Exo1.1

(a) $f_1(x) = \ln(3x^2+5x-8)$

$3x^2+5x-8>0 \quad \Delta = 121 \begin{cases} x_1 = -\frac{8}{3} \\ x_2 = 1 \end{cases}$

$D_f = \left]-\infty; -\frac{8}{3}\right[\cup \left]1; +\infty\right[$

$$f_1'(x) = \frac{6x+5}{3x^2+5x-8}$$

(b) $f_2(x) = \ln(x-\sqrt{x^2-1})$

$x^2-1 \geq 0 \iff x \in \left]-\infty; -1\right] \cup \left[1; +\infty\right[$

et $x > \sqrt{x^2-1}$ car $x^2 > x^2-1 \quad \forall x$

donc $\mathcal{D}_f = \left]-\infty; -1\right] \cup \left[1, +\infty\right[$

$$f_2'(x) = \frac{(x-\sqrt{x^2-1})'}{x-\sqrt{x^2-1}}$$

or $(x-\sqrt{x^2-1})' = 1 - \frac{\cancel{2}x}{\cancel{2}\sqrt{x^2-1}} = \frac{\sqrt{x^2-1}-x}{\sqrt{x^2-1}}$

donc $f_2'(x) = \frac{\sqrt{x^2-1}-x}{(x-\sqrt{x^2-1})\cdot\sqrt{x^2-1}} = \boxed{\frac{-1}{\sqrt{x^2-1}}}$

(c) $f_3(x) = x e^{-2x}$ $\quad \mathcal{D}_f = \mathbb{R}$

$$f_3'(x) = e^{-2x} - 2x e^{-2x} = e^{-2x}(1-2x)$$

(d) $f_4(x) = \dfrac{3x+1}{2x-3}$ $\quad 2x-3 \neq 0 \quad x \neq \dfrac{3}{2}$

$\mathcal{D}_f = \mathbb{R} \setminus \{3/2\}$

$$f_4'(x) = \frac{3(2x-3) - 2(3x+1)}{(2x-3)^2} = \frac{-11}{(2x-3)^2}$$

(e) $f_5(x) = \sin^2(x) + \dfrac{1}{2}\cos(3x)$ $\quad \mathcal{D}_f = \mathbb{R}$

$$f_5(x) = 2\cos(x)\sin(x) - \frac{3}{2}\sin(3x)$$

(f) $f_6(x) = x^2 \sin\left(\dfrac{1}{x}\right)$ $\quad \mathcal{D}_f = \mathbb{R}^* = \mathbb{R}\setminus\{0\}$

$$f_6'(x) = 2x\sin\left(\frac{1}{x}\right) + \cancel{x^2}\cdot\left(\frac{-1}{\cancel{x^2}}\right)\cos\left(\frac{1}{x}\right)$$

$$= 2x\sin\left(\frac{1}{x}\right) - \cos\left(\frac{1}{x}\right)$$