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

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Diferencial, section B, Spring 2019
Instructor: Christiaan Ketelaar

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

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

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Request Extension

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1. 1.5/1.5 points | Previous AnswersSCalcET8 3.11.008.

Prove the identity.

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

(This shows that cosh is an even function.)

$\frac{1}{2}\Big[$

$$e(-x)

$\cosh(-x) =$

✔ $\boxed{e^{-x}}$ $+ e^{-(-x)}\Big]$

$\frac{1}{2}\Big($

$$e−x

$=$

✔ $\boxed{e^{-x}}$ $+ e^{x}\Big)$

$$cosh(x)

$=$

✔ $\boxed{\cosh(x)}$

Solution or Explanation

Click to View Solution

2. 1.5/1.5 points | Previous AnswersSCalcET8 3.11.009.

Prove the identity.

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

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

$$ex−e−x

$\cosh(x) + \sinh(x) =$

$\boxed{e^x - e^{-x}}\Big)$

$\frac{1}{2}\Big($

$$2ex

$=$

$\boxed{2e^x}\Big)$

$$ex

$=$

$\boxed{e^x}$

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 Answers SCalcET8 3.11.024.

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

- [ ] $\frac{d}{dx}(\coth(x)) = \frac{d}{dx}\left(\frac{\sinh(x)}{\cosh(x)}\right) = \frac{\cosh(x)\cosh(x) - \sinh(x)\sinh(x)}{\cosh^2(x)} = \frac{\cosh^2(x) - \sinh^2(x)}{\cosh^2(x)} = -\frac{1}{\cosh^2(x)} = -\operatorname{csch}^2(x)$
- [x] $\frac{d}{dx}(\operatorname{sech}(x)) = \frac{d}{dx}\left(\frac{1}{\cosh(x)}\right) = -\frac{\sinh(x)}{\cosh^2(x)} = -\frac{1}{\cosh(x)} \cdot \frac{\sinh(x)}{\cosh(x)} = -\operatorname{sech}(x)\tanh(x)$
- [x] $\frac{d}{dx}(\operatorname{csch}(x)) = \frac{d}{dx}\left(\frac{1}{\sinh(x)}\right) = -\frac{\cosh^2(x)}{\sinh^2(x)} = -\frac{1}{\sinh(x)} \cdot \frac{\cosh^2(x)}{\sinh(x)} = -\operatorname{csch}(x)\coth(x)$
- [x] $\frac{d}{dx}(\operatorname{csch}(x)) = \frac{d}{dx}\left(\frac{1}{\sinh(x)}\right) = -\frac{\cosh(x)}{\sinh^2(x)} = -\frac{1}{\sinh(x)} \cdot \frac{\cosh(x)}{\sinh(x)} = -\operatorname{csch}(x)\coth(x)$
- [ ] $\frac{d}{dx}(\cosh(x)) = \frac{d}{dx}\left[\frac{1}{2}(e^x - e^{-x})\right] = \frac{1}{2}(e^x + e^{-x}) = \sinh(x)$

✗

Solution or Explanation

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

Find the derivative.

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

$f'(x) =$

$$excosh(x)+exsinh(x)

✓ e^{2x}

Solution or Explanation

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

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

5. 1/1 points | Previous AnswersSCalcET8 3.11.031.

Find the derivative.

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

$f'(x) =$
$$sech2(√x)·12√x

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

Solution or Explanation

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

6. 1/1 points | Previous AnswersSCalcET8 3.11.037.

Find the derivative.

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

$y'(x) =$
$$ecosh(7x)·sinh(7x)·7

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

Solution or Explanation

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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, $g = 9.8$ 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, $\lim_{t\to\infty} v(t)$.

(No Response) $\sqrt{\frac{gm}{k}}$

(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.)

(No Response) 36.50 m/s

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

(No Response) 101.19 m/s

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 AnswersSCalcET8 3.11.057.

At what point of the curve $y = \cosh(x)$ does the tangent have slope 4?

$(x, y) = \Big($

$$ln(4+√17), √17

$\boxed{\ln\left(4+\sqrt{17}\right), \sqrt{17}}\Big)$

Solution or Explanation

The tangent to $y = \cosh(x)$ has slope 4 when $y' = \sinh(x) = 4 \Rightarrow x = \sinh^{-1}(4) = \ln(4 + \sqrt{17})$, 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 AnswersSCalcET8 3.11.503.XP.

Find the derivative.

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

$f'(x) =$

$$sech2(1+e4x)·e4x·4

$\boxed{4e^{4x}\operatorname{sech}^2(1 + e^{4x})}$

Solution or Explanation

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10. 1/1 points | Previous AnswersSCalcET8 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

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

Solution or Explanation

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11.2/2 points | Previous AnswersSCalcET8 4.4.001.

Given that

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

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

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

(a) $\lim_{x \to a} \frac{f(x)}{g(x)}$

$$INDETERMINATE

$\boxed{INDETERMINATE}$

(b) $\lim_{x \to a} \frac{f(x)}{p(x)}$

$$0

$\boxed{0}$

(c) $\lim_{x \to a} \frac{h(x)}{p(x)}$

$$0

$\boxed{0}$

(d) $\lim_{x \to a} \frac{p(x)}{q(x)}$

$$INDETERMINATE

$\boxed{INDETERMINATE}$

Solution or Explanation

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12. 3/3 points | Previous Answers SCalcET8 4.4.004.

