Agenda:

Review Practice Test

Lecture:Related Rates

Introduce L'hopitals Rule

Project Discussions

Practice Test

Find the derivative $y'(x)$ implicitly for the equation $\dfrac{9x + 7}{y} = 6x + y^2$.

$y'(x)=$ $\boxed{}$

$$\frac{d}{dx}\quad 9x+7 = 6xy + y^3$$

$$9 = \underbrace{6x\cdot y' + 6y}_{\text{Product rule.}} + \underbrace{3y^2}_{\text{Chain Rule}}\cdot y'$$

Algebra

$$9-6y = (6x+3y^2)y'$$

$$y' = \frac{9-6y}{6x+3y^2}$$

$$f(x) = \begin{cases} \dfrac{34\sin(x)}{x} & \text{if } x < 0 \\ a & \text{if } x = 0 \\ b\cos(x) & \text{if } x > 0 \end{cases}$$

a = ☐ **and b =** ☐

$$\lim_{x \to 0^-} \frac{34\sin x}{x} = 34$$

$$\parallel$$

$$\lim_{x \to 0^+} b\cos x = b$$

$$\parallel$$

$$f(0) = a$$

Find the derivative of the function.

$f(x) = \frac{x^2}{3} + \frac{8}{x^2}$ $\longrightarrow$ $\frac{1}{3}x^2 + 8x^{-2}$

$f'(x) =$ $\square$

$\frac{2}{3}x^1 - 16x^{-3}$

Differentiate $y = (x^5 + x - 8)^6$.

$$\frac{dy}{dx} = 6\,(x^5+x-8)^5\,(5x^4+1)$$

$\frac{d}{dx}(x^5+x-8)$

Compute the derivative of $f(x) = 2\cos(x^7)$.

$f'(x) =$

Saving ink notes...

$$f' = -2\sin(x^7) \cdot \frac{d}{dx}x^7$$

$$= -2\sin(x^7) \cdot 7x^6$$

or

$$= -14x^6 \sin(x^7)$$

The function is decreasing.

$f(x) = -x^5 - 9x + 9$

$f'(x) = -5x^4 - 9$

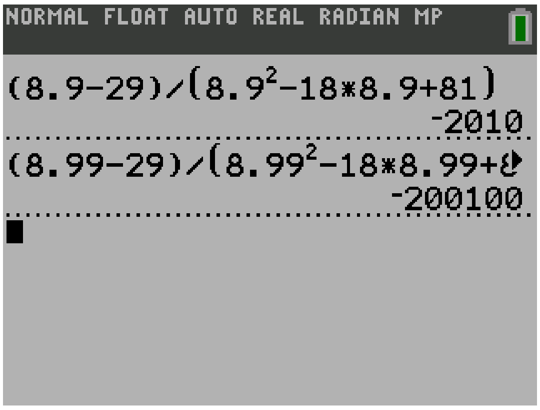
Alway < 0

- True
- False

#1

Determine the limit (answer as appropriate, with a number, ∞, $-\infty$ or does not exist).

$$\lim_{x \to 9^-} \frac{x - 29}{x^2 - 18x + 81}$$



#1

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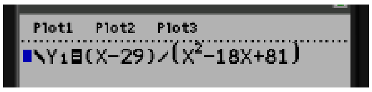
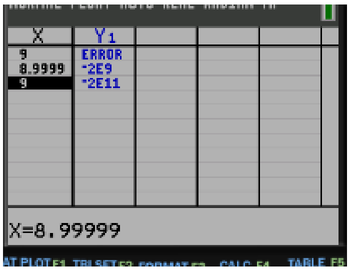
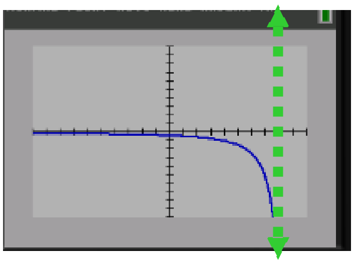


answer: -∞





#3

Determine the limit (answer as appropriate, with a number, ∞, −∞ or does not exist).

$$\lim_{x \to -\infty} \frac{-x}{\sqrt{196 + x^2}}$$

#3

Determine the limit (answer as appropriate, with a number, ∞, −∞ or does not exist).

$$\lim_{x \to -\infty} \frac{-x}{\sqrt{196 + x^2}}$$

$$\lim_{x \to -\infty} \frac{\dfrac{-x}{\sqrt{x^2}}}{\sqrt{\dfrac{196}{x^2} + \dfrac{x^2}{x^2}}} = \lim_{x \to -\infty} \frac{\dfrac{-x}{|x|}}{\sqrt{\dfrac{196}{x^2} + 1}}$$

$$= \lim_{x \to -\infty} \frac{-x}{|x|} = 1$$

#5 Find an equation of the tangent line to $y = x^2 - 9x$ at $x = -4$.

