9ª Lista de Exercícios – Métodos Matemáticos
(Transformada de Laplace)
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1) Calcule as transformadas de Laplace:

a) $L\{e^{at})\}$; R: $\frac{1}{s-a}$; $s > a$ Resolvido nas notas de aulas

b) $L\{Sen^2(t)\}$; R: $\frac{2}{s(s^2+4)}$ Note que: $Sen^2(t) = \frac{1-Cos(2t)}{2}$

c) $L\{f(t)\}, \quad onde \quad f(t) = \begin{cases} 0, & 0 \le t < 3 \\ 2, & t \ge 3 \end{cases}$; R: $\frac{2\,e^{-3s}}{s}$

d) $L\{t)\}$; R: $\frac{1}{s^2}$; $s > 0$ Resolvido nas notas de aulas

2) Resolva os PVI's usando Transformada de Laplace.

a) $\frac{dy}{dt} - 5y = 0; \quad y(0) = 2;$ R: $f(t) = 2e^{5t}$

b) $y'' - 6y' + 9y = t^2e^{3t}; \quad y(0) = 2; \; y'(0) = 6;$

R: $f(t) = 2e^{3t} + \frac{t^4e^{3t}}{12}$

c) $X'' + 16X = Cos(4t); \quad X(0) = 0; \quad X'(0) = 1, \quad X = f(t)$

R: $X(t) = \frac{1}{4}Sen(4t) + \frac{1}{8}t.Sen(4t)$

d) $\frac{dN}{dt} = 0{,}05N; \quad N(0) = 20.000;$ R: $N(t) = 20.000e^{0{,}05t}$

e) $X'' + 16X = 2\,Sen(4t); \quad X(0) = -\frac{1}{2}; \quad X'(0) = 0;$

R: $X(t) = \frac{1}{16}\{Sen(4t) - 4tCos(4t) - \frac{1}{2}Cos(4t)\}$

3) Calcule as Transformadas Inversas de Laplace de:

a) $L^{-1}\{\frac{1}{S}\}$; R: $f(t) = 1$

b) $L^{-1}\{\frac{1}{s-8}\}$; R: $f(t) = e^{8t}$

c) $L^{-1}\{\frac{5S}{(S^2+1)^2}\}$; R: $f(t) = \frac{5}{2}xSen(x)$

d) $L^{-1}\{\frac{1}{S^2-2S+9}\}$; R: $f(t) = \frac{1}{\sqrt{8}}e^{x}Sen(\sqrt{8}x)$

e) $L^{-1}\{\frac{S+4}{S^2+4S+8}\}$; R: $f(t) = e^{-2x}Cos(2x) + e^{-2x}Sen(2x)$