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17. $f(x)=\sqrt{x}$ @ (4,2)

$$\lim_{h\to 0}\frac{\sqrt{x+h}-\sqrt{x}}{h}\left(\frac{\sqrt{x+h}+\sqrt{x}}{\sqrt{x+h}+\sqrt{x}}\right)\Rightarrow\lim_{h\to 0}\frac{x+h-x}{h(\sqrt{x+h}+\sqrt{x})}\Rightarrow\lim_{h\to 0}\frac{1}{\sqrt{x+h}+\sqrt{x}}=\frac{1}{2\sqrt{x}}$$

@ (4,2) $m=\frac{1}{2\sqrt{x}}=\frac{1}{4}$ $\quad y-2=\frac{1}{4}(x-4)$

$$\boxed{y=\frac{1}{4}x+1}$$

19. $y=\frac{1}{x-1}$ @ $x=3$

$$\lim_{h\to 0}\frac{\frac{1}{x+h-1}-\frac{1}{x-1}}{h}\Rightarrow\lim_{h\to 0}\frac{\frac{x-1-(x+h-1)}{(x-1)(x+h-1)}}{h}\Rightarrow\lim_{h\to 0}\frac{-h}{(x-1)(x+h-1)}\cdot\frac{1}{h}\Rightarrow$$

$$\lim_{h\to 0}\frac{-1}{(x-1)(x+h-1)}=\frac{-1}{(x-1)^2}\qquad m=\frac{-1}{(x-1)^2}=\boxed{\frac{-1}{4}}$$

25. $y=\frac{1}{x-1}$ see derivative above $\quad m=-1$

$$y'=\frac{1}{(x-1)^2}\Rightarrow -1=\frac{1}{(x-1)^2}\Rightarrow (x-1)^2=1\Rightarrow x-1=\pm 1$$

$$x=1\pm 1\Rightarrow x=2,0$$

$m=-1$ (2,1) $\quad y-1=-1(x-2)$ $\quad\boxed{y=-x+3}$

$m=-1$ (0,-1) $\quad y+1=-1(x-0)$ $\quad\boxed{y=-x-1}$

29. $A=\pi r^2$

$$\frac{dA}{dr}=2\pi r\Rightarrow\frac{dA}{dr}=2\pi(3)\Rightarrow\boxed{\frac{dA}{dr}=6\pi\ \text{units}^2}$$

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9. $S=\frac{t}{2t+1}\Rightarrow S'=\frac{(2t+1)(1)-t(2)}{(2t+1)^2}\Rightarrow\frac{1}{(2t+1)^2}$

$$\lim_{h\to 0}\frac{\frac{t+h}{2(t+h)+1}-\frac{t}{2t+1}}{h}\Rightarrow\lim_{h\to 0}\frac{(t+h)(2t+1)-t[2(t+h)+1]}{(2(t+h)+1)(2t+1)}\cdot\frac{1}{h}$$

$$\Rightarrow\lim_{h\to 0}\frac{2t^2+t+2th+h-2t^2-2th-t}{2((t+h)+1)(2t+1)}\cdot\frac{1}{h}\Rightarrow\frac{1}{(2t+1)(t+1)}$$

$$\Rightarrow\frac{1}{(2t+1)^2}$$

27. b 28. a 29. d 30. c

3.2

2 ⇒ T

3 ⇒ b/c there could be multiple tangents

4 ⇒ F ⇒ a function is continuous @ a sharp pt but not differentiable

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1. $y = x^5 - .125x^2 + .25x$

$y' = 5x^4 - .25x + .25$

3. $y = x^3 - 3(x^2 - \pi^2)$ a constant

$y' = 3x^2 - 6x$

5. $y = (x+1)^2(x^2+2x)$

$y' = 2(x+1)(x^2+2x) + (x+1)^2(2x+2)$

$y' = 2(x+1)(x^2+2x) + 2(x+1)(x+1)^2$

7. $y = (\theta^2 + \sec\theta + 1)^3$

$y' = 3(\theta^2+\sec\theta+1)^2(2\theta+\sec\theta\tan\theta)$

9. $s = \dfrac{\sqrt{t}}{1+\sqrt{t}}$

$s' = \dfrac{(1+\sqrt{t})(\frac{1}{2\sqrt{t}}) - \sqrt{t}(\frac{1}{2\sqrt{t}})}{(1+\sqrt{t})^2}$