Given that

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

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

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

(a) $\lim\limits_{x \to a} [f(x)]^{g(x)}$

$$INDETERMINATE

$\boxed{INDETERMINATE}$

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

$$0∞

$\boxed{0}$

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

$$INDETERMINATE

$\boxed{INDETERMINATE}$

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

$$INDETERMINATE

$\boxed{INDETERMINATE}$

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

$$∞

$\boxed{INFINITY}$

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

$$INDETERMINATE

$\boxed{INDETERMINATE}$

Solution or Explanation
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13.1/1 points | Previous AnswersSCalcET8 4.4.008.

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

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

$$16

$\boxed{\frac{1}{6}}$

Solution or Explanation

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

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

14.1/1 points | Previous AnswersSCalcET8 4.4.015.

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

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

$$9

$\boxed{9}$

Solution or Explanation

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

15.2/2 points | Previous AnswersSCalcET8 4.4.017.

Find the limit. Use l'Hospital's Rule 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

$\boxed{\frac{1}{4}}$

Solution or Explanation

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

16.1/1 points | Previous AnswersSCalcET8 4.4.019.MI.

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

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

$$0

$\boxed{0}$

Solution or Explanation

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17.1/1 points | Previous AnswersSCalcET8 4.4.025.

Find the limit. Use l'Hospital's Rule 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

$\boxed{3}$

Solution or Explanation

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

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

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

18.2/2 points | Previous AnswersSCalcET8 4.4.027.

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

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

$$812

$\boxed{\frac{81}{2}}$

Solution or Explanation

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19. 1/0 points | Previous Answers SCalcET8 4.4.031.

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

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

$$19

$\boxed{\frac{1}{9}}$

Solution or Explanation

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20. 1/1 points | Previous Answers SCalcET8 4.4.033.

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

$$\lim_{x \to 0} \frac{x6^x}{6^x - 1}$$

$$1*ln*(6)

$\boxed{\frac{1}{\ln(6)}}$

Solution or Explanation

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

$$\lim_{x \to 0} \frac{x6^x}{6^x - 1} \overset{\text{H}}{=} \lim_{x \to 0} \frac{x6^x \ln 6 + 6^x}{6^x \ln 6} = \lim_{x \to 0} \frac{6^x(x \ln 6 + 1)}{6^x \ln 6} = \lim_{x \to 0} \frac{x \ln 6 + 1}{\ln 6} = \frac{1}{\ln 6}$$

21. 1/1 points | Previous Answers SCalcET8 4.4.040.

Find the limit. Use l'Hospital's Rule 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

$\boxed{16}$

Solution or Explanation

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22.1/1 points | Previous AnswersSCalcET8 4.4.045.

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

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

$$53

$\boxed{\frac{5}{3}}$

Solution or Explanation

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

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

23.2/0 points | Previous AnswersSCalcET8 4.4.051.

Find the limit. Use l'Hospital's Rule 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

$\boxed{\frac{7}{2}}$

Solution or Explanation

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24.1/1 points | Previous AnswersSCalcET8 4.4.056.

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

$$\lim_{x \to 1^+} [\ln(x^7 - 1) - \ln(x^5 - 1)]$$

$$ln(75)

$\ln\left(\frac{7}{5}\right)$

Solution or Explanation

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

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

25.2/2 points | Previous AnswersSCalcET8 4.4.058.

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

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

$$1

1

Solution or Explanation

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26.2/2 points | Previous AnswersSCalcET8 4.4.059.MI.

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

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

$$1e6

$\frac{1}{e^6}$

Solution or Explanation

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27. 2/0 points | Previous Answers SCalcET8 4.4.060.

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

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

$$eab

$\boxed{e^{ab}}$

Solution or Explanation

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28. 1/1 points | Previous Answers SCalcET8 4.4.062.

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

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

$$9

$\boxed{9}$

Solution or Explanation

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29. 1/1 points | Previous Answers SCalcET8 4.4.063.

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

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

$$1

$\boxed{1}$

Solution or Explanation

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30. 2/2 points | Previous Answers SCalcET8 4.4.065.

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

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

$$e3

e^3

Solution or Explanation

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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 $\lim_{t \to \infty} v$.

(No Response) $\frac{mg}{c}$

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 l'Hospital's Rule to calculate $\lim_{c \to 0^+} v$.

(No Response) gt

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

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32. 1/1 points | Previous Answers SCalcET8 4.4.070.

Use l'Hospital's Rule to find the exact value of the limit.

$$\lim_{x \to 0} \frac{7^x - 6^x}{5^x - 4^x}$$

$$ln(76)ln(54)

$$\frac{\ln\left(\frac{7}{6}\right)}{\ln\left(\frac{5}{4}\right)}$$

Solution or Explanation
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33. 2/0 points | Previous Answers SCalcET8 4.4.068.

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

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

$$e−6

$$\frac{1}{e^6}$$

Solution or Explanation
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34. 1/0 points | Previous Answers SCalcET8 4.4.087.

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

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

63 63

Solution or Explanation
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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.

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

$$16

$\boxed{\frac{1}{6}}$

Solution or Explanation

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