1. Use the definition to determine the Laplace transform of $f(t) = \begin{cases} t, & 0 \leq t < 4 \\ e^{-t}, & 4 < t \end{cases}$

2. $\boxed{2}$ Use the provided table and linearity to determine the Laplace transform of the following functions.

   (a) $f(t) = 4t^2 - 7e^{2t}\cos 3t$

   (b) $g(t) = 6 + t^8 e^{-3t}$

   (c) $h(t) = 5te^{2t}\sin 3t$

   (d) $j(t) = \cos^2 bt$

   [HINT: $\cos^2 x = (1 + \cos 2x)/2$.]

3. For each of the following choose all that apply; the function is not piecewise continuous on $[0, \infty)$ (**NPC**), the function is not of exponential order (**NEO**), and/or the function has a Laplace transform (**LT**).

   (a) **NPC / NEO / LT :** $f(t) = \tan t$

   (b) **NPC / NEO / LT :** $f(t) = e^{\sin t}$

   (c) **NPC / NEO / LT :** $f(t) = 14e^{t^2+7}$

   (d) **NPC / NEO / LT :** $f(t) = \begin{cases} 4e^{3t}, & 0 < t < 2 \\ 12e^{t}, & 2 < t \end{cases}$

4. The inverse Laplace transform is defined as you would expect it to be[1]. For example, since $\mathscr{L}\{\sin 3t\} = \dfrac{3}{s^2+9}$, we have $\mathscr{L}^{-1}\left\{\dfrac{3}{s^2+9}\right\} = \sin 3t$. Find the inverse Laplace transform of the following.

   (a) $F(s) = \dfrac{s}{s^2+4}$

   (b) $G(s) = \dfrac{8s}{s^2+4}$

   (c) $H(s) = \dfrac{6}{s^4}$

   (d) $K(s) = \dfrac{1}{s^4}$

   (e) $W(s) = \dfrac{6-7s}{s^2+9}$ [Hint: separate the fraction.]

[1] There are some technical complications we will address next week, but for now we will ignore them and assume it works as we expect.