) = \$\$ sech2(\sqrt{x}) \cdot 12\sqrt{x}$$

$$\frac{\operatorname{sech}^{2}(\sqrt{x})}{2\sqrt{x}}$$

Solution or Explanation

$$f(x) = \tanh(\sqrt{x}) \Rightarrow f'(x) = \operatorname{sech}^2(\sqrt{x}) \frac{d}{dx} \sqrt{x} = \operatorname{sech}^2(\sqrt{x}) \left(\frac{1}{2\sqrt{x}}\right) = \frac{\operatorname{sech}^2(\sqrt{x})}{2\sqrt{x}}$$

6. 1/1 points | Previous Answers SCalcET8 3.11.037.

Find the derivative.

$$y = e^{\cosh(7x)}$$

$$y'(x) =$$

$$\$ \sec \cosh(7x) \cdot \sinh(7x) \cdot 7$$

$$7 \sinh(7x) e^{\cosh(7x)}$$

Solution or Explanation

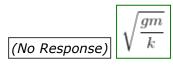
7. -/0 pointsSCalcET8 3.11.054.

A model for the velocity of a falling object after time t is

$$v(t) = \sqrt{\frac{mg}{k}} \tanh\left(t\sqrt{\frac{gk}{m}}\right) \dagger$$

where m is the mass of the object, $g = 9.8 \text{ m/s}^2$ is the acceleration due to gravity, k is a constant, t is measured in seconds, and v is in m/s.

(a) Calculate the terminal velocity of the object, that is, $\lim_{t\to\infty} v(t)$.



(b) If a person is falling from a building, the value of the constant k depends on his or her position. For a "belly-to-earth" position, k = 0.515 kg/s, but for a "feet-first" position, k = 0.067 kg/s. If a 70-kg person falls in belly-to-earth position, what is the terminal velocity? (Round your answer to two decimal places.)

What about feet-first? (Round your answer to two decimal places.)

Solution or Explanation

(a)
$$\lim_{t \to \infty} v(t) = \lim_{t \to \infty} \sqrt{\frac{mg}{k}} \tanh\left(t\sqrt{\frac{gk}{m}}\right) = \sqrt{\frac{mg}{k}} \lim_{t \to \infty} \tanh\left(t\sqrt{\frac{gk}{m}}\right) = \sqrt{\frac{mg}{k}}$$

(b) Belly-to-earth:
$$g = 9.8, k = 0.515, m = 70$$
, so the terminal velocity is $\sqrt{\frac{70(9.8)}{0.515}} \approx 36.50$ m/s.

Feet-first:
$$g = 9.8, k = 0.067, m = 70$$
, so the terminal velocity is $\sqrt{\frac{70(9.8)}{0.067}} \approx 101.19$ m/s.

8. 1/0 points | Previous Answers SCalcET8 3.11.057.

At what point of the curve $y = \cosh(x)$ does the tangent have slope 4? (x, y) = ($\$ \ln(4 + \sqrt{17}), \sqrt{17}$

Solution or Explanation

The tangent to $y = \cosh(x)$ has slope 4 when $y' = \sinh(x) = 4 \implies x = \sinh^{-1}(4) = \ln(4 + \sqrt{17})$, since

$$\sinh^{-1}(x) = \ln(x + \sqrt{x^2 + 1}), \quad x \in \mathbb{R}.$$

Since $\sinh(x) = 4$ and $y = \cosh(x) = \sqrt{1 + \sinh^2(x)}$, we have $\cosh(x) = \sqrt{17}$. The point is $(\ln(4 + \sqrt{17}), \sqrt{17})$.

9. 1/1 points | Previous Answers SCalcET8 3.11.503.XP.

Find the derivative.

$$f(x) = \tanh(1 + e^{4x})$$

 $f'(x) =$
\$\$\sech2(1+e4x)\cdot e4x\cdot 4\$
\$\sqrt{4}e^{4x}\sech^2(1+e^{4x})\$

Solution or Explanation

Click to View Solution

10.1/1 points | Previous Answers SCalcET8 3.11.511.XP.

Find the derivative.

$$G(x) = \frac{9 - \cosh(x)}{9 + \cosh(x)}$$

$$G'(x) =
\$\$[(-\sinh(x))(9 + \cosh(x))] - [(9 - \cosh(x))(\sinh(x))](9 + \cosh(x))2$$

$$\frac{-18\sinh(x)}{(9 + \cosh(x))^2}$$

Solution or Explanation

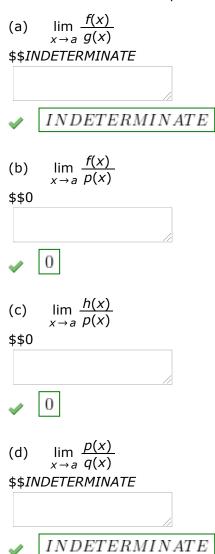
11.2/2 points | Previous Answers SCalcET8 4.4.001.

