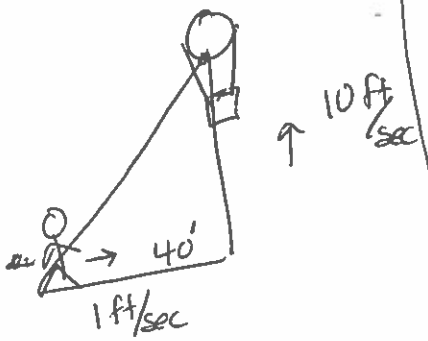
Related Rates (Balloon)



How fast is the rate between you and the balloon changing after 3 seconds?

1 Step: Find relationship

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

2nd Step: d/dt both sides

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

3rd Step: Unknown Values / Unknown Rates

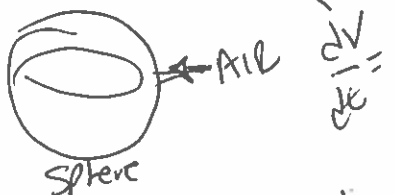
$x=40-3=37$ $dx/dt=-1$ ft/sec
$y=3\times10=30$ $dy/dt=10$ ft/sec
$z=\sqrt{37^2+30^2}$ $dz/dt=?$
$=47.634$

After 3 sec

4th Step: Solve

$\frac{2(37)(-1)+2(10)(30)}{2(47.63\ldots)}=dz/dt$ ft/sec

$\frac{263}{47}\approx 5.52$ ft/sec $=dz/dt$



How Fast is the radius changing at 1"? 3"? 50"?

1st Step: $V=\frac{4}{3}\pi r^3$

2nd Step: $\frac{dV}{dt}=\frac{4}{3}\pi r^2\frac{dr}{dt}$

3rd Step: Vals / Rates

$r=$ $dr/dt=?$
$dV/dt=$

4th Step: Solve

$dV/dt=60$

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

$r=1$: $\frac{60}{4\pi(1)}=4.77$ in/sec $=dr/dt$

$r=3$: $\frac{60}{4\pi(3)}=1.6$ in/sec

$r=50$: $\frac{60}{4\pi(50)}=.0954$ in/sec.

Selling Balloons

$	Sell
1	30
.75	50
.50	75

$S=f(\$)$

STATED IT

L1	L2
1	30
.75	50
.50	70

STAT CALC 4: LinReg

$S=-90x+119.6$

Profit = Revenue − Cost
$=S\times\text{Price}-.10\cdot S$
$=(-.90x+119)[x-.10]$

$P=-.90x^2+119x-11.9$

If I sell $\$1=x$
raise price by .01/day

$\frac{dP}{dt}=P'\cdot\frac{dx}{dt}$

If $\frac{dP}{dt}=\oplus$ Raise price
$\frac{dP}{dt}=\ominus$ Don't Raise price

nDeriv(Y1,X,1)×.01
$=-.518$

variables match $\frac{d}{dx}(x^2 - 7x) = 2x - 7$

variables don't match $\frac{d}{dx}(y^2 - 7y) = 2y\frac{dy}{dx} - 7\frac{dy}{dx}$

(chain Rule.

$$\frac{d}{dt}(y^2 - 7y) = 2y\frac{dy}{dt} - 7\frac{dy}{dt}$$

↑ time

Rates.

50 miles (per) hour

.05 # earned (per) 100 $ invested)

3F (per) 2 hours

Rate →	Value
60 cc per min → $\frac{dV}{dt}$	Smiles = ~~x~~
1 wall per 20 min → $\frac{dw}{dt}$	1 wall = w