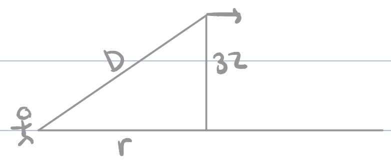
XRONOS HW 14 #2:

1. WANT TO FIND: $\frac{dD}{dt}$, D = DISTANCE

2. GIVEN: RATE = $r = 24$, $\frac{dr}{dt} = 120$, ALTITUDE = 32 THOUSAND FEET

"THOUSAND FT."



3. PYTHAGOREAN THEOREM: $r^2 + (32)^2 = D^2$

(NOTE: WHEN $r = 24$, $24^2 + 32^2 = D^2$

$\Rightarrow D^2 = 1600 \Rightarrow D = 40$)

4. DERIVATIVE: $2r\frac{dr}{dt} = 2D\frac{dD}{dt}$

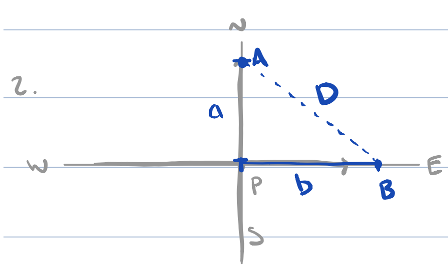
5. PLUG IN $r=24$, $D=40$, $\frac{dr}{dt}=120$: $2(24)(120) = 2(40)\frac{dD}{dt}$

$\Rightarrow 5760 = 80\frac{dD}{dt} \Rightarrow \boxed{\frac{dD}{dt} = 72 \text{ mph}}$

XRONOS HW 14 #3:

1. WANT TO FIND $\frac{dD}{dt}$, D = DISTANCE

2.



GIVEN: AT A PARTICULAR TIME, $a = 39$, $b = 52$, $\frac{da}{dt} = 32$, $\frac{db}{dt} = 24$

3. $a^2+b^2=D^2$ (NOTE: TO FIND D, PLUG IN $a=39$, $b=52$: $39^2+52^2=D^2$

$\Rightarrow D^2=4225 \Rightarrow D=65$)

4. DERIVATIVE: $2a\frac{da}{dt}+2b\frac{db}{dt}=2D\frac{dD}{dt}$

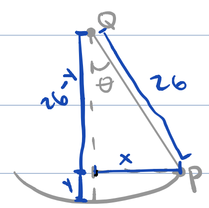
5. PLUG IN $a=39$, $b=52$, $D=65$, $\frac{da}{dt}=32$, $\frac{db}{dt}=24$:

$2(39)(32)+2(52)(24)=2(65)\frac{dD}{dt} \Rightarrow 4992=130\frac{dD}{dt} \Rightarrow \boxed{\frac{dD}{dt}=\frac{192}{5}\ M/S}$

XRONOS HW 14 #4:

1. WANT TO FIND: $\frac{d\theta}{dt}$

2.



GIVEN: LENGTH OF ROPE = 26 FT, $\frac{dx}{dt}=10$ FT/sec, $x=10$ (BECAUSE $t=0$)

3. $\sin\theta=\frac{\text{OPPOSITE}}{\text{HYPOTENUSE}}=\frac{x}{26}$

4. DERIVATIVE: $\cos\theta\frac{d\theta}{dt}=\frac{1}{26}\frac{dx}{dt}$

(NOTE, USING DIAGRAM: $\cos\theta=\frac{26-y}{26}$ AND TO FIND y, $x^2+(26-y)^2=26^2$

$100+(26-y)^2=676$

$\Rightarrow y=2$

$\Rightarrow \cos\theta=\frac{26-2}{26}=\frac{24}{26}=\frac{12}{13}$

5. PLUG IN $\cos\theta = \frac{12}{13}$, $\frac{dx}{dt} = 10 \Rightarrow \frac{12}{13}\frac{d\theta}{dt} = \frac{1}{26}(10)$

$$\Rightarrow \frac{d\theta}{dt} = \frac{\cancel{10}^{5}}{\cancel{26}_{2}} \cdot \frac{\cancel{13}^{1}}{\cancel{12}_{6}} = \frac{5}{12} \Rightarrow \boxed{\frac{d\theta}{dt} = \frac{5}{12} \text{ RAD/S}}$$

XRONOS HW 15 #9: APPROXIMATE $e^{0.2}$ BY LETTING $f(x) = e^x$ AND $a=0$

$L(x) = f'(a)(x-a) + f(a)$

$f'(x) = e^x \Rightarrow f'(0) = 1$, $f(a) = f(0) = 1$

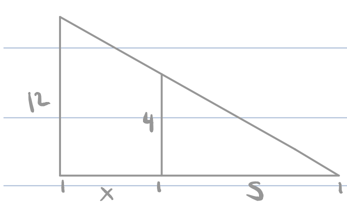
SINCE $0.2 - 0 = 0.2$,

$L(x) = f'(a)(x-a) + f(a) = 1(0.2) + 1 = \boxed{1.2}$

XRONOS HW 14 #5:

