1. Find and plot the magnitude, phase, and real and imaginary parts of the following complex signals \( s(t) \) for \( t \in [-2, 2] \) (1 point each)

(a) \( s(t) = \sin(\pi t) e^{-j \pi t} \)  
(b) \( s(t) = \frac{3t + 4i}{5j t} \)  
(c) \( s(t) = e^{(j - \pi) t} \)

*Note:* You can use a computer (e.g., MATLAB) to generate the plots, but you must find and use the mathematical expressions for the quantities above to generate your plots.

2. Write the UMass function \( m(t) \) plotted on the right in terms of step functions \( u(t) \) and ramp functions \( tu(t) \). (3 points)

3. For the UMass function \( m(t) \) plotted on the right, calculate the energy of the following functions (1 pt each):

(a) \( m(t) \)  
(b) \( m(t + 10) \)  
(c) \( m(20 - 2t) \)  
(d) \( m(t/5 - 5) \)

4. Find the energy of the functions \( s(t) \) given below. For each \( s(t) \), if its energy is infinite, find the power of \( s(t) \). (4 points)

(a) \( s(t) = 3u(t) \)  
(b) \( s(t) = \text{rect}(t - 10) \)  
(c) \( s(t) = \sin(8\pi t) \)

5. What is the numerical value of each of the following integrals? (1 point each)

(a) \( \int_{-\infty}^{\infty} \delta(t) \sin(30\pi t) dt \)  
(b) \( \int_{-\infty}^{\infty} \delta(t - 3)(t^{2} - 3t + 2) dt \)

(c) \( \int_{-\infty}^{\infty} \delta(t - 2) \cos(10\pi t) dt \)  
(d) \( \int_{-\infty}^{\infty} \delta(t - 2.5) \text{sinc}(5t) dt \)

6. Determine whether the following systems with input \( x(t) \) and output \( y(t) \) are linear and time invariant. (1 point each)

(a) \( y(t) = t \cdot x(3t) \)  
(b) \( y(t) = x(t - 5)^{2} \)

*Notation:* \( \text{sinc}(x) = \frac{\sin(\pi x)}{\pi x} \); \( \text{rect}(t) = 1 \) if \( |t| \leq 1/2 \), and \( \text{rect}(t) = 0 \) otherwise.