$y =$ ☐

POINT

$x = -4 \quad y = 52$

$y(-4) = (-4)^2 - 9(-4)$

$= 16 + 36$

$= 52$

$y' = 2x - 9$

$y' = 2(-4) - 9$

$= -17$

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

$y - 52 = -17(x + 4)$

$\boxed{y =} -17(x+4) + 52$

#5 Find an equation of the tangent line to $y = x^2 - 9x$ at $x = -4$.

$y =$ ☐

POINT + SLOPE

$x = -4$

$(-4, 52)$

$y = (-4)^2 - 9(-4)$

Slope of Tangent Line

$y' = 2x - 9$

AT $x = -4$

$m = -8 - 9 = -17$

Point / Slope

$y - 52 = -17(x + 4)$

$y = -17(x+4) + 52$

$= -17x \underbrace{-68 + 52}_{-16}$

#9

Ques

Use the position function $s(t) = \dfrac{62t}{\sqrt{t^2 + 6}}$ to find the velocity at time $t = 1$.

(Assume units of meters and seconds.)

$v(1) =$ ☐ m/s

#9

Use the position function $s(t) = \dfrac{62t}{\sqrt{t^2+6}}$ to find the velocity at time $t = 1$.

(Assume units of meters and seconds.)

$v(1) =$ ☐ m/s

$$s' = \frac{(t^2+6)^{1/2}\cdot 62 - 62t\left(\frac{1}{2}\right)(t^2+6)^{-1/2}(2t)}{t^2+6}$$

chain

$$v(1) = \frac{62\sqrt{7} - 62\frac{1}{\sqrt{7}}}{7}$$

$$v(1) = \frac{62}{7}\left(\sqrt{7} - \frac{1}{\sqrt{7}}\right) = \frac{62}{7}\left(\frac{6}{\sqrt{7}}\right)$$

$$\frac{\sqrt{7}}{\sqrt{7}} \quad \frac{7}{\sqrt{7}} - \frac{1}{\sqrt{7}} = \frac{6}{\sqrt{7}}$$

$$\frac{372\sqrt{7}}{49}$$

```
372√7/49
                20.08611199
d/dX(62X/(X²+6)^.5)|X=1
                20.08611158
```

#10

Compute the derivative of $f(x) = 9\cos x^5$.

$$9\cos\left(x^5\right)$$

$$-9\sin\left(x^5\right)\cdot\frac{d}{dx}x^5$$

$$-9\cdot\sin\left(x^5\right)\cdot 5x^4$$

or $-45x^4\sin\left(x^5\right)$

#13 **Find the derivative $y'(x)$ implicitly for the equation**

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

#13 Find the derivative $y\,'(x)$ implicitly for the equation

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

$$\frac{d}{dx}\left(3x+1 = (4xy + y^3)'\right)$$

$$(4x)(y)$$

$$3 = \underbrace{4x \cdot \frac{dy}{dx} + y(4)}_{\text{Product}} + \underbrace{3y^2 \cdot \frac{dy}{dx}}_{\text{chain}}$$

$$3 - 4y = (4x + 3y^2)\frac{dy}{dx}$$

$$\frac{3-4y}{4x+3y^2} = \frac{dy}{dx}$$

#17

Find the linear approximation at $x = 0$ to show that the following commonly used approximations are valid for "small" x. Compare the approximate and exact values for $x = 0.01$, $x = 0.1$, and $x = 1$. Round your calculations to seven decimal places if neede

$5\sin x \approx 5x$

	$L(x)$	$f(x)$
$x = 0.01$	.05	
$x = 0.1$	.5	
$x = 1$	5	

Note: $f(x) = 5\sin x$

#17

Find the linear approximation at $x = 0$ to show that the following commonly used approximations are valid for "small" x. Compare the approximate and exact values for $x = 0.01$, $x = 0.1$, and $x = 1$. Round your calculations to seven decimal places if neede

$5\sin x \approx x$

$5\sin x$

	$L(x)$	$f(x) =$
$x = 0.01$	.05	
$x = 0.1$	.5	
$x = 1$	5	

$5\sin x$

$f(x$

Note: $f(x) = 5\sin x$

X	Y_1	Y_2
.01	.05	.05
.1	.5	.49917
1	5	4.2074

≈ 0

$\sin x \approx x$

$5\sin x \approx 5x$

Use Newton's method to approximate $\sqrt[3]{13}$.

