2.2 & 2.3

#3 $f(x) = 2x^3 - 3x^2 - 5$

$f'(x) = 6x^2 - 6x$

#5 $f(t) = 4\sqrt{t} - \frac{1}{4}t^4 + t + 1 + \frac{1}{t}$

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

#9 $f(x) = \sqrt[4]{x} + \sqrt[3]{x} + \sqrt{2} x^{\sqrt{2}}$

$= x^{1/4} + x^{1/3} + \sqrt{2} x^{\sqrt{2}}$

$f'(x) = \frac{1}{4}x^{-3/4} + \frac{1}{3}x^{-2/3} + 2x^{\sqrt{2}-1}$

#11 $f(x) = \frac{1 - 2x}{x^{1/2}}$

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

$f'(x) = -\frac{1}{2}x^{-3/2} - x^{-1/2}$

$= -\frac{1}{2x\sqrt{x}} - \frac{1}{\sqrt{x}}$

#14 $f(x) = (5x^3 + 3x + 1)(x^2 + 5)$

$f'(x) = (15x^2 + 3)(x^2 + 5) + 2x(5x^3 + 3x + 1)$

$= 15x^4 + 78x^2 + 15 + 10x^4 + 6x^2 + 2x$

$= 25x^4 + 84x^2 + 2x + 15$

2.d - H.w.k

1/ $f(x) = \sqrt{x}\, \sin x$

$f'(x) = \frac{1}{2\sqrt{x}} \sin x + \sqrt{x}\, \cos x$

2/ $f(x) = \frac{\cos x}{x^3}$

$f'(x) = \frac{-(\sin x)x^3 - 3x^2 \cos x}{x^6}$

$= \frac{-x\sin x - 3\cos x}{x^4}$

#10. $f(\theta) = (\theta + 1)\cos \theta$ $(\sin \theta)(\theta + 1)$

$f'(\theta) = \cos \theta - (\theta + 1)\sin \theta$

#11 $f(x) = \frac{\sec x}{x}$

$f'(x) = \frac{x \sec x \tan x - \sec x}{x^2}$

#15 $f(\theta) = \frac{\theta}{1 - \sin \theta}$

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

2.6

$(u^n)' = u' \cdot n \cdot (\,)^{n-1}$

1) $f(x) = (x-2)^2$

$f'(x) = a(x-2)$

2) $y = (2\sqrt{x} - 1)(4x+1)^{-1}$

$y' = -\dfrac{1}{(4x+1)^2}\left(\dfrac{1}{\sqrt{x}}(4x+1) - 4(2\sqrt{x}-1)\right)$

$= \dfrac{4x+1 - 8x + 4\sqrt{x}}{\sqrt{x}\,(4x+1)^2}$

$= \dfrac{1 - 4x + 4\sqrt{x}}{\sqrt{x}\,(4x+1)^2}$

#7) $y = \left(\dfrac{1}{x-3}\right)^2$

$y' = \dfrac{-2}{(x-3)^2}\left(-\dfrac{1}{x-3}\cdot\right)$

$= \dfrac{-2}{(x-3)^3}$

$\dfrac{ax+b}{cx+d}$

$y = \dfrac{-1}{(x-3)^2}\left(\dfrac{1}{u}\right)'$

#12) $f(x) = \left(\dfrac{3x^2-2}{2x+3}\right)^3$

$(u^n)' = nu'u^{n-1}$

$f'(x) = 3\,\dfrac{6x^2+18x+4}{(2x+3)^2}\left(\dfrac{3x^2-2}{2x+3}\right)^2$

$= \dfrac{6(3x^2+9x+2)(3x^2-2)^2}{(2x+3)^4}$

$f(x) = (3x^2-2)^3(2x+3)^{-3}$ $(u^n v^m)'$

#14 $f(\theta) = \tan^2 5\theta$ $2(\tan 5\theta)' \tan 5\theta$

$f'(\theta) = 2(5) \sec^2 5\theta \tan 5\theta$

$= 10 \sec^2 5\theta \tan 5\theta$

#15 $f(x) = \sqrt{x} + \frac{1}{4} \sin(2x)^2$

$= \sqrt{x} + \frac{1}{4} \sin(4x^2)$

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

#16 $y = \sin(\tan 2x)$

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

#17 $h(t) = 2 \cot^2(\pi t + 2)$ $(\cot u)^2 = 2(\cot u)' \cot u$

$h'(t) = -4 \pi \csc^2(\pi t + 2) \cot(\pi t + 2)$

$\#$ 15.

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

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

$$\left(\; 4(x^4-3)(x^2-5x+2) \right.$$
$$+ 12x^3(2x+5)(x^2-5x+2)$$
$$\left. + 6(2x-5)(2x+5)(x^4-3) \; \right)$$

$$= (2x+5)(x^4-3)^2(x^2-5x+2)^5$$

$$\left(\; (4x^4-12)(x^2-5x+2) \right.$$
$$+ (24x^4+60x^3)(x^2-5x+2)$$
$$\left. + (4x^2-25)(6x^4-18) \; \right)$$

x^6	x^5	x^4	x^3	x^2	x^1	x^0
4	20	8	120	-12	60	-24
24	-120	48		-72		450
24	60	-300				
		-150				

