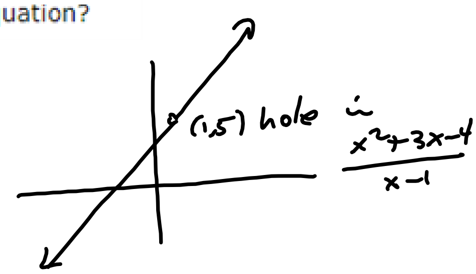
1. 0/2 points

(a) What is wrong with the following equation?

$$\frac{x^2+3x-4}{x-1} = x+4$$

$\mathcal{D} = \{x \mid x \neq 1\}$ $\mathcal{D} = \mathbb{R}$

$= \mathbb{R} \setminus \{1\}$



(b) In view of part (a), explain why the following equation is correct.

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

They agree everywhere except $x=1$ so $\lim_{x\to 1}$ (both) = same.

Evaluate $\lim_{x \to 3} \frac{x-3}{x^3-27}$ if it exists

$\nexists$, $\frac{1}{27}$

1st 2nd

$$\frac{x-3}{x^3-27} = \frac{\cancel{x-3}}{\cancel{(x-3)}(x^2+3x+9)} = \frac{1}{x^2+3x+9} \xrightarrow{x \to 3} \frac{1}{9+9+9} = \frac{1}{27}$$

Riley, Jocelyn

Calc II :

$$\frac{x-3}{x^3-27} \xrightarrow{x \to 3} \frac{0}{0} \xrightarrow[x \to 3]{L'H} \frac{1}{3x^2} \xrightarrow{x \to 3} \frac{1}{3(9)} = \frac{1}{27}$$

L'HÔPITAL

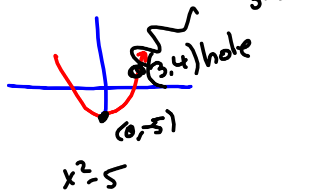
Let $f(x) = \begin{cases} x^2-5 & \text{if } x < 3 \\ 4x-8 & \text{if } x \geq 3 \end{cases}$

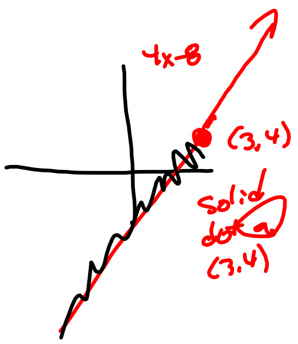
(a) $\lim_{x \to 3^-} f(x) = \lim_{x \to 3^-} (x^2-5) = 9-5 = 4$

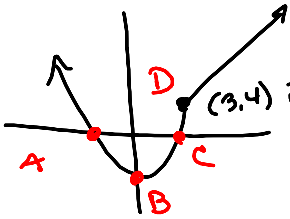
(b) $\lim_{x \to 3^+} f(x) = \lim_{x \to 3^+} (4x-8) = 12-8 = 4$

(c) $\lim_{x \to 3} f(x) = 4$

Sketch $f(x)$







(3,4) is suture point.

It's cute!

$A = (-\sqrt{5}, 0)$

$B = (0, -5)$

$C = (\sqrt{5}, 0)$

$D = (3, 4)$

12. A crystal growth furnace is used in research to determine how best to manufacture crystals used in electronic components for the space shuttle. For proper growth of the crystal, the temperature must be controlled accurately by adjusting the input power. Suppose the relationship is given by

$$T(w) = 0.1w^2 + 2.155w + 20$$

where T is the temperature in degrees Celsius and w is the power input in watts.

(a) How much power is needed to maintain the temperature at 200°C?

$|T(w) - 200|$

$|.1w^2 + 2.155w - 180|$

$T'(w) = .2w + 2.155 \overset{\text{SET}}{=} 0$

$.2w = -2.155$

$w = \frac{-2.155}{.2} \approx -10.775$

vertex $\approx (-10.775, 54.083)$

$.1w^2 + 2.155w + 20 = 200$

$.1w^2 + 2.155w - 180 = 0$

$b^2 - 4ac = (2.155)^2 - 4(.1)(-180) = 76.644025$

$w = \frac{-2.155 \pm \sqrt{76.644025}}{2(.1)} \approx$ 32.99828666 watts OR $-39.\ldots$ Nah.

```
2.155²+4*.1*180
        76.644025
2.155²+4*.1*180
      76.64402500
```

```
      76.64402500
(-2.155+√(Ans))/
.2
      32.99828666
(-2.155-√(Ans))/
.2
     -39.49706759
```

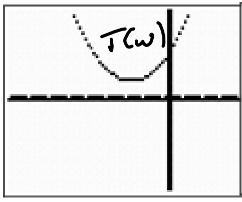
(b) If the temperature is allowed to vary from 200°C by up to ±1°C, what range of wattage is allowed for the input power?

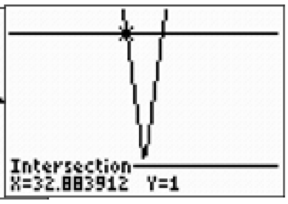
Want $|T(w) - 200| < 1$

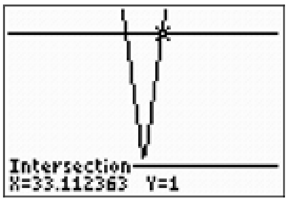
$-1 < T(w) - 200 < 1$

$199 < T(w) < 201$

For written work,
Lexicon:
Let $T = T(w)$ = Temperature, in °C, of the crystal growth chamber, as a function of
w = the # of watts of power put into it.







$32.883912 < w < 33.112363$
WATTS!