Given that

$$\lim_{x \to a} f(x) = 0 \quad \lim_{x \to a} g(x) = 0 \quad \lim_{x \to a} h(x) = 1$$

$$\lim_{x \to a} p(x) = \infty \quad \lim_{x \to a} q(x) = \infty,$$

evaluate the limits below where possible. (If a limit is indeterminate, enter INDETERMINATE.)



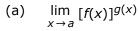
12.3/3 points | Previous Answers SCalcET8 4.4.004.

Given that

$$\lim_{x \to a} f(x) = 0 \quad \lim_{x \to a} g(x) = 0 \quad \lim_{x \to a} h(x) = 1$$

$$\lim_{x \to a} p(x) = \infty \quad \lim_{x \to a} q(x) = \infty,$$

evaluate the limits below where possible. (If a limit is indeterminate, enter INDETERMINATE.)



\$\$INDETERMINATE



(b)
$$\lim_{x \to a} [f(x)]^{p(x)}$$

\$\$0∞



(c)
$$\lim_{x \to a} [h(x)]^{p(x)}$$

\$\$INDETERMINATE



(d)
$$\lim_{x \to a} [p(x)]^{f(x)}$$

\$\$INDETERMINATE



(e)
$$\lim_{x \to a} [p(x)]^{q(x)}$$

\$\$∞



(f)
$$\lim_{x \to a} \sqrt[q(x)]{p(x)}$$

\$\$INDETERMINATE

Solution or Explanation

Click to View Solution

13.1/1 points | Previous Answers SCalcET8 4.4.008.

Find the limit. Use <u>l'Hospital's Rule</u> where appropriate. If there is a more elementary method, consider using it.

$$\lim_{x \to 3} \frac{x - 3}{x^2 - 9}$$
\$\$16



Solution or Explanation

This limit has the form
$$\frac{0}{0}$$
. $\lim_{x \to 3} \frac{x - 3}{x^2 - 9} = \lim_{x \to 3} \frac{x - 3}{(x + 3)(x - 3)} = \lim_{x \to 3} \frac{1}{x + 3} = \frac{1}{3 + 3} = \frac{1}{6}$

Note: Alternatively, we could apply l'Hospital's Rule.

14.1/1 points | Previous Answers SCalcET8 4.4.015.

Find the limit. Use <u>l'Hospital's Rule</u> where appropriate. If there is a more elementary method, consider using it.

$$\lim_{t\to 0} \frac{e^{9t}-1}{\sin(t)}$$



Solution or Explanation

This limit has the form
$$\frac{0}{0}$$
. $\lim_{t \to 0} \frac{e^{9t} - 1}{\sin(t)} = \lim_{t \to 0} \frac{9e^{9t}}{\cos(t)} = \frac{9(1)}{1} = 9$

15.2/2 points | Previous Answers SCalcET8 4.4.017.

Find the limit. Use <u>l'Hospital's Rule</u> where appropriate. If there is a more elementary method, consider using it.

$$\lim_{\theta \to \pi/2} \frac{1 - \sin(\theta)}{1 + \cos(2\theta)}$$
\$\$14

Solution or Explanation

This limit has the form
$$\frac{0}{0}$$
. $\lim_{\theta \to \pi/2} \frac{1 - \sin(\theta)}{1 + \cos(2\theta)} = \lim_{\theta \to \pi/2} \frac{-\cos(\theta)}{-2\sin(2\theta)} = \lim_{\theta \to \pi/2} \frac{\sin(\theta)}{-4\cos(2\theta)} = \frac{1}{4}$

16.1/1 points | Previous Answers SCalcET8 4.4.019.MI.

Find the limit. Use <u>l'Hospital's Rule</u> if appropriate. If there is a more elementary method, consider using it.

$$\lim_{x \to \infty} \frac{\ln(x)}{\sqrt{x}}$$
\$\$0

17.1/1 points | Previous Answers SCalcET8 4.4.025.

