2. (12 points) Problems (a) and (b) below are independent of each other.

(a) (7 pts.) In each case, calculate the value of the given integral expression. Where appropriate, you may assume that f is a differentiable function. *Your final answer should* **not** *contain any integral symbols and* **should be simplified** *as much as possible.* You may assume the symbols a, b and c represent constants. *Show your work!*

(i) $\displaystyle\int_a^b cf'(t)\,dt = c\int_a^b f'(t)\,dt = c(f(b)-f(a)).$

(ii) $\displaystyle\frac{d}{dt}\left(\int_1^2 f(t)\,dt\right) = \frac{d}{dt}(\text{Constant}) = 0.$

(iii) $\displaystyle\int_1^3 \left(c+\frac{t^3}{4}\right)\,dt = \left(ct+\frac{t^4}{16}\right)\Big|_1^3 = \left(3c+\frac{81}{16}\right)-\left(c+\frac{1}{16}\right) = 2c+5.$

(b) (5 pts.) Assume now that f is a differentiable function of w, and that $w = w(x)$ is a differentiable function of x. Calculate the derivative indicated below. You may assume the symbol a stands for a constant. *Show your work.*

$$\frac{d}{dx}\Big(af(w)+xw^2\Big) = a\frac{df}{dw}\frac{dw}{dx}+\left(w^2+2xw\frac{dw}{dx}\right) = w^2+\frac{dw}{dx}\left(a\frac{df}{dw}+2xw\right).$$