(c) In terms of the ε, δ definition of $\lim_{x\to a} f(x) = L$, what is x? What is $f(x)$? What is a? What is L? What value of ε is given? What is the corresponding value of δ?

x = power supplied $= w$ = wattage

$f(x) = T(w)$ = Temp

$L = 200°C$

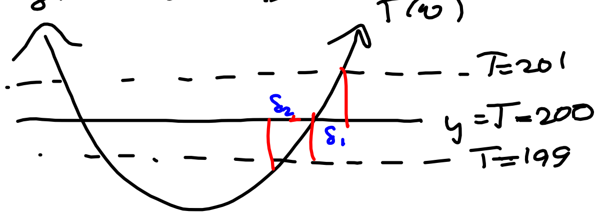
$\varepsilon = 1$

$\delta_1 \approx |33.112363 - 32.99828666|$

$\delta_2 \approx |32.99828666 - 32.883912|$

$\delta \approx \min\{\delta_1, \delta_2\} = \delta_1$

```
      76.64402500
(-2.155+√(Ans))/
.2
      32.99828666
(-2.155-√(Ans))/
.2
     -39.49706759
```



$y=f(x)$. Give eq'n of the slope of the secant line thru $P(7, f(7))$ & $Q(x, f(x))$

$$m=\frac{y_2-y_1}{x_2-x_1}=\frac{f(x)-f(7)}{x-7}$$

Write expression for slope of tangent line @ P.

$$m_{tan}=\lim_{x\to 7}\frac{f(x)-f(7)}{x-7}$$

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① Differentiate $\frac{4x^2-3x+2}{\sqrt{x}}=4x^{\frac{3}{2}}-3x^{\frac{1}{2}}+2x^{-\frac{1}{2}} \Rightarrow$

$$\frac{4x^2}{\sqrt{x}}-\frac{3x}{x^{1/2}}+\frac{2}{x^{1/2}}=$$

$f'(x)=6x^{\frac{1}{2}}-\frac{3}{2}x^{-\frac{1}{2}}-x^{-\frac{3}{2}}$ would be fine for me.

$$=6\sqrt{x}-\frac{3}{2\sqrt{x}}-\frac{1}{\sqrt{x^3}}$$

Find eq'n of the tangent line to

$f(x) = \frac{3x}{x+7}$ @ $(1, \frac{3}{8})$

$\left(\frac{f}{g}\right)' = \frac{f'g - fg'}{g^2} = \frac{3(x+7) - 3x}{(x+7)^2} \Rightarrow$

$y = m(x - x_1) + y_1$

$f'(1) = \frac{3(8) - 3}{(8)^2} = \frac{21}{64} = m$

$y = L_1(x) = \frac{21}{64}(x-1) + \frac{3}{8}$

$= \frac{21}{64}x - \frac{21}{64} + \frac{24}{64}$ $= \frac{21}{64}x + \frac{3}{64}$ for webassign

Find the derivative

$f(t) = \sqrt[7]{3+\tan(t)} = (\tan(t)+3)^{\frac{1}{7}}$

$\Rightarrow f'(t) = \frac{1}{7}(\tan(t)+3)^{-\frac{6}{7}}(\sec^2(t))$ Fine 4 Me.

Chain Rule

$\frac{d}{dx}[f(x)^n] = (n f(x)^{n-1}) f'(x)$

Webassign wants:

$$\frac{\sec^2(t)}{7\sqrt[7]{(\tan(t)+3)^6}}$$

Read Carefully! Find $\frac{dx}{dy}$!? → x' !

§2.6 $y\csc(x) = x^2\cot(y)$

$1\csc(x) + y(-\csc(x)\cot(x))x' = 2x\,x'\cot(y) + x^2(-\csc^2(y))$

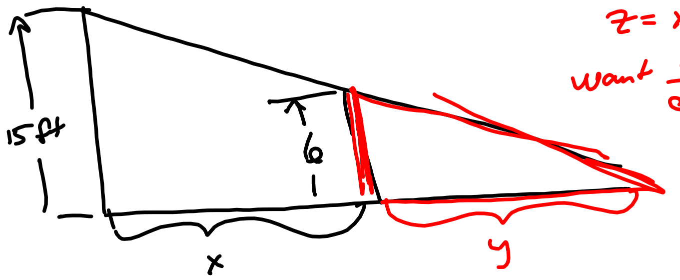
$-y\csc(x)x' - 2x\cot(y)x' = -\csc(x) - x^2\csc^2(y)$

$x'(y\csc(x) + 2x\cot(y)) = \csc(x) + x^2\csc^2(y)$

$$x' = \frac{dx}{dy} = \frac{\csc(x) + x^2\csc^2(y)}{y\csc(x) + 2x\cot(y)}$$

4. 0/1 points SCalc9 2.8.015. [4707866]

A street light is mounted at the top of a 15-ft-tall pole. A man 6 feet tall walks away from the pole with a speed of 5 ft/s along a straight path. How fast (in ft/s) is the tip of his shadow moving when he is 45 feet from the pole?



$z = x + y$

want $\left.\frac{dz}{dt}\right|_{x=45}$

$\frac{dx}{dt} = \frac{5 \text{ ft}}{s}$

$\frac{15}{x+y} = \frac{6}{y}$

$\frac{15}{6} = \frac{5}{2} = \frac{x+y}{y}$

$15y = 6x + 6y$

$9y = 6x$

$y = \frac{6}{9}x = \frac{2}{3}x$

Rate of change of $x+y$ w.r.t. t?

$\frac{d}{dt}[x+y] = \frac{d}{dt}\left[x + \frac{2}{3}x\right] = \frac{d}{dt}\left[\frac{5}{3}x\right]$

$= \frac{5}{3}\frac{dx}{dt} = \left(\frac{5}{3}\right)(5) = \frac{25}{3}\ \frac{\text{ft}}{s}$ & the 45 had nothing to do with the final Answer!