1/ $f(t) = 6\sqrt{t} - \frac{1}{3}t^3 + t + 1 + \frac{1}{t}$

$f'(t) = \frac{3}{\sqrt{t}} - t^2 + 1 - \frac{1}{t^2}$

2/ $y = x^2\cos x - 2x\sinh x - 2\cos x$

$y' = 2x\cos x - x^2\sin x - 2\sinh x - 2x\cos x + 2\sin x$

$= -x^2\sin x$

3/ $f(x) = (x^3 + 2x)^5$

$f'(x) = 5(3x^2 + 2)(x^3 + 2x)^4$

4/ $y = \ln(\sec^2\theta)$

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

$= 2\tan\theta$

5/ $f(x) = \frac{2x+5}{4x+1}$

$f'(x) = \frac{-18}{(4x+1)^2}$

2.2

#10 $y = \dfrac{x^3 - 4x}{\sqrt{x}}$

$= x^{5/2} - 4x^{1/2}$

$y' = \frac{5}{2}x^{3/2} - \dfrac{2}{\sqrt{x}}$

#30 $f(x) = \frac{1}{2}x^4 + \pi x^3 - 7x + 1$

$f'(x) = 2x^3 + 3\pi x^2 - 7$

$f''(x) = 6x^2 + 6\pi x$

#38 $f(x) = 4x^4 - 2x^3 + x + 2$ $f^{(4)}(x)$

$f^{(4)}(x) = 4(4!)$

$= 96$

$f^{(5)}(x) = 0$

2.3

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

$= x^{3/2} + 2x + \sqrt{x} + 2$

$y' = \frac{3}{2}\sqrt{x} + 2 + \frac{1}{2\sqrt{x}}$

#11 $y = \frac{x+4}{5x-2}$

$y' = \frac{-22}{(5x-2)^2}$

#40 $y = \frac{x^2-4}{5x^2-2}$

$y' = \frac{36x}{(5x^2-2)^2}$

#52 $y = \frac{x^2-4x+2}{5x^2-2x-1}$

$y' = \frac{18x^2-12x+6}{(5x^2-2x-1)^2}$

1	-4	1
5	-2	-1

#39 $y = \frac{6x-8}{2x-3}$

$y' = \frac{-2}{(2x-3)^2}$

2.4

$(\cos x)' = -\sin x$ $\quad (\cos x)'' = -\cos x$

$(\cos x)''' = \sin x$ $\quad (\cos x)^{(4)} = \cos x$

$(\cos x)^{(2n+1)} = (-1)^n \sin x$

$$\frac{d^{999}}{dx^{999}}(\cos x) = \sin x$$

#5 $y = (\sin x + \cos x)\sec x$ $\quad \frac{1}{\cos x}$ 

$= \tan x + 1$

$y' = \sec^2 x$

#7 $y = \frac{\cos x}{x} + \frac{x}{\cos x} = \text{———}$

$= \frac{\cos^2 x + x^2}{x \cos x}$

$$y' = \frac{(-2\cos x \sin x + 2x)x\cos x - (\cos x - x\sin x)(\cos^2 x + x^2)}{x^2 \cos^2 x}$$

$$= \frac{-2x\cos^2 x \sin x + 2x^2 \cos x - \cos^3 x - x^2 \cos x + x\sin x \cos^2 x + x^3 \sin x}{x^2 \cos^2 x}$$

$$= \frac{-2x\cos^2 x \sin x + x^2 \cos x - \cos^3 x + x\sin x \cos^2 x + x^3 \sin x}{x^2 \cos^2 x}$$

#25 $f(\theta) = \dfrac{\sin a\theta}{\cos b\theta}$

$$f'(\theta) = \frac{a\cos a\theta \cos b\theta + b\sin b\theta \sin a\theta}{\cos^2 b\theta}$$

#15 $\rho = \dfrac{3\theta + \tan\theta}{\theta \sec\theta}$ $\qquad (3\theta + \tan\theta)$

$$\rho' = \frac{(3+\sec^2\theta)\theta\sec\theta - (\sec\theta + \theta\sec\theta\tan\theta)}{\theta^2\sec^2\theta}$$

$$= \frac{3\theta\sec\theta + \theta\sec^3\theta - 3\theta\sec\theta - \sec\theta\tan\theta}{\theta^2\sec^2\theta} \qquad -3\theta^2\sec\theta\tan\theta - \theta\sec\theta\tan^2\theta$$

$$= \frac{\theta\sec^3\theta - \sec\theta\tan\theta(1+3\theta^2) - \theta\sec\theta\tan^2\theta}{\theta^2\sec^2\theta}$$

