MATH 1210: HOMEWORK SOLUTIONS §2.3

1. $D_x(2x^2) = 4x$

3. $D_x(\pi x) = \pi$

5. $D_x(2x^{-2}) = -4x^{-3}$

7. $D_x\left(\frac{\pi}{x}\right) = \frac{-\pi}{x^2}$

9. $D_x\left(\frac{100}{x^5}\right) = \frac{-500}{x^6}$

11. $D_x(x^2+2x) = 2x+2$

13. $D_x(x^4+x^3+x^2+x+1)$
$= 4x^3+3x^2+2x+1$

15. $D_x(\pi x^7 - 2x^5 - 5x^{-2})$
$= 7\pi x^6 - 10x^4 + 10x^{-3}$

17. $D_x\left(\frac{3}{x^3} + x^{-4}\right)$
$= \frac{-9}{x^4} - 4x^{-5}$

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

21. $D_x\left(\frac{1}{2x} + 2x\right)$
$= \frac{-1}{2x^2} + 2$

23. $D_x(x(x^2+1))$
$= (x^2+1) + x \cdot 2x$
$= 3x^2+1$

25. $D_x((2x^2+1)^2)$
$= D_x(4x^4+4x^2+1)$
$= 16x^3+8x$

27. $D_x((x^2+2)(x^3+1))$
$= (2x)(x^3+1) + (x^2+2)(3x^2)$

29. $D_x((x^2+17)(x^3-3x+1))$
$= 2x(x^3-3x+1) + (x^2+17)(3x^2-3)$

31. $D_x((5x^2-7)(3x^2-2x+1))$
$= 10x(3x^2-2x+1) + (5x^2-7)(6x-2)$

33. $D_x\left((3x^2+1)^{-1}\right)$
$= \frac{-(1)(6x)}{(3x^2+1)^2}$

35. $D_x\left(\frac{1}{4x^2-3x+9}\right)$
$= \frac{-(1)(8x-3)}{(4x^2-3x+9)^2}$

37. $\frac{d}{dx}\left[\frac{x-1}{x+1}\right] = \frac{(x+1)-(x-1)}{(x+1)^2}$
$= \frac{2}{(x+1)^2}$

39. $\frac{d}{dx}\left[\frac{2x^2-1}{3x+5}\right]$
$= \frac{(3x+5)(4x)-(2x^2-1)(3)}{(3x+5)^2}$

41. $\frac{d}{dx}\left[\frac{2x^2-3x+1}{2x+1}\right] = \frac{(2x+1)(4x-3)-(2x^2-3x+1)(2)}{(2x+1)^2}$

43. $\frac{d}{dx}\left[\frac{x^2-x+1}{x^2+1}\right] = \frac{(x^2+1)(2x-1)-(x^2-x+1)(2x)}{(x^2+1)^2}$

45. $(f\cdot g)'(0) = f(0)g'(0) + f'(0)g(0) = (4)(5) + (-3)(-1) = 23$

47. $D_x([f(x)]^2) = D_x(f(x)\cdot f(x)) = D_x(f(x))\cdot f(x) + f(x)\cdot D_x(f(x))$

$= 2\ f(x)\ D_x(f(x)).$

49. $\frac{dy}{dx} = 2x-2$. At $(1,1)$, $\frac{dy}{dx} = 0 \Rightarrow y=1$ is tangent.

51. Tangent line is horizontal when $\frac{dy}{dx}=0$. $y = x^3-x^2$

$\frac{dy}{dx} = 3x^2-2x = x(3x-2) = 0 \iff x = 0, \frac{2}{3}$.