Step Functions
For problems 1 – 3 find the Laplace transform of the given function.

1. $g(t) = 10u_4(t)\cos(6t - 24) - 2u_8 e^{\frac{1}{2}t - 4}$

2. $f(t) = 3t^2 u_4(t) - u_2(t)\sin(3t)$

3. $h(t) = \begin{cases} 7 - 3t & t < 3 \\ -2 & 3 \le t < 8 \\ 4 - 9e^{-2t} & t > 8 \end{cases}$

For problems 4 – 6 find the inverse Laplace transform of each of the following

4. $F(s) = \dfrac{5e^{-3s}}{s} - \dfrac{13e^{-16s}}{4s + 5} + \dfrac{6(s + 7)e^{-20s}}{s^2 + 14s + 58}$

5. $F(s) = \dfrac{9e^{-7s} + 4se^{-s} + 9s - 1}{(s + 2)(s - 6)}$

6. $H(s) = \dfrac{12 - 5e^{-7s} + 2se^{-4s}}{(s + 1)^2 (s - 4)}$

IVP's with Laplace Transforms
Use Laplace transforms to solve the given IVP. In the partial fraction stage all quadratics that can be factored with integer coefficients must be factored.

7. $y'' - 3y' - 10y = 3e^{-4t}$ $\qquad\qquad y(0) = -3,\ y'(0) = 8$

8. $4y'' + 8y' + 5y = 5t - 8$ $\qquad\qquad y(0) = 0,\ y'(0) = 0$

9. $y'' + 16y = 7\sin(16t)$ $\qquad\qquad y(0) = 4,\ y'(0) = 1$