

sect 5.1

#7 $3 = e^{0.1r} \Rightarrow 0.1r = \ln 3 \quad r = \frac{\ln 3}{0.1} = \frac{1.0986}{0.1} \approx 10.986 \quad (10.99)$

#19 $A = Pe^{rt} \quad 20000 = P e^{0.052(10)} = 1.682 P \quad P = \frac{20000}{1.682} = \underline{\$ 11,890.41}$

#25 $A = Pe^{rt} \quad A = 2P = P e^{0.07t} \quad e^{0.07t} = 2 \quad 0.07t = \ln 2$
 $t = \frac{\ln 2}{0.07} = \frac{0.693...}{0.07} = \underline{9.9 \text{ yrs}} \quad (\text{can use rule of 70})$

#29 $20000 \rightarrow 10000 \Rightarrow 10000 e^{0.072t}$
 $\rightarrow 10000 \Rightarrow 10000 (1+0.08t)^t$
 $10000 e^{0.072(7.3)} + 10000 (1.08t)^{7.3} = 16,915 + 18,018 = 34,933 \leftarrow \text{closer}$
 $10000 e^{0.072(7.4)} + 10000 (1.08t)^{7.4} = 17,037 + 18,164 = 35,201$
 trial + error / graphics gives $t \approx 7.3$

sect 5.2

#3 $f[g(x)] = e^{g(x)} = \underline{\underline{e^{-x^2}}}$

#23 $f(x) = x e^{-2x} \quad f'(x) = 1 \cdot e^{-2x} + x \cdot e^{-2x} (-2) = \underline{\underline{(1-2x)e^{-2x}}}$

#41 $f(x) = \frac{x^3}{e^x} = x^3 e^{-x} \quad f'(x) = 3x^2 \cdot e^{-x} + x^3 e^{-x} (-1) = (3x^2 - x^3) e^{-x} = 0$
 $x=0 \text{ or } x=3 \quad f(0) = 0 \quad \underline{\underline{f(3) = 27e^{-3}}}$ is abs. max

#59 $p = 100 e^{-0.05x}$
 $R = px = 100x e^{-0.05x} \quad R' = 100 e^{-0.05x} + 100x (e^{-0.05x}) (-0.05)$
 $= (100 - 5x) e^{-0.05x} = 0 \Rightarrow x = \frac{100}{5} = 20$

$R(20) = 2000 e^{-1} = \underline{\underline{735.76}} \quad p = \underline{\underline{36.79}}$

sect 5.3

#3 $y = \ln(3-2t) \quad y' = \frac{dy}{dt} = \frac{1}{3-2t} \cdot (-2) = \frac{-2}{2t-3}$

#7 $\frac{d}{dx} (\ln x)^6 = 6(\ln x)^5 \cdot \frac{1}{x} = \frac{6(\ln x)^5}{x}$

#69 $p = 5 - \ln x \quad 5 \leq x \leq 50 \quad R = x(5 - \ln x) \quad P = R - C = 4x - x \ln x$
 $C = 1 \cdot x \quad P' = 4 - \ln x - x \cdot \frac{1}{x} = 3 - \ln x = 0 \quad x = e^3 = 20.09$
 $p = 5 - \ln(e^3) = \underline{\underline{2}}$

#77 $f(x) = 17.5(1 + \ln x) \quad 10 \leq x \leq 100$

$f'(x) = 17.5 \left(\frac{1}{x}\right) = \frac{17.5}{x}$
 $f'(40) = 0.4375 \sim 0.44 \text{ incr.}$
 $f'(90) = 0.1944 \sim 0.19 \text{ incr.}$

Sect 5.4 #3

$$y = e^u \quad \frac{dy}{du} = e^u \quad \left. \begin{array}{l} u = 2-x^4 \quad \frac{du}{dx} = -4x^3 \end{array} \right\} \frac{dy}{dx} = e^{2-x^4} (-4x^3) = -4x^3 e^{2-x^4}$$

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#7 $y = 1+w^2 \quad \frac{dy}{dw} = 2w, w = \ln u \quad \frac{dw}{du} = \frac{1}{u}, u = 2+e^x \quad \frac{du}{dx} = e^x$

$$\frac{dy}{dx} = 2w \left(\frac{1}{u}\right) e^x = \frac{2e^x \ln(1+e^x)}{2+e^x}$$

$$y = 1 + [\ln(2+e^x)]^2$$

#15 $f(x) = 100x - 0.5x^2 \quad f'(x) = 100 - x \quad \frac{f'(x)}{f(x)} = \frac{100-x}{100x-0.5x^2}$

