Numerical methods in chemistry. Homework 1

Problem 1

Evaluate the following Laplace transforms:

(a)
$$\mathcal{L}[\cos(5t)e^{-3t}];$$

(b)
$$\mathcal{L}[h(t-2)\cos(t-2)],$$

where h denotes the Heaviside function;

(c)
$$\mathcal{L}[t^4 * \sin t],$$

where $f * g$ denotes the convolution of the functions f and g.

Problem 2

Evaluate the following inverse Laplace transforms:

(a)
$$\mathcal{L}^{-1}\left[\frac{1}{s^2 + 2s + 1}\right];$$

(b)
$$\mathcal{L}^{-1}\left[\frac{1}{s^4 - 1}\right];$$

(c)
$$\mathcal{L}^{-1}\left[\frac{s^3}{s-1}\right].$$

Problem 3

Evaluate the following convolutions:

(a)
$$f(t) * 1;$$

(b)
$$e^t * e^t;$$

(c)
$$f(t) * \delta(t),$$

where $f(t)$ is a general well-behaved function and $\delta(t)$ is the Dirac delta function.