2. exercise sheet for Engineering Mathematics

(first name)   (last name)

(student id number)

2.1. *(Differentiation)* (4 credits)

Compute the following derivatives:

(a) $\dfrac{\mathrm{d}}{\mathrm{d}x}\dfrac{x}{x} = $ [ ] ,

(b) $\dfrac{\mathrm{d}}{\mathrm{d}x}\dfrac{x-2}{x^2+1} = $ [ ] ,

(c) $\dfrac{\mathrm{d}}{\mathrm{d}x}\exp(\cos(x)^2) = $ [ ] ,

(d) $\dfrac{\mathrm{d}}{\mathrm{d}x}\arcsin(x) = $ [ ] .

(Hint: arcsin is the inverse function of the sine function restricted to $(-\frac{\pi}{2}, \frac{\pi}{2})$.)

2.2. *(Integration)* (4 credits)

Compute the following integrals:

(a) $\displaystyle\int_1^2 \left(x + \frac{1}{x} + \frac{1}{x^2}\right)\mathrm{d}x = $ [ ] ,

(b) $\displaystyle\int_0^{\sqrt{\pi}} x\cos(x^2)\,\mathrm{d}x = $ [ ] ,

(c) $\displaystyle\int_0^5 x^2 \exp(x)\, dx =$ $\boxed{}$.

(Please give *exact* values, and not approximations. For instance, do *not* write 0.6931 for $\log(2)$.)

Hint: All of the above exercises can be solved using the fundamental theorem of calculus. For (c) one would usually use a trick called "integration by parts". If you do not know this trick, try to find $A, B, C \in \mathbb{R}$ such that $\frac{d}{dx}((A+Bx+Cx^2)\exp(x)) = x^2 \exp(x)$ and then apply the fundamental theorem.