1. WANT TO FIND: $\frac{ds}{dt}$, S = SHADOW

2. STREET LIGHT = 12 FT, PERSON = 4 FEET, $\frac{dx}{dt} = 8$ FT/S, $x = 3$



3. $\frac{4}{s} = \frac{12}{x+s}$ ↙ SIMILAR TRIANGLES

$$\Rightarrow 4(x+s) = 12s \Rightarrow 4x + 4s = 12s \Rightarrow 4x = 8s \Rightarrow s = \frac{1}{2}x$$

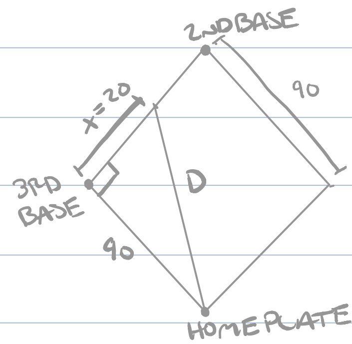
4. DERIVATIVE OF $s = \frac{1}{2}x$: $\frac{ds}{dt} = \frac{1}{2}\frac{dx}{dt}$

5. PLUG IN $\frac{dx}{dt} = \frac{1}{2}(8) = 4 \Rightarrow \frac{dx}{dt} = 4$ FT/S

XRONOS HW 14 #7:

1. WANT TO FIND: $\frac{dD}{dt}$, D= DISTANCE FROM HOME PLATE

2.



GIVEN: 90= LENGTH OF ONE SIDE, $x=20$, $\frac{dx}{dt}=30$

3. $90^2+x^2=D^2$ [NOTE: TO FIND D, PLUG IN $x=20$: $90^2+20^2=D^2 \Rightarrow D^2=8500$ $\Rightarrow D=\sqrt{8500}$]

4. DIFFERENTIATE: $2x\frac{dx}{dt}=2D\frac{dD}{dt}$

5. PLUG IN $x=20$, $\frac{dx}{dt}=30$, $D=\sqrt{8500}$

$$2(20)(30)=2\sqrt{8500}\,\frac{dD}{dt} \Rightarrow \frac{dD}{dt}=-\frac{1200}{2\sqrt{8500}}$$

$$\Rightarrow \boxed{\frac{dD}{dt}=-\frac{600}{\sqrt{8500}}}$$ FT/SEC

* MINUS SIGN B/C PLAYER'S DISTANCE TO HOME PLATE IS GETTING SMALLER

XRONOS HW 14 #8:

1. WANT TO FIND: $\frac{dV}{dt}$, V= RATE SAND IS POURING FROM CHUTE

@ HEIGHT OF 10FT

2. GIVEN: HEIGHT=DIAMETER (LET h=HEIGHT, d= DIAMETER),

$\frac{dh}{dt} = 5 \text{ FT/MIN}$, $\underbrace{h = 10 \text{ FT}}$

3. $V = \frac{1}{3}\pi r^2 h$

VOLUME OF CONE. NOTICE, $d = 2r \Rightarrow r = \frac{d}{2}$. SINCE $d = h$, THIS MEANS $r = \frac{h}{2}$, SO $r^2 = \frac{h^2}{4}$. SO, $V = \underbrace{\frac{1}{3}\pi\left(\frac{h^2}{4}\right)h}$

$\Rightarrow V = \frac{1}{12}\pi h^3$

4. TAKE DERIVATIVE: $\frac{dV}{dt} = \frac{3}{12}\pi h^2 \frac{dh}{dt}$

5. PLUG IN $h = 10$, $\frac{dh}{dt} = 5$: $\frac{dV}{dt} = \frac{\pi}{4}(100)(5) = 125\pi$

$\Rightarrow \boxed{\frac{dV}{dt} = 125\pi \text{ FT}^3/\text{MIN}}$

XRONOS HW 15 #1:

COMPUTE THE DIFFERENTIAL OF $y = \frac{-5}{(x+3)^2}$

* $dy = f'(x)\,dx$

WRITE $y = \frac{-5}{(x+3)^2}$ AS $y = -5(x+3)^{-2}$ $\Rightarrow dy = -5(-2)(x+3)^{-3}\,dx$

$\Rightarrow dy = 10(x+3)^{-3}\,dx$

$\Rightarrow \boxed{dy = \frac{10}{(x+3)^3}\,dx}$

XRONOS HW 15 #2:

COMPUTE dy USING $y = \frac{-4}{x-2}$ AS x GOES FROM 3 TO 2.9

NOTE: $y = -4(x-2)^{-1}$

$dx = 2.9 - 3 = -0.1$

$dy = f'(x)\,dx$ ↓ $dy = f'(3)(-0.1)$

$y = -4(x-2)^{-1} \Rightarrow dy = -4(-1)(x-2)^{-2}\,dx \Rightarrow dy = \frac{4}{x-2}\,dx$

$\Rightarrow dy = \frac{4}{3-1}(-0.1) \Rightarrow \boxed{dy = -0.4}$

XRONOS HW 15 #9: APPROXIMATE $e^{0.2}$ BY LETTING $f(x) = e^x$ AND $a = 0$

$L(x) = f'(a)(x-a) + f(a)$

$f'(x) = e^x \Rightarrow f'(0) = 1$, $f(a) = f(0) = 1$

SINCE $0.2 - 0 = 0.2$,

$L(x) = f'(a)(x-a) + f(a) = 1(0.2) + 1 = \boxed{1.2}$