Find the limit. Use <u>l'Hospital's Rule</u> where appropriate. If there is a more elementary method, consider using it.

$$\lim_{x \to 0} \frac{\sqrt{1 + 4x} - \sqrt{1 - 2x}}{x}$$
\$\$3

Solution or Explanation

This limit has the form $\frac{0}{0}$.

$$\lim_{x \to 0} \frac{\sqrt{1 + 4x} - \sqrt{1 - 2x}}{x} \stackrel{H}{=} \lim_{x \to 0} \frac{\frac{1}{2}(1 + 4x)^{-1/2} \cdot 4 - \frac{1}{2}(1 - 2x)^{-1/2}(-2)}{1}$$

$$= \lim_{x \to 0} \left(\frac{\frac{2}{\sqrt{1 + 4x}} + \frac{1}{\sqrt{1 - 2x}} \right) = \frac{\frac{2}{\sqrt{1}} + \frac{1}{\sqrt{1}}}{1} = 3$$

18.2/2 points | Previous Answers SCalcET8 4.4.027.

Find the limit. Use <u>l'Hospital's Rule</u> if appropriate. If there is a more elementary method, consider using it.

$$\lim_{x \to 0} \frac{e^{9x} - 1 - 9x}{x^2}$$
\$\$812

19.1/0 points | Previous Answers SCalcET8 4.4.031.

Find the limit. Use <u>l'Hospital's Rule</u> if appropriate. If there is a more elementary method, consider using it.

$$\lim_{x \to 0} \frac{\sin^{-1}(x)}{9x}$$
\$\$19

Solution or Explanation

Click to View Solution

20.1/1 points | Previous Answers SCalcET8 4.4.033.

Find the limit. Use <u>l'Hospital's Rule</u> where appropriate. If there is a more elementary method, consider using it.

$$\lim_{x \to 0} \frac{x 6^{x}}{6^{x} - 1}$$

$$\$\$1 \ln(6)$$

Solution or Explanation

This limit has the form $\frac{0}{0}$.

$$\lim_{x \to 0} \frac{x \, 6^{x}}{6^{x} - 1} \stackrel{\text{H}}{=} \lim_{x \to 0} \frac{x \, 6^{x} \ln 6 + 6^{x}}{6^{x} \ln 6} = \lim_{x \to 0} \frac{6^{x} (x \ln 6 + 1)}{6^{x} \ln 6} = \lim_{x \to 0} \frac{x \ln 6 + 1}{\ln 6} = \frac{1}{\ln 6}$$

21.1/1 points | Previous Answers SCalcET8 4.4.040.

Find the limit. Use <u>l'Hospital's Rule</u> if appropriate. If there is a more elementary method, consider using it.

$$\lim_{x \to 0} \frac{e^{2x} - e^{-2x} - 4x}{x - \sin(x)}$$
\$\$16

Solution or Explanation

22.1/1 points | Previous Answers SCalcET8 4.4.045.

Find the limit. Use <u>l'Hospital's Rule</u> where appropriate. If there is a more elementary method, consider using it.

$$\lim_{x \to 0} \sin(5x) \csc(3x)$$
\$\$53

Solution or Explanation

This limit has the form $0 \cdot \infty$. We'll change it to the form $\frac{0}{0}$.

$$\lim_{x \to 0} \sin(5x) \csc(3x) = \lim_{x \to 0} \frac{\sin(5x)}{\sin(3x)} + \lim_{x \to 0} \frac{5 \cos(5x)}{3 \cos(3x)} = \frac{5 \cdot 1}{3 \cdot 1} = \frac{5}{3}$$

23.2/0 points | Previous Answers SCalcET8 4.4.051.

Find the limit. Use <u>l'Hospital's Rule</u> if appropriate. If there is a more elementary method, consider using it.

$$\lim_{x \to 1} \left(\frac{7x}{x-1} - \frac{7}{\ln(x)} \right)$$
\$\$72

Solution or Explanation

24.1/1 points | Previous Answers SCalcET8 4.4.056.

Find the limit. Use <u>l'Hospital's Rule</u> where appropriate. If there is a more elementary method, consider using it.

$$\lim_{x \to 1^{+}} [\ln(x^{7} - 1) - \ln(x^{5} - 1)]$$
\$\$\lim_{\lim_{1\text{n}}}\left(\frac{7}{-}\right)

Solution or Explanation

This limit has the form $\infty - \infty$.

$$\lim_{x \to 1^+} \left[\ln(x^7 - 1) - \ln(x^5 - 1) \right] = \lim_{x \to 1^+} \ln \left(\frac{x^7 - 1}{x^5 - 1} \right) = \ln \left(\lim_{x \to 1^+} \frac{x^7 - 1}{x^5 - 1} \right) \stackrel{H}{=} \ln \left(\lim_{x \to 1^+} \frac{7x^6}{5x^4} \right) = \ln \left(\frac{7}{5} \right)$$

25.2/2 points | Previous Answers SCalcET8 4.4.058.

