Math 3301 **Homework Set 8** **10 Points**

Step Functions

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

1. $g(t) = 3u_2(t)\mathbf{e}^{8-4t} + 7u_6(t)\cos\left(\frac{1}{3}t - 2\right)$

2. $f(t) = u_4(t)\sin(3t) - 2t^2 u_3(t)$

3. $h(t) = \begin{cases} -2 & t < 6 \\ 4t & 6 \le t < 9 \\ 3 + 4t - \mathbf{e}^t & t \ge 9 \end{cases}$

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

4. $F(s) = \dfrac{s\mathbf{e}^{-3s}}{s^2+4} + \dfrac{9}{s} - \dfrac{3\mathbf{e}^{-7s}}{s}$

5. $F(s) = \dfrac{6\mathbf{e}^{-s} + s^2\mathbf{e}^{-8s} + 11\mathbf{e}^{-2s}}{s(s+2)^2}$

6. $H(s) = \dfrac{11\mathbf{e}^{-7s} - 9s - 2s\mathbf{e}^{-17s}}{(s-4)(s^2+9)}$

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. $y'' + 9y = 4\cos(3t)$ $\qquad y(0) = 0,\ y'(0) = 0$

8. $2y'' - 5y' - 3y = 2\mathbf{e}^{6t}$ $\qquad y(0) = -2,\ y'(0) = 1$

9. $y'' + 2y' + 5y = 4t$ $\qquad y(0) = 0,\ y'(0) = -6$