Round your final answer to nine decimal places.

Your Answer:

$5 \rightarrow X$

$X - Y_1 / \text{nDeriv}(Y_1, X, X)$

<enter> <enter>

#16 Use Newton's method to approximate $\sqrt[3]{13}$. $= x$ $\longrightarrow$

Round your final answer to nine decimal places.

Your Answer: [ ]

$$x^3 = 13$$

$$y = x^3 - 13 = 0$$

$$y' = 3x^2$$

Start with guess: $x = 2$

$$2 - \frac{2^3 - 13}{3 \cdot 2^2} = 2 + \frac{+5}{12} = +29/12$$

$$29/12 - \frac{(29/12)^3 - 13}{2\,(29/12)^2} = \rightarrow$$

$2 \rightarrow x$

$X - Y_1 / \text{nDeriv } Y_1 \rightarrow X$

```
NORMAL FLOAT AUTO REAL RADIAN MP
X-(X⁻-13)/(3X⁻)→X
                    2.416666667
Ans▸Frac
                          29/12
X-(X³-13)/(3X²)→X
                    2.353084952
Ans▸Frac
                    2.353084952
```

```
NORMAL FLOAT AUTO REAL RADIAN MP
X-(X⁻-13)/(3X⁻)→X
                    2.351335989
X-(X³-13)/(3X²)→X
                    2.351334688
X-(X³-13)/(3X²)→X
                    2.351334688
13^(1/3)
                    2.351334688
```

d to approximate $\sqrt[3]{13}$.
swer to nine decimal places.

$Y_1 = x^3 - 13$

$x - \sqrt[3]{13} = 0$

$Y_1 = X - (13) \wedge (1/3)$ ←

Guess $5 \to X$ $\qquad 2 \xrightarrow{\text{STO}} X$

$X - Y_1 \,/\, \text{nderiv}(Y_1, X, X) \to X$

$\frac{d}{dx}\boxed{Y_1}\Big|_{x=\boxed{x}} \to X$

More Review

Find the derivative $y\ '(x)$ implicitly.

$\sqrt{xy} - 6y^2 = 12$

Find the derivative $y\ '(x)$ implicitly.

$\sqrt{xy} - 6y^2 = 12$

$$\frac{d}{dx}(xy)^{1/2} \qquad \frac{d}{dx} -6y^2 = -12yy'$$

$$\frac{1}{2}(xy)^{-1/2}\cdot\frac{d}{dx}(xy)$$

$$\frac{1}{2}(xy)^{-1/2}\left(x\frac{dy}{dx}+y\right)$$

$$\frac{1}{2(xy)^{1/2}}(xy'+y)$$

$$2\sqrt{xy}\cdot\left(\frac{1}{2\sqrt{xy}}(xy'+y) - 12yy'\right) = 0$$

$$xy'+y - 12yy'\,2\sqrt{xy} = 0$$

$$y'(x - 12y\cdot 2\sqrt{xy}) + y = 0$$

$$y' = \frac{-y}{x-12\cdot y\cdot 2\sqrt{xy}} = \frac{y}{24y\sqrt{xy}-x}$$

$$A - B = -(B-A)$$

$$\frac{2-x}{x-2} = -1$$

$$\frac{d}{dx} \sin^{-1}(\text{crap})$$

$$\frac{d}{dx} \sin^{-1}(x) = \frac{1}{\sqrt{1-x^2}}$$

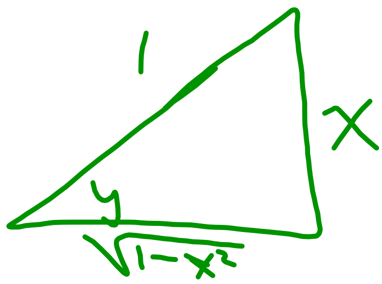
$$\frac{d}{dx} \sin^{-1}(\text{crap}) = \frac{1}{\sqrt{1-\text{crap}^2}} \cdot \frac{d}{dx}\text{crap}$$

$$y = \sin^{-1}(x)$$

Angle

Value

$$\frac{d}{dx}(\sin y) = \frac{d}{dx}x$$



$$\cos y \cdot y' = 1$$

$$\cos y = \frac{\text{adj}}{\text{hyp}}$$

$$y' = \frac{1}{\cos y} = \frac{1}{\sqrt{1-x^2}}$$

Related Rates

Related Rates

Rate

$\boxed{X = 1000}$ $\boxed{\frac{dy}{dt}} = 65$ mph

value

per time

Per cent

100

%

Related Rate.