$$\rho = \frac{3\theta + \tan\theta}{\theta\sec\theta}$$

$$= 3\cos\theta + \frac{1}{\theta}\sin\theta$$

$$\rho' = -3\sin\theta + \frac{\theta\cos\theta - \sin\theta}{\theta^2}$$

$$= \frac{-3\theta^2\sin\theta + \theta\cos\theta - \sin\theta}{\theta^2}$$

#29 $\frac{d}{dx}\left(2x(\sin x)\sqrt{3x-1}\right)$

$= 2(\sin x)\sqrt{3x-1} + 2x\cos x\sqrt{3x-1} + \frac{3x\sin x}{\sqrt{3x-1}}$

$= \frac{(6x-2)\sin x + (6x^2-2x)\cos x + 3x\sin x}{\sqrt{3x-1}}$

$= \frac{(9x-2)\sin x + (6x^2-2x)\cos x}{\sqrt{3x-1}}$

2.6

#24 $f(\theta) = \left(\frac{\sin\theta}{1+\cos\theta}\right)^2$

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

$$= \frac{2\sin\theta}{(1+\cos\theta)^2}$$

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

#29 $y = \tan^2(\sin^3 x)$

$2\tan(\sin^3 x)(\tan\sin^3 x)'$

$(\tan u)' = u'\sec^2 u$

$$y' = 2\tan(\sin^3 x)(3\sin^2 x\cos x)\sec^2(\sin^3 x)$$

$$= 6\sin^2 x\cos x\tan(\sin^3 x)\sec^2(\sin^3 x)$$

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

$f'(x) = 0$

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

$= (3x^2-1)^{-3}(3x^2+1)^3$

$f'(x) = \frac{(3x^2+1)^2}{(3x^2-1)^4}\left(-3(6x)(3x^2+1) + 3(6x)(3x^2-1)\right)$

$= \frac{(3x^2+1)^2}{(3x^2-1)^4}\left(-54x^3 - 18x + 54x^3 - 18x\right)$

$= \frac{-36x(3x^2+1)^2}{(3x^2-1)^4}$

#46 $y = \left(\frac{x-3}{2x+5}\right)^5$

$$y' = 5\left(\frac{x-3}{2x+5}\right)^4 \frac{11}{(2x+5)^2}$$

$$= \frac{55(x-3)^4}{(2x+5)^6}$$

#60 $f(x) = (x^2+2x-3)^4 (x^2+3x+5)^6$

$$f'(x) = (x^2+2x-3)^3 (x^2+3x+5)^5$$

$$\Big((8x+8)(x^2+3x+5) + 6(2x+3)(x^2+2x-3) \Big)$$

x^3	x^2	x^1	x^0
8	24	40	40
12	8	24	−54
	24	−18	
	18	36	

$$f'(x) = (20x^3 + 74x^2 + 82x - 14)(x^2+2x-3)^3 (x^2+3x+5)^5$$

2.8

#32 $y = \ln(\sec(\ln x))$

$$y' = \frac{\frac{1}{x}\sec(\ln x)\tan(\ln x)}{\sec(\ln x)}$$

$$= \frac{1}{x}\tan(\ln x)$$

#51 $y = \sqrt{e^{2x^2} + e^{-2x^2}}$

$(\sqrt{u})' = \frac{u'}{2\sqrt{u}}$

$(e^u)' = u'e^u$

$$y' = \frac{4xe^{2x^2} - 4xe^{-2x^2}}{2\sqrt{e^{2x^2} + e^{-2x^2}}}$$

#68 $f(x) = \frac{xe^x}{\ln(x^2+1)}$

$(\frac{u}{v})'$

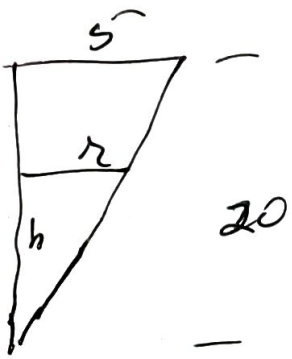
$$f'(x) = \frac{(e^x + xe^x)\ln(x^2+1) - xe^x \frac{2x}{x^2+1}}{(\ln(x^2+1))^2}$$

$$= \frac{e^x(1+x)(x^2+1)\ln(x^2+1) - 2x^2e^x}{(x^2+1)\ln^2(x^2+1)}$$

2.10 — $\frac{dh}{dt}$ @ $h = 5'$

#16

$\frac{dV}{dt} = 4$



$\frac{r}{5} = \frac{h}{20}$

$r = \frac{h}{4}$

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

$= \frac{1}{3}\pi \frac{h^2}{16} h$

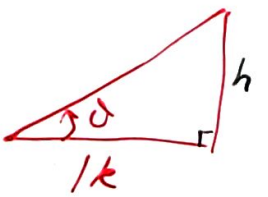
$= \frac{\pi}{48} h^3$

$\frac{dV}{dt} = \frac{\pi}{16} h^2 \frac{dh}{dt}$

$4 = \frac{\pi}{16} 25 \frac{dh}{dt}$

$\frac{dh}{dt} = \frac{64}{25\pi}$ ft/min

#28 $\frac{d\theta}{dt} = .2$ rad/min



$\frac{dh}{dt}$ @ $\theta = \frac{\pi}{4}$

$\tan\theta = \frac{h}{1000}$

$h = 1000 \tan\theta$

$\frac{dh}{dt} = 1000 \sec^2\theta \frac{d\theta}{dt} \Big|_{\theta = \pi/4,\ d\theta/dt = .2 = \frac{2}{10}}$

$= 1000 \sec^2\frac{\pi}{4} \left(\frac{1}{5}\right)$

$= 400$ ft/min