$s' = \dfrac{\frac{1}{2\sqrt{t}}}{(1+\sqrt{t})^2}$

11. $y = 2\tan^2 x - \sec^2 x$

$y' = 4\tan x\sec^2 x - 2\sec x \cdot \sec x\tan x$

$= 4\tan x\sec^2 x - 2\sec^2 x\tan x$

$y' = 2\tan x\sec^2 x$

13. $s = \cos^4(1-2t)$

$s' = 4\cos^3(1-2t) \cdot -\sin(1-2t)(-2)$

$= 8\sin(1-2t)\cos^3(1-2t)$

15. $s = (\sec x + \tan x)^5$

$s' = 5(\sec x+\tan x)^4(\sec x\tan x + \sec^2 x)$

17. $r = \sqrt{2\theta}\sin\theta$

$r' = \dfrac{1}{2\sqrt{2\theta}\sin\theta} \cdot (\sin\theta + 2\theta\cos\theta)$

$r' = \dfrac{\sin\theta + 2\theta\cos\theta}{2\sqrt{2\theta}\sin\theta}$

19. $r = \sin\sqrt{2\theta}$

$r' = \cos\sqrt{2\theta} \cdot \dfrac{1}{2\sqrt{2\theta}} \cdot 2$

$r' = \dfrac{\cos\sqrt{2\theta}}{\sqrt{2\theta}}$

21. $y = \frac{1}{2}x^2 \csc\left(\frac{2}{x}\right)$

$y' = x\csc\left(\frac{2}{x}\right) + \frac{1}{2}x^2\left(+\csc\left(\frac{2}{x}\right)\cot\left(\frac{2}{x}\right)\cdot\left(\frac{+2}{x^2}\right)\right)$

$y' = x\csc\left(\frac{2}{x}\right) + \csc\left(\frac{2}{x}\right)\cot\left(\frac{2}{x}\right)$

23. $y = x^{-1/2}\sec(2x)^2 \Rightarrow y = x^{-1/2}\sec(4x^2)$

$y' = x^{-1/2}\left(\sec(4x^2)\tan(4x^2)\cdot 8x\right) + \left(-\frac{1}{2}x^{-3/2}\right)\sec(4x^2)$

$= 8x^{1/2}\sec(4x^2)\tan(4x^2) - \frac{\sec(4x^2}{2x^{3/2}}$

25. $y = 5\cot(x^2)$

$y' = -5\csc^2(x^2)\cdot 2x$

$y' = -10x\csc^2(x^2)$

27. $y = x^2\sin^2(2x^2)$

$y' = 2x\sin^2(2x^2) + x^2\left(2\sin(2x^2)\cos(2x^2)\cdot 4x\right)$

$y' = 2x\sin^2(2x^2) + 8x^3\cos(2x^2)\sin(2x^2)$

29. $S = \left(\frac{4x}{x+1}\right)^{-2}$

$S' = -2\left(\frac{4x}{x+1}\right)^{-3}\left(\frac{(x+1)(4)-4x(1)}{(x+1)^2}\right)$

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

31. $y = \left(\frac{\sqrt{x}}{1+x}\right)^2$

$y' = 2\left(\frac{\sqrt{x}}{1+x}\right)\left(\frac{(1+x)\left(\frac{1}{2\sqrt{x}}\right)-\sqrt{x}(1)}{(1+x)^2}\right)$

$y' = \frac{2\sqrt{x}}{1+x}\left(\frac{(1+x)\left(\frac{1}{2\sqrt{x}}\right)-\sqrt{x}}{(1+x)^2}\right)$