#23 $X = f(p) = 950 - 2p - 0.1p^2 \quad f'(p) = -2 - 0.2p \quad E(p) = -\frac{pf'(p)}{f(p)} = \frac{+2p + 0.2p^2}{950 - 2p - 0.1p^2}$

$E(30) = \frac{+240}{800} = +0.3$ inelastic

$E(50) = \frac{+600}{600} = +1$ unit elasticity

$E(70) = \frac{+1120}{320} = +3.5$ elastic

#47 $C = \$1.25 \quad \frac{dx}{dt} = 20 \quad T = Cx \quad \frac{dT}{dt} = C \frac{dx}{dt} = 1.25(20) = 25/\text{day}$

Sect 5.5

#1 $3x + 5y + 9 = 0$ (A) $3 + 5 \frac{dy}{dx} + 0 = 0 \quad \frac{dy}{dx} = -\frac{3}{5}$
(B) $5y = -3x - 9 \quad y = -\frac{3}{5}x - \frac{9}{5} \quad \frac{dy}{dx} = -\frac{3}{5}$

#9 $y^2 + 2y + 3x = 0$
 $2y \frac{dy}{dx} + 2 \frac{dy}{dx} + 3 = 0 \quad (2+2y)y' + 3 = 0 \quad y' = -\frac{3}{2+2y} \Big|_{(-1,1)} = \boxed{-\frac{3}{4}}$

#15 $x^2y - 3x^2 - 4 = 0 \quad ; \quad (3,4)$
 $2xy + x^2y' - 6x = 0 \quad x^2y' = 6x - 2xy \quad y' = \frac{6x - 2xy}{x^2} = \frac{6}{x} - \frac{2y}{x} \Big|_{(3,4)} = 3 - \frac{4}{3} = \underline{\underline{-1}}$

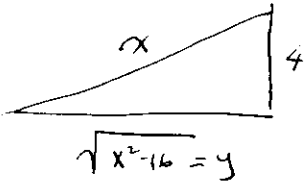
#19 $x^3 - y = \ln y \quad (1,1)$
 $3x^2 - y' = \frac{1}{y} y' \quad (1 + \frac{1}{y})y' = 3x^2 \quad y' = \frac{3x^2}{1 + \frac{1}{y}} = \frac{3x^2y}{y+1} \Big|_{(1,1)} = \underline{\underline{\frac{3}{2}}}$

Sect 5.6

Math 108 (3)
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#3 $x^2 + y^2 = 1$ $2x\dot{x} + 2y\dot{y} = 0$ $2(-0.6)\dot{x} + 2(0.8)(-4) = 0$
 $\dot{x} = \frac{6.4}{-1.2} = \boxed{-\frac{16}{3}}$

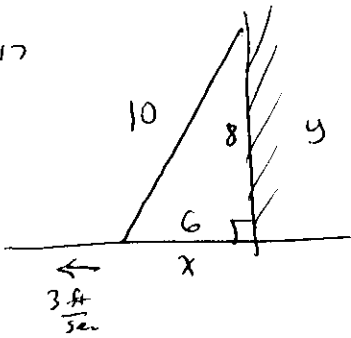
#9



$y^2 + 16 = x^2$
 $2y\dot{y} = 2x\dot{x}$
 $\dot{y} = \frac{x\dot{x}}{y} = \frac{30.265(-3)}{30} = \underline{\underline{-3.0265 \frac{ft}{sec}}}$

$\dot{x} = -3$
 $y = 30$ $x = \sqrt{4^2 + 30^2} = 30.265$

#17



$x^2 + y^2 = 10^2 = 100$
 $2x\dot{x} + 2y\dot{y} = 0$
 $2(6)(-3) + 2(8)\dot{y} = 0$ $\dot{y} = -\frac{36}{16} = \underline{\underline{-2.25 \frac{ft}{sec}}}$

#27

$S' = 60,000 - 40,000 e^{-0.0005x}$

$X = 2000 + 300t$

$\frac{dS}{dt} = \frac{dS}{dx} \cdot \frac{dx}{dt} = (20e^{-0.0005x}) 300 = 6000 e^{-0.0005x} \Big|_{2000}$
 $= 6000 e^{-1} = \underline{\underline{2,207.28 / wk}}$