① Find relationship ✓

② differentiate with r.to time ✓

③ solve ✓

Ex

$\boxed{\text{Pythagorean}}$

$$\frac{d}{dt}\left(x^2+y^2=z^2\right)$$

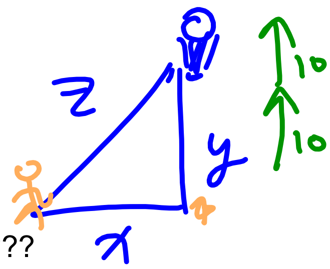
$$2x\left[\frac{dx}{dt}\right]+2y\left[\frac{dy}{dt}\right]=2z\left[\frac{dz}{dt}\right]$$

Balloon Problems

a balloon is rising by 10 feet per second $= \frac{dy}{dt}$

you are 20 feet away from it along ground $= x$

after 2 seconds, how fast is the balloon moving away from you???? rate.



Rel

$$x^2 + y^2 = z^2$$

$x = 20$

$y = 20$

$z = \sqrt{800}$

$$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 2z\frac{dz}{dt}$$

$\frac{dx}{dt} = 0$

$\frac{dy}{dt} = 10$

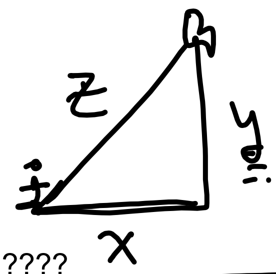
$\frac{dz}{dt} = ?$

$20^2 + 20^2 =$

$400 = z^2$

$z = \sqrt{400}$

Balloon Problems



a balloon is rising by 10 feet per second

you are 20 feet away from it along ground

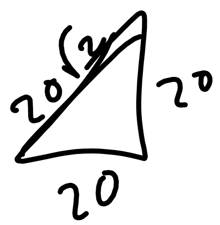
after 2 seconds, how fast is the balloon moving away from you????

$\cdot\ x = 20'$ $\boxed{\frac{dx}{dt} = 0}$ (Pythagoran Thearem) $\boxed{x^2 + y^2 = z^2}$

$\cdot\ y = 20'$ $\boxed{\frac{dy}{dt} = 10'/sec}$ $\rightarrow$ $t = 2$ seconds.

$y = 20'$

$z = 20\sqrt{2} = 28.28...$



$\boxed{\frac{dz}{dt} = ?}$

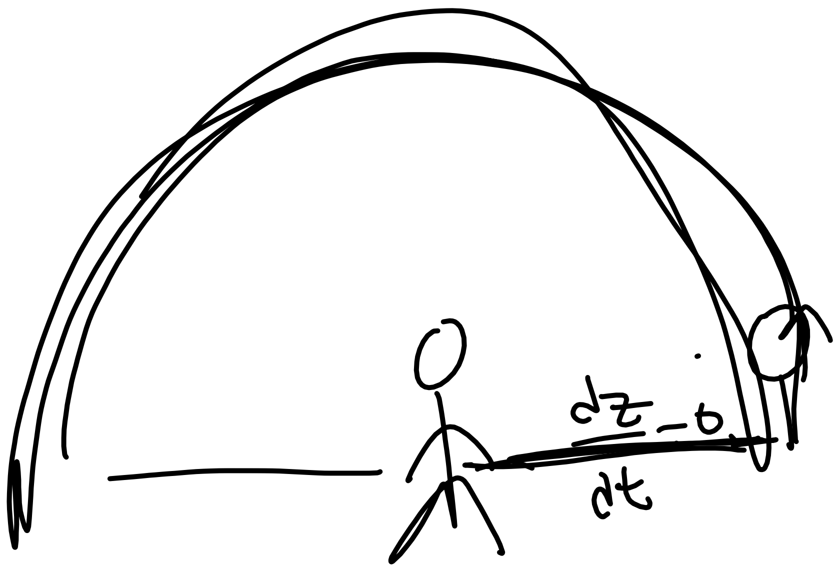
$$\frac{d}{dt}\left(x^2 + y^2 = z^2\right)$$

