Partial fraction expansion

6 Using the partial fraction expansion find the inverse Laplace transform of the following functions

(a) $\dfrac{s^2+6s+8}{s^2+4s+3}\,e^{-sT}$

(b) $\dfrac{s^2+s}{s^3+2s^2+s+2}$

(c) $\dfrac{e^{-s}}{s^3+2s^2+2s+1}$

(d) $\dfrac{1}{s^4+3s^3+4s^2+3s+1}$

(e) $\dfrac{1-e^{-4s}}{5s^2}$

(f) $\dfrac{(s+1)(s+3)}{s(s+2)(s+5)}$

(g) $\dfrac{s(s^2+2)}{(s^2+1)(s^2+3)}$

(h) $\dfrac{1}{s^2(s+1)^2(s+2)}$

(i) $\dfrac{s^3+1}{s^2+2s+2}$

(j) $\dfrac{s\,e^{-s}+2s^2+9}{s(s^2+9)}$

7 Solve the following differential equations using Laplace transform methods:

(a) $\ddot{x}+4x=0$ where $x(0)=1$ $\dot{x}(0)=0$

(b) $\ddot{x}+2\dot{x}+x=21(t)$ where $x(0)=1$ $\dot{x}(0)=1$

(c) $\ddot{x}+\dot{x}=t^2+2t$ where $x(0)=4$ $\dot{x}(0)=-2$

(d) $2\,\dot{x}(t)+4\,x(t)+\dot{y}(t)-y(t)=0$
$\dot{x}(t)+2\,x(t)+\dot{y}(t)+y(t)=0$
where $x(0)=0$ $\dot{x}(0)=2$
$y(0)=1$ $\dot{y}(0)=-3$