

# ENG EK 307: Electric Circuits, Fall 2025

## Problem Set 1

Due Wednesday 9/10/2025 by 11:59pm

Reading: *Alexander and Sadiku* (AS), Chapter 1.

- (20 points) Determine the current flowing through a circuit element if the charge is given by each of the following ( $t$  is in seconds). Be sure to get the units correct, refer to Chapter 1 for prefixes.

(a)  $q(t) = (3t + 8) \text{ mC}$

(b)  $q(t) = (8t^2 + 4t - 2) \text{ C}$

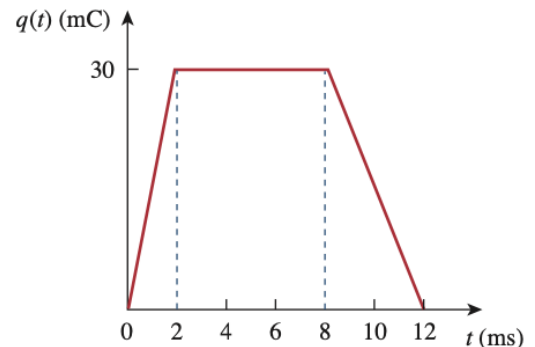
(c)  $q(t) = (3e^{-t} - 5e^{-2t}) \text{ nC}$

(d)  $q(t) = 10 \sin 120\pi t \text{ pC}$

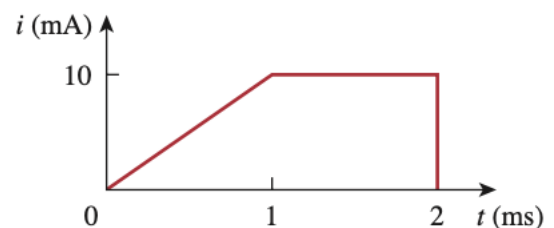
(e)  $q(t) = 20e^{-4t} \cos 50t \mu\text{C}$

- (15 points) The figure at right plots the charge entering a certain circuit element. Find the current at times

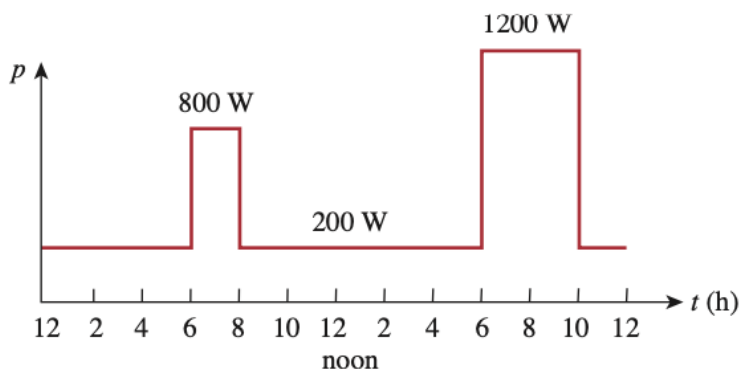
(a)  $t = 1 \text{ ms}$       (b)  $t = 6 \text{ ms}$       (c)  $t = 10 \text{ ms}$



- (15 points) The current flowing past a point in a device is shown at right. Calculate the total charge that passed through the point.



- (10 points) A rechargeable flashlight battery is capable of delivering 90 mA for 12 hours. How much total energy can the battery deliver if its terminal voltage is 1.5 V?
- (10 points) A lightning bolt strikes an airplane with 40 kA for 1.7 ms. How many Coulombs of charge are deposited on the airplane?
- (10 points) The figure below shows the power consumption of a certain household in 1 day. Calculate
  - the total energy in units of kWh (kilo-Watt hours),
  - the average power per hour over the total 24 hour period.



7. (20 points) For the network of circuit elements shown below find:

a) The current labeled  $i$  and the signed power for each element. Recall that under the passive sign convention, positive power means the element is absorbing power, negative power means the element is delivering power.

b) Verify your answers to part a by showing that the algebraic sum of the powers over all elements equals 0.