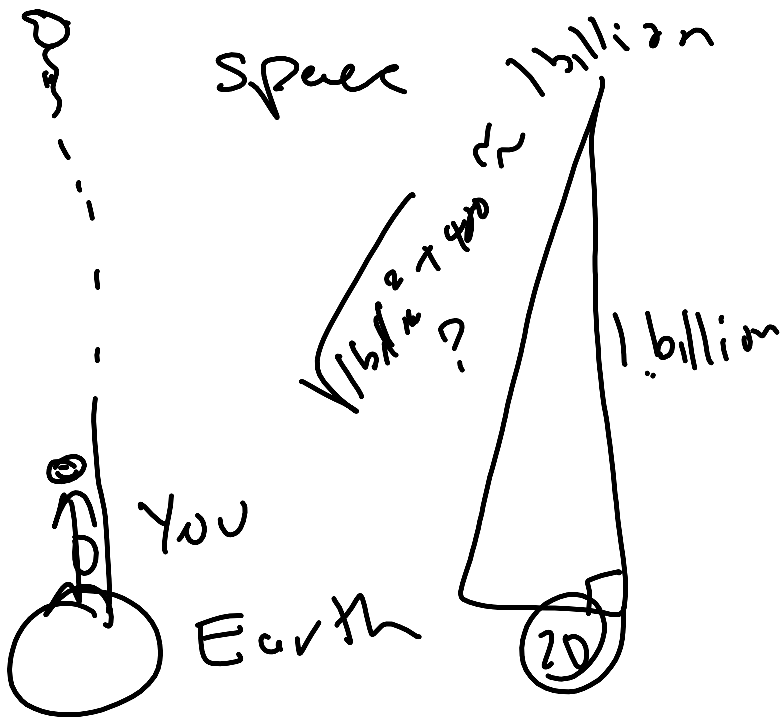
$$2x \cdot \frac{dx}{dt} + 2y\frac{dy}{dt} = 2z\frac{dz}{dt}$$

$$2(20)(0) + 2(20)(10) = 2(28.28) \cdot \frac{dz}{dt}$$

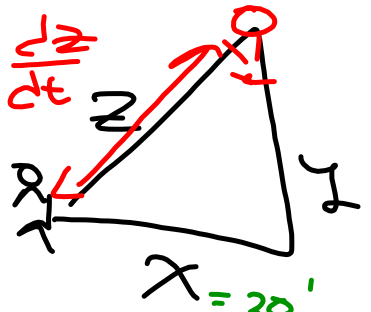
$$\frac{2(20)(0) + 2(20)(10)}{2(28.28)} = \frac{dz}{dt}$$

$$7.07 = dz/dt$$


dz/dt -0


Space
1 billion
You
Earth
1 billion
20
?
$\sqrt{1bn^2 + 400}$ dr

Bulloon Problems



$\frac{dy}{dt} = 10$

$\frac{dx}{dt} \longrightarrow$ Neg

$\longleftarrow \frac{dx}{dt}$ Positive

Relationship

$$\frac{d}{dt}\left(x^2 + y^2 = z^2\right)$$

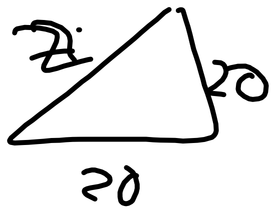
$$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 2z\frac{dz}{dt}$$

$x = 20$ 0 $y = 20$ $10'/\text{sec}$ $= \frac{dz}{dt}$

Not moving

After 2 seconds

$\times 10$



$$20^2 + 20^2 = z^2$$

$$800 = z^2 \qquad z = \sqrt{800} = 20\sqrt{2}$$

$$x\frac{dx}{dt} + y\frac{dy}{dt} = z\frac{dz}{dt}$$

$$\cancel{(20)(0)} + \frac{(20)(10)}{20\sqrt{2}} = \frac{(20\sqrt{2})}{20\sqrt{2}}\frac{dz}{dt}$$