Find the limit. Use <u>l'Hospital's Rule</u> if appropriate. If there is a more elementary method, consider using it.

$$\lim_{x \to 0^+} (\tan(5x))^x$$
\$\$1

Solution or Explanation

Click to View Solution

26.2/2 points | Previous Answers SCalcET8 4.4.059.MI.

Find the limit. Use <u>l'Hospital's Rule</u> if appropriate. If there is a more elementary method, consider using it.

$$\lim_{x \to 0} (1 - 6x)^{1/x}$$
\$\$1e6

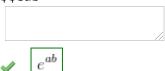
Solution or Explanation

27.2/0 points | Previous Answers SCalcET8 4.4.060.

Find the limit. Use <u>l'Hospital's Rule</u> if appropriate. If there is a more elementary method, consider using it.

$$\lim_{x \to \infty} \left(1 + \frac{a}{x} \right)^{bx}$$

\$\$eab



Solution or Explanation

Click to View Solution

28.1/1 points | Previous Answers SCalcET8 4.4.062.

Find the limit. Use <u>l'Hospital's Rule</u> if appropriate. If there is a more elementary method, consider using it.

$$\lim_{x\to\infty} \chi^{(\ln(9))/(1+\ln(x))}$$

\$\$9		
/	9	

Solution or Explanation

Click to View Solution

29.1/1 points | Previous Answers SCalcET8 4.4.063.

Find the limit. Use <u>l'Hospital's Rule</u> if appropriate. If there is a more elementary method, consider using it.

$$\lim_{x \to \infty} x^{9/x}$$
\$\$1

Solution or Explanation

30.2/2 points | Previous Answers SCalcET8 4.4.065.

Find the limit. Use <u>l'Hospital's Rule</u> if appropriate. If there is a more elementary method, consider using it.

$$\lim_{x \to 0^+} (3x + 1)^{\cot(x)}$$



31.1/0 points | Previous Answers SCalcET8 4.4.078.

If an object with mass m is dropped from rest, one model for its speed v after t seconds, taking air resistance into account, is

$$v = \frac{mg}{c}(1 - e^{-ct/m})$$

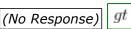
where g is the acceleration due to gravity and c is a positive constant describing air resistance.

(a) Calculate $\lim_{t\to\infty} v$.

$t \rightarrow$	$\rightarrow \infty$		
	mg		
(No Response)	c		

What is the meaning of this limit?

- It is the time it takes for the object to stop.
- It is the time it takes the object to reach its maximum speed.
- It is the speed the object approaches as time goes on.
- It is the speed the object reaches before it starts to slow down.
- (b) For fixed t, use <u>l'Hospital's Rule</u> to calculate $\lim_{c \to 0^+} v$.



What can you conclude about the velocity of a falling object in a vacuum?

- An object falling in a vacuum will accelerate at a slower rate than an object not in a vacuum.
- The velocity of a falling object is proportional to its mass in a vacuum.
- The heavier the object is the faster it will fall in a vacuum.
- The velocity of a falling object in a vacuum is directly proportional to the amount of time it falls.

Solution or Explanation

32.1/1 points | Previous Answers SCalcET8 4.4.070.

Use <u>l'Hospital's Rule</u> to find the exact value of the limit.

$$\lim_{x \to 0} \frac{7^{x} - 6^{x}}{5^{x} - 4^{x}}$$
\$\$\frac{1}{5}\left[n(76)\left]\left[n(54)]



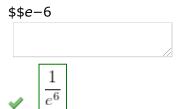
Solution or Explanation

Click to View Solution

33.2/0 points | Previous Answers SCalcET8 4.4.068.

Find the limit. Use <u>l'Hospital's Rule</u> if appropriate. If there is a more elementary method, consider using it.

$$\lim_{x\to\infty} \left(\frac{5x-4}{5x+2}\right)^{5x+1}$$



Solution or Explanation

Click to View Solution

34.1/0 points | Previous Answers SCalcET8 4.4.087.

If f' is continuous, f(1) = 0, and f'(1) = 9, evaluate

$$\lim_{x \to 0} \frac{f(1+3x) + f(1+4x)}{x}.$$

Solution or Explanation

35.1/1 points | Previous Answers SCalcET8 4.4.505.XP.

Find the limit. Use l'Hospital's Rule if appropriate. If there is a more elementary method, consider using it.

