EECS 210 Fall 1999
Midterm Exam #1(in class)
Professor Hero
October 20th, 1999

Rules:

(1) **DO NOT OPEN OR START THIS EXAM UNTIL TOLD TO DO SO.**
(2) The only material you are allowed to use during this exam are pencils, pens, and calculators. **NO** additional paper will be permitted. You do **NOT** have to write in ink.
(3) All your work must be done on the exam and all the pages must be handed in.
(4) Place your ANSWERS where indicated on the exam and do your calculations on the blank page following the problem. Two extra blank pages are at the end of the exam if you need extra paper for your work. These are **NOT** to be removed.
(5) You will get **NO** credit if you don't show your work.
(6) Do **NOT** discuss this exam with anyone in the other lecture section of EECS 210 until after 2 pm today. Violations will be reported to the honor council.
(7) There are five problems and each problem is worth 20 points.

Good Luck!

Print Your Name: _____

Print Your Student ID Number: _____

Sign the Honor Pledge:

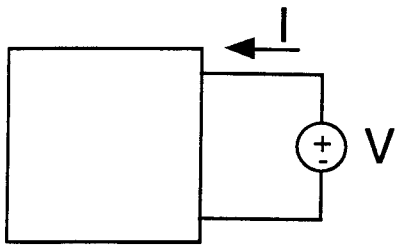
I have neither given nor received aid on this exam, nor have I concealed any violations of the honor code.

Sign Your Name Here:_____

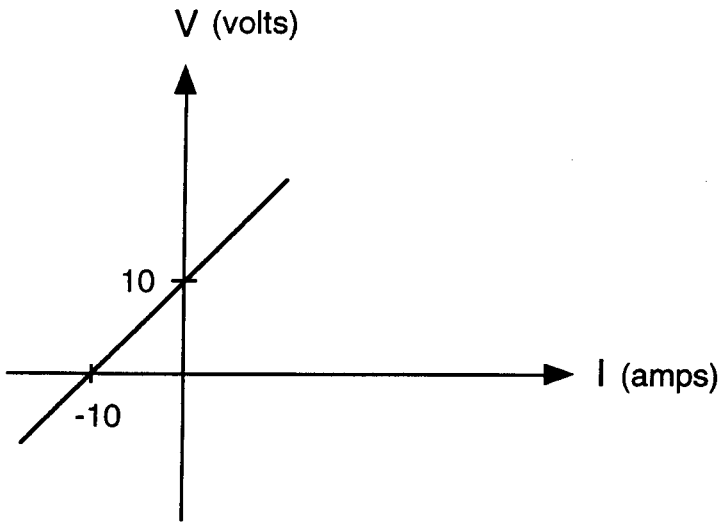
Exam Number: _____

1.

(a) Consider the following circuit connected to an external voltage source as shown.

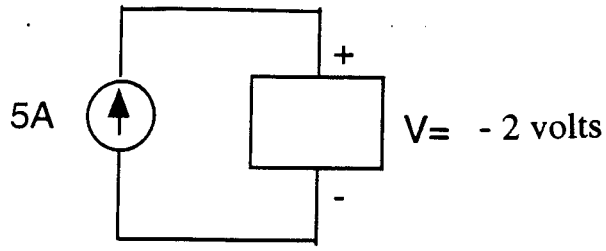


The relationship between V and I is plotted below.



Draw the Thevenin equivalent for this circuit in the space provided below.

1(b) Consider the ideal current source connected to a circuit as shown below. The voltage drop across the circuit terminals is –2 volts as indicated.



Is the current source delivering power to the circuit(circle yes or no below)? Justify your answer using one sentence.

YES NO

Justification sentence:

_____

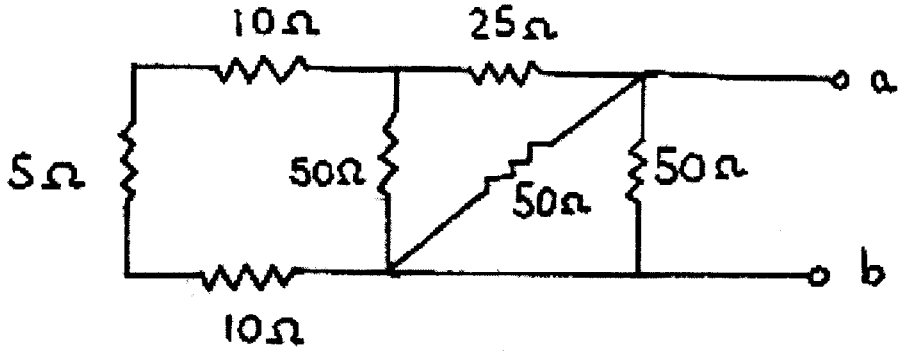
_____

_____.

Compute the absolute value of the power (P), which is either delivered to the circuit by the current source or absorbed by the current source.

P = _____.

1(c) Find the resistance of the following circuit as viewed from terminals a and b.



R = _____.

2. Consider a periodic sawtooth signal which has the following Fourier series representation, where t is in seconds.

$$x(t) = \sum_{n=1}^{\infty} (-1)^{n+1} \frac{\sin(nt)}{n}$$

(a) Find its period.

Period = _____.

(b) Find the frequency of the sawtooth signal in Hz and rad/s.

Frequency = _____ (Hz).

_____ (rad/s).

(c) Find the frequency of the fourth harmonic in Hz.

Fourth Harmonic Frequency = _____ (Hz).