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

$$(52x^3-40x^5-296x^4+12x^3-84x^2+60x-426$$

#19

$$f(x) = \frac{(3x^2-1)^4(5-8x)^3}{(x^3-2x+1)^2}$$

$$f'(x) = \frac{(3x^2-1)^3(5-8x)^2}{(x^3-2x+1)^3}$$

$$\left[24x(5-8x)(x^3-2x+1) \right.$$
$$-24(3x^2-1)(x^3-2x+1)$$
$$\left. -2(3x^2-2)(3x^2-1)(5-8x) \right]$$

$$= \frac{(3x^2-1)^3(5-8x)^2}{(x^3-2x+1)^3}$$

$$\left[(120x-192x^2)(x^3-2x+1) \right.$$
$$+(72x^2+24)(x^3-2x+1)$$
$$\left. +(6x^2+4)(15x^2-24(x^3-5+8x)) \right]$$

	x^5	x^4	x^3	x^2	x^1	x^0
	-192	120	384	-240	120	24
	-72	-80	144	-192	-48	-20
	144		24	-72	32	
			-48	50		
			-96	60		

$$f'(x) = \frac{(3x^2-1)^3(5-8x)^2}{(x^3-2x+1)^3} \left[-120x^5 + 30x^4 + 408x^3 \right.$$
$$\left. -414x^2 + 104x + 4 \right]$$

#20. $\quad y = \sec \left(\dfrac{x^2+1}{x^4+2} \right)^3 \qquad\qquad (\sec u)'$

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

$$\sec \left(\dfrac{x^2+1}{x^4+2} \right)^3 \tan \left(\dfrac{x^2+1}{x^4+2} \right)^3$$

$$= 3 \; \dfrac{(x^2+1)^2(-2x^5+4x-4x^3)}{(x^4+2)^4} \sec \left(\dfrac{x^2+1}{x^4+2} \right)^3 \tan \left(\dfrac{x^2+1}{x^4+2} \right)^3$$
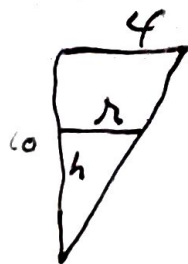

$$(\ln u)' = \dfrac{u'}{u} \quad\Longrightarrow\quad (e^u)' = u' e^u$$

#14 $\quad$ 2.10 $\qquad\qquad\qquad\qquad V = \tfrac{1}{3} \pi r^2 h$

$$\dfrac{dV}{dt} = 5 \; \dfrac{ft^3}{min} \quad ; \quad \dfrac{dh}{dt} ? \Big/_{h=6}$$

$$\dfrac{r}{4} = \dfrac{h}{10}$$

$$r = \dfrac{2}{5} h$$

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

$$= \dfrac{1}{3} \pi \dfrac{4}{25} h^3$$

$$= \dfrac{4\pi}{75} h^3$$

$$\dfrac{dV}{dt} = \dfrac{4\pi}{25} h^2 \dfrac{dh}{dt}$$

$$\dfrac{25}{4\pi} 5 = 36 \dfrac{dh}{dt}$$

$$\dfrac{dh}{dt} = \dfrac{125}{144 \pi} \; ft/min$$

$$x^2 + y^2 - 2y - 4x = 4 \qquad \frac{dy}{dx}$$

$$2x + 2yy' - 2y' - 4 = 0$$

$$(y-1)y' = 2-x$$

$$y' = \frac{dy}{dx} = \frac{2-x}{y-1}$$

2.2 # 33 $f(x) = 3x^4 - 6x^3 + \frac{x^2}{8} + 5$

$$f^{(4)}(x) = 3(4!)$$
$$= 72$$

#34 $f(x) = 3x^4 - 6x^3 + \frac{x^2}{8} + 5$

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

see
2.6
#67 $f(x) = e^{2x} \ln(xe^x + 1)$

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

$$= 2e^{2x} \ln(xe^x + 1) + \frac{(x+1)e^{3x}}{xe^x + 1}$$

65) $y = \ln \frac{1+e^x}{1-e^x}$ $\frac{e^x+1}{-e^x+1}$

$$e^x(1-e^x) + e^x(1+e^x)$$

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

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

2.3

34 $y = \dfrac{-3x - 4}{2x - 1}$ $\qquad\qquad$ $(-3)(-1) - (-4)(2)$

$\qquad y' = \dfrac{11}{(2x-1)^2}$

36 $y = \dfrac{3x}{3x - 2}$ $\quad \to \quad y' = \dfrac{-6}{(3x-2)}$

37 $y = \dfrac{x - 3}{2x + 5}$

$\qquad y' = -\dfrac{11}{(2x+5)^2}$

38 $y = \dfrac{5x - 3}{2x + 5}$

$\qquad y' = \dfrac{31}{(2x+5)^2}$

41 $y = \dfrac{3x^2 - 4}{5x^2 - 2}$ $\qquad\qquad$ $\begin{matrix} 3 & 0 & -4 \\ 5 & 0 & -2 \end{matrix}$

$\qquad y' = \dfrac{28x}{(5x^2-2)^2}$ $\qquad\qquad$ $y' = \dfrac{-12x + 40x}{(5x^2-2)2}$

$\qquad\qquad\qquad\qquad\qquad \left(\dfrac{\alpha + b}{\beta + d} \right)' = \alpha d - \beta d$

50 $y = \dfrac{x^2 - 3x + 1}{x^2 - 8x + 5}$ $\qquad\qquad$ $\begin{matrix} 1 & -3 & 1 \\ 1 & -8 & 5 \end{matrix}$

$\qquad y' = \dfrac{-5x^2 + 8x - 7}{(x^2 - 8x + 5)^2}$

α.?

59 $f(x) = (2x^2 - 4x + 3)^4 (3x - 5)^5$

$f'(x) = (2x^2 - 4x + 3)^3 (3x - 5)^4$
$$[4(4x - 4)(3x - 5)$$
$$+ 15(2x^2 - 4x + 3)]$$

x^2	x^1	x^0
48	-80	80
30	-48	45
	-60	

$f'(x) = (2x^2 - 4x + 3)^3 (3x - 5)^4 (78x^2 - 198x + 125)$