2. (a) $y = (x^5+2x)^3$

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

$y'' = 3(x^5+2x)^2\cdot(20x^3)+(5x^4+2)6(x^5+2x)(5x^4+2)$

$y'' = 60x^3(x^5+2x)^2+6(5x^4+2)^2(x^5+2x)$

(b) $y = 4\sin(5x)$

$y' = 4\cos(5x)\cdot 5$

$y' = 20\cos(5x)$

$y'' = -20\sin(5x)\cdot 5$

$y'' = -100\sin(5x)$

3. (a) $5y^{-2} - 6x + \frac{7}{3}y^6 = 3y + 4x^5 + 10$

$-10y^{-3}\frac{dy}{dx} - 6 + \frac{42}{3}y^5\frac{dy}{dx} = 3\frac{dy}{dx} + 20x^4$

$-10y^{-3}\frac{dy}{dx} + 14y^5\frac{dy}{dx} - 3\frac{dy}{dx} = 20x^4 + 6$

$\frac{dy}{dx}(-10y^{-3} + 14y^5 - 3) = 20x^4 + 6$

$\frac{dy}{dx} = \frac{20x^4+6}{-10y^{-3}+14y^5-3}$

(b) $x^4 + 5x^2y^3 + 8y^2 = 3y - 4$

$4x^3 + 5x^2 3y^2\frac{dy}{dx} + y^3 10x + 16y\frac{dy}{dx} = 3\frac{dy}{dx}$

$4x^3 + 15x^2y^2\frac{dy}{dx} + 10xy^3 + 16y\frac{dy}{dx} = 3\frac{dy}{dx}$

$15x^2y^2\frac{dy}{dx} + 16y\frac{dy}{dx} - 3\frac{dy}{dx} = -4x^3 - 10xy^3$

$\frac{dy}{dx}(15x^2y^2 + 16y - 3) = -4x^3 - 10xy^3$

$\frac{dy}{dx} = \frac{-4x^3-10xy^3}{15x^2y^2+16y-3}$

4. $y = 40x^{1/2} - 96x^{1/4}$

$y' = 20x^{-1/2} - 24x^{-3/4}$

$m_{x=16} = 20(16)^{-1/2} - 24(16)^{-3/4}$

$\frac{20}{16^{1/2}} - \frac{24}{16^{3/4}}$

$\frac{20}{4} - \frac{24}{8}$

$5 - 3$

$= 2$

5. $y = \frac{x^2}{(2x-9)^2}$

$y' = \frac{(2x-9)^2 2x - x^2\cdot 2(2x-9)\cdot 2}{(2x-9)^2}$

$m = \frac{2x(2x-9)^2 - 4x^2(2x-9)}{(2x-9)^4}$

$m_{x=6} = \frac{2\cdot 6(3)^2 - 4\cdot 6^2(3)}{3^4}$

$\frac{108-432}{81}$

$= \frac{-324}{81} = 4$

$m = 4$ $(6, 4)$

$y - 4 = 4(x-6)$

$y - 4 = 4x - 24$

$y = 4x + 28$

6. $f(x)=2x^3+7x^2-8x+9$ tangent is $\perp$ to $y=\frac{1}{12}x+10$

$m=\frac{1}{12}$

$\perp m=-12$

$f'(x)=6x^2+14x-8$

$6x^2+14x-8=-12$

$6x^2+14x+4=0$

$2(3x^2+7x+2)=0$

↓ decomposition

$2(3x+1)(x+2)$

$x=-\frac{1}{3},-2$

sub into original $y=2x^3+7x^2-8x+9$

$x=-\frac{1}{3}$ $y=\frac{334}{27}=12.4$

$x=-2$ $y=37$

$(-\frac{1}{3},12.4)$ $(-2,37)$

7. $y=\frac{9}{2x-3}$ parallel to $2x+y+11=0$

$y=-2x-11$

$m=-2$

$y=9(2x-3)^{-1}$

$y'=-9(2x-3)^{-2}\cdot 2$

$y'=\frac{-18}{(2x-3)^2}$ set $=-2$

$\frac{-18}{(2x-3)^2}=-2$

$-18=-2(2x-3)^2$

$-18=-2(4x^2-12x+9)$

$-18=-8x^2+24x-18$

$8x^2-24x=0$

$8x(x-3)=0$

$x=0,+3$

$y=\frac{9}{2x-3}$

$x=0$ $y=\frac{9}{-3}=-3$

$x=3$ $y=\frac{9}{3}=3$

$(0,-3)$ $(3,3)$

8. $12x^3-5xy^2+12y=-6-y^2$ at $(2,-3)$

$36x^2-5x\cdot 2y\frac{dy}{dx}+y^2(-5)+12\frac{dy}{dx}=-2y\frac{dy}{dx}$

$36x^2-10xy\frac{dy}{dx}-5y^2+12\frac{dy}{dx}=-2y\frac{dy}{dx}$

$-10xy\frac{dy}{dx}+12\frac{dy}{dx}+2y\frac{dy}{dx}=-36x^2+5y^2$

$\frac{dy}{dx}(-10xy+12+2y)=-36x^2+5y^2$

$\frac{dy}{dx}=\frac{-36x^2+5y^2}{-10xy+12+2y}$

$m_{(2,-3)}=\frac{-36(2)^2+5(-3)^2}{-10(2)(-3)+12+2(-3)}$

$\frac{-144+45}{60+12-6}$

$\frac{-99}{66}=-\frac{3}{2}$

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

$y+3=-\frac{3}{2}x+3$

$y=\frac{3}{2}x$

9. $y=8\cos^3 x$

$y=8(\cos x)^3$

$y'=24(\cos x)^2(-\sin x)$

$y'=-24(\cos x)^2\sin x$

$m_{x=\pi/6}=-24(\cos\frac{\pi}{6})^2\sin\frac{\pi}{6}$

$-24(\frac{\sqrt{3}}{2})^2\cdot\frac{1}{2}$

$-24(\frac{3}{4})\cdot\frac{1}{2}$

$-\frac{72}{8}$

-9