33. $y = \sqrt{\frac{x^2+x}{x^2}} = \sqrt{1+\frac{1}{x}}$

$y' = \frac{1}{2\sqrt{\frac{x^2+x}{x^2}}}\cdot\left(-\frac{1}{x^2}\right)$

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

35. $r = \left(\frac{\sin\theta}{\cos\theta-1}\right)^2$

$r' = 2\left(\frac{\sin\theta}{\cos\theta-1}\right)\left(\frac{(\cos\theta-1)(\cos\theta)-\sin\theta(-\sin\theta)}{(\cos\theta-1)^2}\right)$ ($\cos^2\theta+\sin^2\theta = 1$)

$r' = -2\left(\frac{\sin\theta}{\cos\theta-1}\right)\frac{1-\cos\theta}{(\cos\theta-1)^2}$

$r' = \frac{-2\sin\theta}{(\cos\theta-1)^2}$

37. $y = (2x+1)\sqrt{2x+1}$

$y = (2x+1)^{3/2} \Rightarrow y' = \frac{3}{2}(2x+1)^{1/2}(2)$

$y' = 3(2x+1)^{1/2}$

39. $y = \dfrac{3}{(5x^2+\sin(2x))^{3/2}}$

$y = 3(5x^2+\sin(2x))^{3/2}$

$y' = 9/2\,(5x^2+\sin(2x))^{1/2}(10x+\cos(2x)\cdot 2)$

41. $y = 10e^{-x/5}$

$y' = 10e^{-x/5}(-1/5)$

$y' = -2e^{-x/5}$

43. $y = 1/4xe^{4x} - 1/16e^{4x}$

$y' = 1/4e^{4x} + 1/4xe^{4x}\cdot 4 - 1/16e^{4x}\cdot 4$

$y' = 1/4e^{4x} + xe^{4x} - 1/4e^{4x}$

$y' = xe^{4x}$

45. $y = \ln(\sin^2\theta)$

$y' = \dfrac{2\sin\theta\cos\theta}{\sin^2\theta}$

$y' = \dfrac{2\cos\theta}{\sin\theta}$

$y' = \cot\theta$

47. $y = \log_2(x^2/2)$

$y' = \dfrac{x}{x^2/2\ln 2}$

$y' = \dfrac{2}{x\ln 2}$

49. $y = 8^{-t}$

$y' = 8^{-t}(-1)\ln 8$

$y' = -\ln 8\cdot 8^{-t}$

51. $y = 5x^{3.6}$

$y' = 18x^{2.6}$

53. $y = (x+2)^{x+2}$

$\ln y = (x+2)\ln(x+2)$

$\dfrac{y'}{y} = 1\ln(x+2) + (x+2)\left(\dfrac{1}{x+2}\right)$

$\dfrac{y'}{y} = \ln(x+2)+1$

$y' = [\ln(x+2)+1](x+2)^{x+2}$

55. $y = \sin^{-1}\sqrt{1-v^2}$ $\quad 0<v<1$

$y' = \dfrac{\frac{1}{2\sqrt{1-v^2}}\cdot(-2v)}{\sqrt{1-(\sqrt{1-v^2})^2}}$

$y' = \dfrac{-v}{\sqrt{1-v^2}}\cdot\dfrac{1}{v}$

$y' = \dfrac{1}{\sqrt{1-v^2}}$

57. $y = \ln\cos^{-1}x$

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

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

59. $y = x\tan^{-1}x - \frac{1}{2}\ln x$

$y' = \tan^{-1}x + x\cdot\frac{1}{1+x^2} - \frac{1}{2}\left(\frac{1}{x}\right)$

$y' = \tan^{-1}x + \dfrac{x}{1+x^2} - \dfrac{1}{2x}$

61. $y = z\sec^{-1}z - \sqrt{z^2-1}$ $(z>1)$

$y' = \sec^{-1}z + z\cdot\frac{1}{|z|\sqrt{z^2-1}} - \frac{1}{2\sqrt{z^2-1}}\cdot 2z$

