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İSTANBUL OKAN ÜNİVERSİTESI MÜHENDİSLİK FAKÜLTESI MÜHENDİSLİK TEMEL BİLİMLERİ BÖLÜMÜ

MATH216 Mathematics IV - Exercise Sheet 6

N. Course

Exercise 26 (The Laplace Transform). Find the Laplace Transform of the following functions:

(a)
$$f(t) = e^{-2t}$$

(b)
$$f(t) = 3t^2$$

(c)
$$f(t) = \cos^2 2t$$

(d)
$$f(t) = t\cos t + te^t$$

(e)
$$f(t) = \frac{\sinh t}{t}$$

(f)
$$f(t) = t^2 \cos 2t$$

(g)
$$f(t) = \frac{e^{3t} - 1}{t}$$

(h)
$$f(t) = te^{-t} \sin^2 t$$

(i)
$$f(t) = \begin{cases} 2 & 0 < t \le 3 \\ 0 & t > 3 \end{cases}$$

(j)
$$f(t) = \begin{cases} \sin 2t & \pi \le t \le 2\pi \\ 0 & t < \pi \text{ or } t > 2\pi \end{cases}$$

Exercise 27 (The Inverse Laplace Transform). Find the inverse Laplace Transform of the following functions:

(a)
$$F(s) = \frac{1}{s-2}$$

(b)
$$F(s) = \frac{1}{s} - \frac{2}{s^{5/2}}$$

(c)
$$F(s) = \frac{3s+1}{s^2+4}$$

(d)
$$F(s) = \frac{2e^{-3s}}{s}$$

(e)
$$F(s) = \frac{1}{s(s-3)}$$

(f)
$$F(s) = \frac{2s+1}{s(s^2+9)}$$

(g)
$$F(s) = \frac{s^3}{(s-4)^4}$$

(h)
$$F(s) = \frac{s^2 - 2s}{s^4 + 5s^2 + 4}$$

(i)
$$F(s) = \frac{2s^3 - s^2}{(4s^2 - 4s + 5)^2}$$

(j)
$$F(s) = \ln\left(1 + \frac{1}{s^2}\right)$$

(k)
$$F(s) = \arctan\left(\frac{3}{s+2}\right)$$

(1)
$$F(s) = \frac{s}{(s^2+1)^3}$$

(m)
$$F(s) = \frac{e^{-s}}{s+2}$$

f(t)	$F(s) = \mathcal{L}[f](s)$	
1	$\frac{1}{s}$	s > 0
e^{at}	$\frac{1}{s-a}$	s > a
$t^n (n \in \mathbb{N})$	$\frac{n!}{s^{n+1}}$	s > 0
$\sin at$	$\frac{a}{s^2+a^2}$	s > 0
$\cos at$	$\frac{s}{s^2+a^2}$	s > 0
$\sinh at$	$\frac{a}{s^2-a^2}$	s > a
$\cosh at$	$\frac{s}{s^2-a^2}$	s > a
$e^{at}\sin bt$	$\frac{b}{(s-a)^2+b^2}$	s > a
$e^{at}\cos bt$	$\frac{s-a}{(s-a)^2+b^2}$	s > a
$t^n e^{at} (n \in \mathbb{N})$	$\frac{n!}{(s-a)^{n+1}}$	s > a
$u_c(t)$	$\frac{e^{-cs}}{s}$	s > 0
$u_c(t)f(t-c)$	$e^{-cs}F(s)$	
$e^{ct}f(t)$	F(s-c)	
$f(ct) \qquad (c>0)$	$\frac{1}{c}F\left(\frac{s}{c}\right)$	
$\int_0^t f(t-\tau)g(\tau)d\tau$	F(s)G(s)	
$t^n f(t)$	$\left (-1)^n F^{(n)}(s) \right $	