1. a) $(\sin x \cos x)' = \sin' x \cos x + \sin x \cos' x =$

$= \cos^2 x + (-\sin^2 x) = \cos^2 x - \sin^2 x =$

$= \cos 2x$

b) $\left(\ln (2x+1)^3\right)' = \dfrac{1}{(2x+1)^3} \cdot \left((2x+1)^3\right)' =$

$= \dfrac{2(2x+1)^2}{(2x+1)^3} \cdot (2x+1)' = \dfrac{4}{2x+1}$

c) $\left(\sqrt{\sin^2(\ln(x^3))}\right)' = \dfrac{1}{2\sqrt{\sin^2(\ln(x^3))}} \left(\sin^2(\ln(x^3))\right)' =$

$= \dfrac{\sin(\ln(x^3))}{\sqrt{\sin^2(\ln(x^3))}} \cdot \left(\sin(\ln(x^3))\right)' = 1 \cdot \cos(\ln(x^3)) \cdot$

$\cdot (\ln(x^3))' = \dfrac{\cos(\ln(x^3))}{\cancel{2}x^3} \cdot (x^3)' = \dfrac{2\cos(\ln(x^3))}{x}$

d) $\left(\dfrac{x^4}{\ln(x)}\right)' = \dfrac{(x^4)' \ln(x) - x^4 (\ln(x))'}{(\ln(x))^2} =$

$= \dfrac{4x^3 \ln(x) - x^3}{(\ln(x))^2} = x^3 \dfrac{(4\ln(x) - 1)}{(\ln(x))^2}$

2. $f(x) = \cos(x^2+3x)$, $x_0 = \sqrt{\pi}$

$f'(x) = -\sin(x^2+3x)\cdot(x^2+3x)' =$

$= -\sin(x^2+3x)\cdot(x+3) =$

$= -\sin(\pi + 3\sqrt{\pi})\cdot(\sqrt{\pi}+3)$

3. $f(x) = \dfrac{x^3-x^2-x-1}{1+2x+3x^2-4x^3}$, $x_0 = 0$

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

$\dfrac{-(x^3-x^2-x-1)(2+6x-12x^2)}{}$

подставляем $x_0 = 0$

$f'(0) = \dfrac{(0-0-1)(1+0)-(0-1)(2+0)}{(1+0)^2} = 1$

4. $f(x) = \sqrt{3x}\cdot\ln x$, $x_0 = 1$

$f'(x) = (\sqrt{3x})'\ln x + \sqrt{3x}\cdot(\ln x)' =$

$= \dfrac{1}{2\cdot\sqrt{3x}}\cdot\ln x\cdot(3x)' + \dfrac{\sqrt{3x}}{x} =$

$= \dfrac{3\ln x}{2\sqrt{3x}} + \dfrac{\sqrt{3}}{\sqrt{x}} = \dfrac{\sqrt{3}\ln x + 2\sqrt{3}}{2\sqrt{x}}$

$f'(1) = \dfrac{\sqrt{3}(\ln 1 + 2)}{2\cdot 1} = \sqrt{3}$

$\operatorname{tg}\alpha = \sqrt{3} \Rightarrow \alpha = \operatorname{arctg}\sqrt{3} = 60^\circ$