$y' = \sec^{-1}z + \frac{1}{\sqrt{z^2-1}} - \frac{z}{\sqrt{z^2-1}}$

63. $y = \csc^{-1}(\sec\theta)$

$y' = \frac{\sec\theta\tan\theta}{|\sec\theta|\sqrt{\sec^2\theta-1}}$

$y' = \frac{\tan\theta}{\sqrt{\sec^2\theta-1}}$

6. 427^{th} derivative of $\sin x$

sinx sinx
cosx
$-\sin x$
$-\cos x$

· True

7. $fgh' + fg'h + f'gh$

$fgh'' + fg'h' + f'gh' + fg''h + fg'h' + f'g'h + f''gh + f'g'h + f'gh'$

8. $y = \sqrt[3]{x} + e^{1-x}$ @ $x=(1,2)$

$y' = \frac{1}{3}x^{-2/3} - e^{1-x}$

$y' = 1/3 - 1 = -2/3$

$y-2 = -2/3(x-1)$

$\boxed{y = -2/3x + 8/3}$

$xe^y = y-1$ @ $(0,1)$ $\Rightarrow m = e$

$e^y + xe^y y' = y'$

$e^y = y' - xe^y y'$

$\frac{e^y}{1-xe^y} = y'$

$y-1 = e(x-0)$

$\boxed{y = ex+1}$

$y = x - x^2$ @ $(1,0)$

$y' = 1 - 2x$

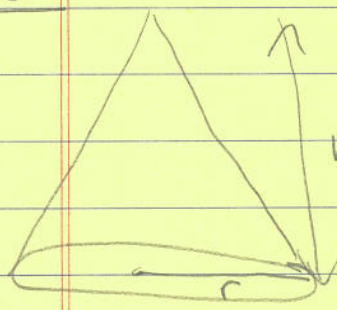
$m = -1$

$y-0 = -1(x-1)$

$\boxed{y = -x+1}$

Sec 3.10

10.



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

$2r = h$ $\quad V = \frac{1}{3}\pi \left(\frac{1}{2}h\right)^2 h$

$r = \frac{1}{2}h$ $\quad V = \frac{1}{3}\pi \left(\frac{1}{4}h^3\right)$

$$\frac{dV}{dt} = \frac{1}{4}\pi h^2 \frac{dh}{dt}$$

$$30 = \frac{1}{4}\pi (10)^2 \, dh/dt$$

$$\frac{dh}{dt} = .382 \text{ ft/min}$$

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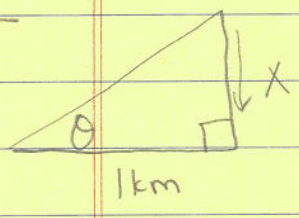
151.



$$\tan\theta = \frac{x}{1}$$

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

$$\sec^2(0) \cdot -.6 = \frac{dx}{dt}$$

$$-.6 \text{ km/sec} = \frac{dx}{dt}$$

ignore part b

p 210

2. $f(x) = \sqrt{x^2+9}$ @ $x = -4$

$$f'(x) = \frac{1}{2\sqrt{x^2+9}} \cdot 2x$$

$$f'(x) = \frac{x}{\sqrt{x^2+9}} = \frac{-4}{5}$$

$y - 5 = -4(x+4)$

$y = -4x - 11$

$\boxed{L(x) = -4x - 11}$

5. $f(x) = \tan x$ @ $x = \pi$

$f'(x) = \sec^2 x$

$f'(\pi) = 1$

$y - 0 = 1(x - \pi)$

$\boxed{y = x - \pi}$

23. $2y^{3/2} + xy - x = 0$

$3yy' + xy' + y - 1 = 0$

$3yy' + xy' = -y + 1$

$y' = \frac{-y+1}{3y+x}$

$dy = \left(\frac{-y+1}{3y+x}\right) dx$

37. $y = \sec^{-1}(e^{-x})$

$y' = \frac{-e^{-x}}{|e^{-x}|\sqrt{(e^{-x})^2 - 1}}$

$dy = \frac{-1}{\sqrt{e^{-2x} - 1}} dx$

39. $f(x) = x^2 + 2x \quad @ x_0 = 1 \quad dx = .1$

ignore