(d) If x(t) as given above is the input to a linear time-invariant system, the output (y(t)) is

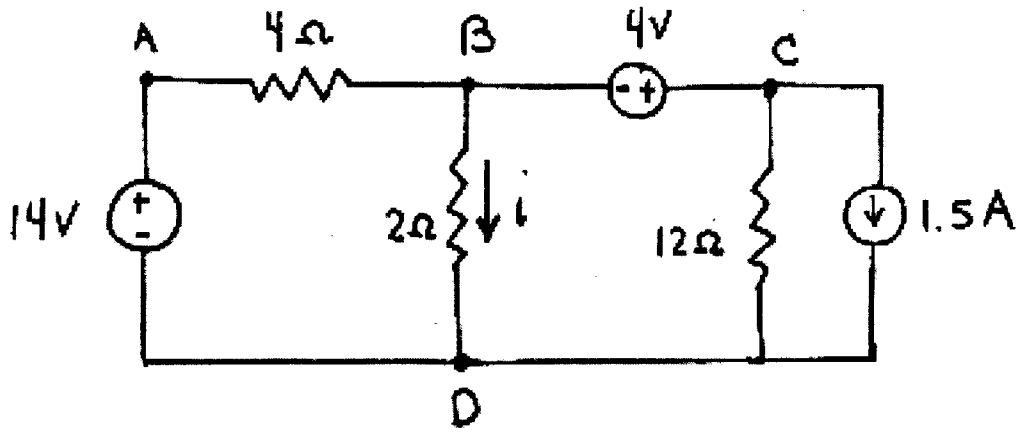
$$y(t) = \cos(3t) + \sin(2t + \frac{\pi}{4})$$

Find the output (y(t)) of this system when the input is

$$4\sin(t + \frac{\pi}{6}) + \cos(2t)$$

y(t) = _____.

3. Consider the following circuit, which is to be solved using node analysis.



(a) List the essential nodes of the above circuit diagram.

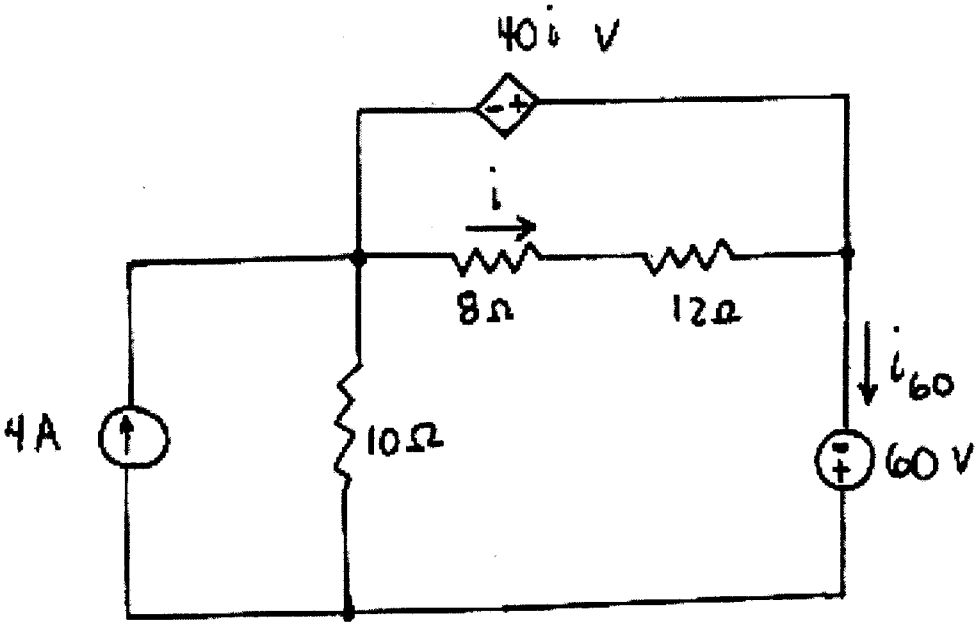
Essential nodes are _____.

(b) Choose node D as the ground and write the required node equations in the space below.

(c) Use your node equations to find the value of i.

i = _____ (A).

4. Consider the circuit shown below.



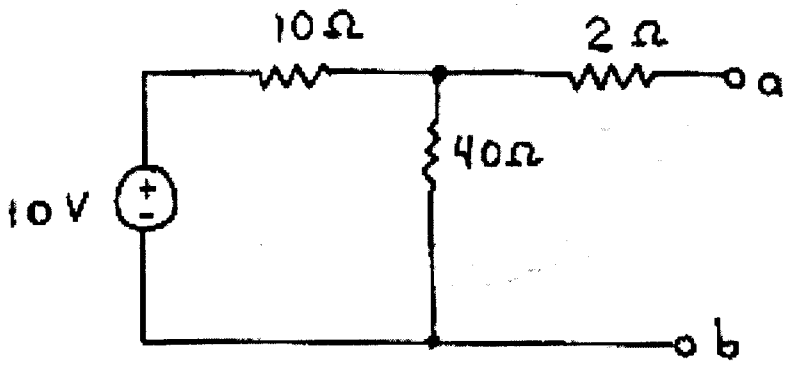
(a) Draw and label the mesh currents on the above figure.

(b) Write the mesh equations in the space provided below.

(c) Solve the mesh equation to find the current i_{60}.

I_{60} = _____(A).

5. Consider the following circuit.



(a) Compute the Thevenin equivalent voltage and resistance.

V_T = _____ V.

R_T = _____ Ω.

(b) Draw the Norton equivalent circuit in the space provided below.