$$\to \frac{10}{\sqrt{2}} = \frac{dz}{dt}$$

Blowing up Balloon

$$\boxed{V = \frac{4}{3}\pi r^3}$$

r = radius

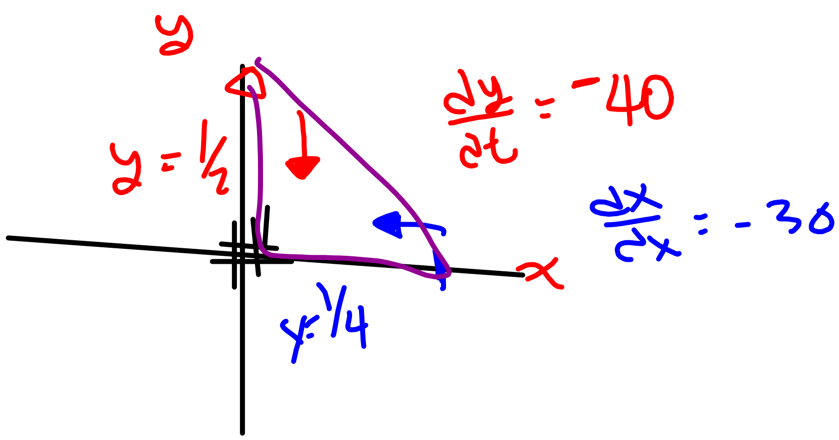
$$\boxed{\frac{dV}{dt}} = \frac{4}{3}\pi \cdot 3r^2 \cdot \frac{dr}{dt}$$

$\frac{dr}{dt}$ = How fast radius grows

$$\text{constant} = \frac{\boxed{dV/dt}}{4\pi r^2} = \boxed{\frac{dr}{dt}}$$

$\frac{dV}{dt}$ = Air blown in

A car is traveling at 40 mph due south at a point 1/2 mile north of an intersection. A police car is traveling at 30 mph due west at a point 1/4 mile due east of the same intersection. At that instant, the radar in the police car measures the rate at which the distance between the two cars is changing. What does the radar gun register? Round your answer to three decimal places.



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$$x = 1/4$$
$$y = 1/2$$
$$z = \sqrt{(1/2)^2 + (1/4)^2} = .559$$
$$\frac{dx}{dt} = -30\text{mph}$$
$$\frac{dy}{dt} = -40\text{mph}$$

$$x^2 + y^2 = z^2$$

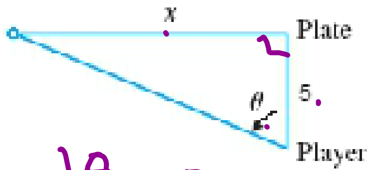
$$\downarrow$$

$$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 2z\frac{dz}{dt}$$

$$\frac{dz}{dt} = \frac{2\left(\frac{1}{4}\right)(-30) + 2\left(1/2\right)(-40)}{2(.559)}$$

A baseball player stands 5 feet from home plate and watches a pitch fly by. In the diagram, x is the distance from the ball to home plate and θ is the angle indicating the direction of the player's gaze. Find the rate θ' at which his eyes must move to watch a fastball with $x'(t) = -165$ ft/s as it crosses home plate at $x = 0$.

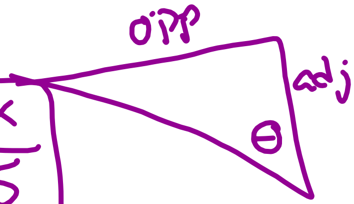
$\theta' =$ $\boxed{-165/5}$ rad/s.



$$\frac{d\theta}{dt} = ?$$

$$\frac{dx}{dt} = -165$$

$$x = 0$$



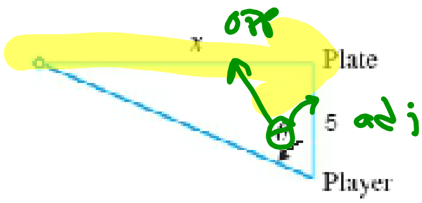
$$\frac{d}{dx}\boxed{\tan\theta = \frac{x}{5}}$$

$$\sec^2\theta \cdot \frac{d\theta}{dt} = \frac{1}{5}\frac{dx}{dt}$$

$$\underbrace{\sec^2(0)}_{1}\ \frac{d\theta}{dt} = \frac{-165}{5}$$

A baseball player stands 5 feet from home plate and watches a pitch fly by. In the diagram, x is the distance from the ball to home plate and θ is the angle indicating the direction of the player's gaze. Find the rate θ' at which his eyes must move to watch a fastball with $x'(t) = -165$ ft/s as it crosses home plate at $x = 0$.

$\theta' =$ ______ rad/s.

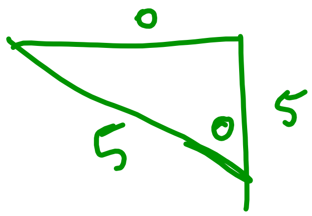


SOH CAH $\boxed{\text{TOA}}$

$$\frac{d}{dt} \tan\theta = \frac{x}{5}$$

$$\sec^2\theta \cdot \boxed{\frac{d\theta}{dt}} = \boxed{\frac{dx}{dt}}$$

$1 \cdot \frac{d\theta}{dt} = -165$



$$\sec\theta = \frac{H}{A} = \frac{5}{5} = 1$$

LHopitals Rule:

Uses Derivatives to Find Limits

$$\frac{0}{0} \qquad \frac{\infty}{\infty}$$

Rule Breaking Limits $0*\infty$

$\infty - \infty$ $\quad 1$

$$\lim_{x \to 0} \frac{\sin x}{x} = \frac{0}{0}$$

Use L'Hopitals Rule

$$\lim_{x \to 0} \frac{\cos x}{1} = 1$$

$0 \cdot \infty$

LHopitals Rule:

Uses Derivatives to Find Limits

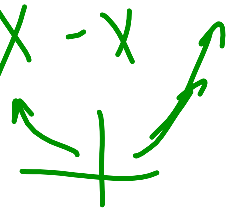
Rule Breaking Limits $\quad 0*\infty \quad \boxed{\frac{0}{0}} \quad \boxed{\frac{\infty}{\infty}}$

$\frac{1}{\infty}$ or $\frac{1}{0}$

$\lim_{y\to\infty} X^2 + A - x^2$

$\infty - \infty$?

$\lim_{x\to\infty} X^2 - X$



$\infty - \infty \qquad 1^\infty$

∞^0

$$\boxed{\lim_{x\to a} \frac{f(x)}{g(x)} = \frac{0}{0} \text{ or } \frac{\infty}{\infty}}$$

$$\parallel$$

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

(NOT QUOTIENT RULE!)

L'Hopitals Rule

If $\boxed{\lim_{x \to a} \frac{f(x)}{g(x)}} = \frac{\infty}{\infty}$ or $\frac{0}{0}$

Then $\lim_{x \to a} \frac{f(x)}{g(x)} = \boxed{\lim_{x \to a} \frac{f'(x)}{g'(x)}}$

Ex $\lim_{x \to \infty} \frac{2x+1}{3x-8} = \frac{\infty}{\infty}$

Use LHR

Ex

$$\lim_{x \to 0} \frac{\sin x}{x} = \frac{0}{0}.$$

use LHR

$$\lim_{x \to \infty} \frac{3x^2 - 7x + 9}{7x^2 - 7} = \frac{\infty}{\infty}$$

Sec. Ex. 11 - 1.5 Section Exercise 11

Question

Determine the limit (answer as appropriate, with a number, ∞, −∞ or does not exist).

$$\lim_{x \to -\infty} \frac{-2x}{\sqrt{256 + x^2}}$$

Sec. Ex. 11 - 1.5 Section Exercise 11

$(256+x^2)^{1/2}$

Question

Determine the limit (answer as appropriate, with a number, ∞, −∞ or does not exist).

$$\lim_{x \to -\infty} \frac{-2x}{\sqrt{256+x^2}}$$

$\frac{\infty}{\infty}$ Use L'Hopitals Rule

$$\lim_{x \to -\infty} \frac{-2}{\frac{1}{2}(256+x^2)^{-1/2} \cdot 2x} =$$

Algebra

$(256+x^2)^{1/2}$

$$\lim_{x \to -\infty} \frac{-2\sqrt{256+x^2}}{x} = \frac{\infty}{\infty}$$

Use L'Hopitals Rule AGAIN

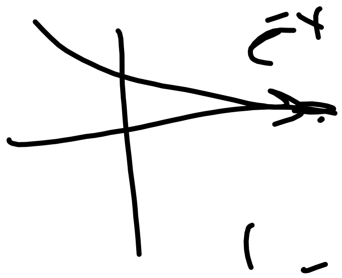
$$\lim_{x \to -\infty} -\frac{-2\sqrt{256+x^2}}{x} \frac{/\sqrt{x^2}}{/x}$$

$$\lim_{x \to -\infty} -2\sqrt{\cancel{\frac{256}{x^2}}^{0} + 1} = -2$$

EX:

$$\lim_{x \to \infty} \boxed{e^{-x}} \cdot x = \lim_{x \to \infty} \frac{x}{e^{x}}$$

$$\boxed{0 \cdot \infty}$$



Use L'Hopital's rule

$=$

$\frac{1}{\infty} = 0$

Ex $\lim_{x \to \infty} e^{-x} \cdot x = 0 \cdot \infty$

$\lim_{x \to \infty} \frac{x}{e^{x}} = \frac{\infty}{\infty}$

use LHR

$\lim_{x \to \infty} \frac{1}{e^{x}} = \frac{1}{\infty} = 0$

$\frac{0}{0}$, $\frac{\infty}{\infty}$, $0 \cdot \infty$, $(\infty - \infty)$

1^{∞},

1.0001^{∞} $= \infty$

$1.000\ldots1$

$.\overline{99} = \underline{1}$

$.\overline{33} = 1/3$

$.\overline{66} = 2/3$

$.\overline{99} = 3/3 = 1$

$.999^{\infty} = 0$

$.99999^{\infty} = 0$

$.\overline{9}^{\infty}$ $\cancel{\times}0 = 1$

Compound Interest $P = Q\boxed{\left(1+\frac{R}{N}\right)^{N}}^{T}$

$\updownarrow$

Compound continuously

$P = Q\boxed{e^{R}}^{T}$

$$\lim_{N\to\infty}\left(1+\frac{R}{\infty}\right)^{\infty} = \underline{e^{R}}$$

$$1+\frac{\#}{\infty} \therefore 0+1 = 1^{\infty} = \underbrace{0 \text{ or } \# \text{ or } \infty}_{\text{Anything}}$$

$$= e^{\#}$$

$$\boxed{e = \lim_{x\to\infty}\left(1+\frac{1}{x}\right)^{x}} = 1^{\infty} \qquad (1+0)^{\infty}$$

Compound Interest $\boxed{\left(1+\frac{R}{N}\right)^{NT}}$

$$\lim_{x\to\infty} \boxed{e}^{\boxed{\ln}\left(1+\frac{1}{x}\right)^{x}}$$

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

$$e^{\lim_{x\to\infty} x \ln\left(1+\frac{1}{x}\right)} = e^{\infty\cdot 0}$$

$$e^{\lim_{x\to\infty}\frac{\ln\left(1+\frac{1}{x}\right)}{x^{-1}}} = e^{\frac{0}{0}}$$

Use L'Hopitals Rule

$$e^{\lim_{x\to\infty}\frac{\frac{1}{(1+1/x)}\cdot\cancel{\frac{d}{dx}(1+1/x)}}{\cancel{\frac{d}{dx}(1/x)}}}$$

$$e^{\lim_{x\to\infty}\frac{1}{1+1/x}} = e^{\frac{1}{1+0}} = e^{1}$$

$$\lim_{x \to \infty} \left(1 + \frac{R}{x}\right)^x = e^R$$

$1^\infty =$ ANY Number ≥ 0

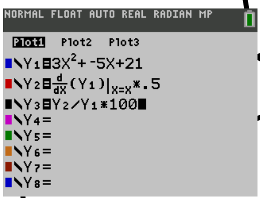
Project: Finish the Error project

$Y_1 = \text{regression}$ 90%

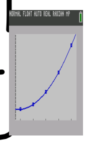
$Y_2 = \frac{dy_1}{dx}\Big|_{x=20,1} * .5$ $\frac{2\ 3\ 4\ 5}{dx\ \ yr.}$

$Y_3 = \underline{Y_2} / \underline{Y_1} * 100$

Picture:



X	Y_1	Y_2	Y_3
a	b	c	d
e	f	g	h



Math

$f'(a)\,dx = c$

$f(a) = b$

% error $f'(a)dx / f(a) =$

Words: At $x = a$, regress predicts $\underline{b}$ with an error of $\underline{c}$ % error of $\underline{d}$ using ___ regression

y_1 $y_1' \cdot x \cdot .5$

NORMAL FLOAT AUTO REAL RADIAN MP

X	Y1	Y2	Y3
6	99	15.5	15.657 %
7	133	18.5	13.91 %
8	173	21.5	12.428 %

X=

$Y(6) = 99 \pm 15.5$

$Y(7) = 133 \pm 18.5$

According to our model in year 7, the sales are $133 ± 18.5.
Error is 13.91%

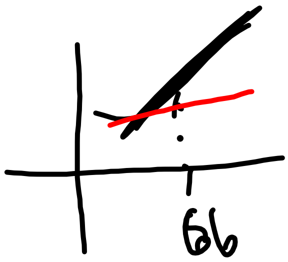
$\text{error} = dy = f'(x) \cdot dx$

$dx = .5$

Project

$$w = r(H)$$

weight is growing $= \dfrac{dw}{dt} = r'(H) \cdot \dfrac{dH}{dt}$



Growing at 7"/yr

120lbs
5'6"