UNIVERSITY OF CALIFORNIA
College of Engineering
Department of Electrical Engineering
and Computer Sciences

Professor Oldham Spring 2001

EECS 42 — MIDTERM #1

22 February 2001

Name: _____ **Student ID:** _____
Last, First

Signature: _____

Guidelines:

1. Closed book. A 2-page summary sheet with formulas is provided at the end of the exam.
2. Show ***all your work and reasoning on the exam*** in order to receive credit.
3. **Warning**: Some problems will be graded with no partial credit, so check your answers.
4. You may use a calculator.
5. Do not unstaple the exam.
6. This exam contains 5 problems worth 20 points each, and corresponding worksheets plus the cover page and the 2-page summary sheet.
7. **Please do not ask questions** except to point out possible errors or typographical mistakes.

Problem	Points Possible	Your Score
1	20	
2	20	
3	20	
4	20	
5	20	
Total	**100**	

Problem 1 (20 points)

In the circuit below we are interested in the voltage at nodes X and Y and use nodal analysis.

(a) Some possible nodal equations are given below. Circle the equation that is correct. (If none are correct, then correct one and circle it.)

(a.1) $V_1/R_1 - I_1 - V_X/R_2 = I_2 - V_Y/R_3$

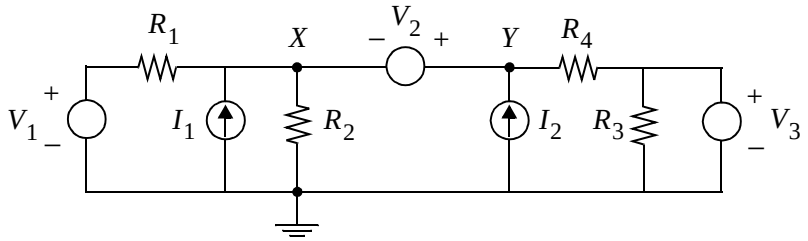
(a.2) $V_1/R_1 + V_3/R_4 = 0$

(a.3) $I_1 + I_2 + V_1/R_1 + V_3/R_4 + V_3/R_3 = 0$

(a.4) $V_1/R_1 + I_1 - V_X/R_2 + I_2 + (V_3 - V_Y)/R_4 = 0$

(a.5) $(V_1 - V_X)/R_1 + I_1 - V_X/R_2 = -I_2 + (V_Y - V_3)/R_4$

(a.6) $(V_1 - V_X)/R_1 + I_1 - V_X/R_2 = (V_2 - V_3)/R_4$



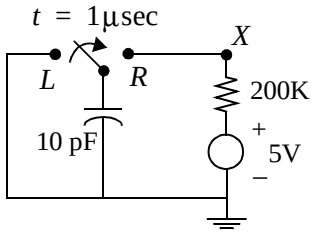
(b) What other equation, if any, is needed to solve for V_X and V_Y? Write it in the box below, BUT DO NOT SOLVE for V_X and V_Y.

Answer here ⟶

Problem 1 Worksheet

Problem 2 (20 points)

In the circuit below, the switch is operated at $t = 1\mu\text{sec}$ (in other words, the capacitor is switched from node L to node R).



(a) Find V_X, the voltage at node X, for $t < 1\mu\text{sec}$.

(**Note**: Answer must be in the box.)

a) V_X =

(b) Find V_X for $t = 1\mu\text{sec}$ (just after switch moves).

(**Note**: Answer must be in the box.)

b) V_X =

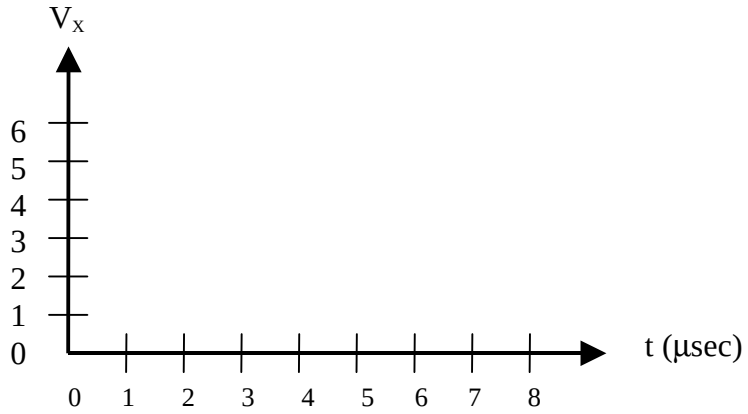
(c) Find V_X for $t \to \infty$.

(**Note**: Answer must be in the box.)

c) V_X =

(d) Sketch neatly on the axes below a plot of V_X versus time.

(**Warning**: Neatness and accuracy will be rewarded.)

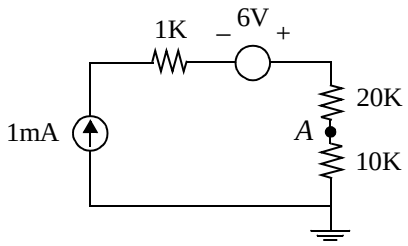


Problem 2 Worksheet

Problem 3 (20 points)

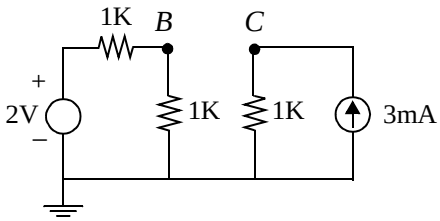
Find the voltage indicated for each of the following circuits. (The answer MUST be in the box provided.)

(a) Find V_A.



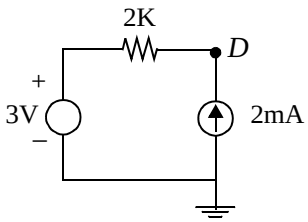
V_A =

(b) Find V_{BC}.



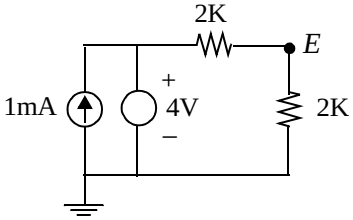
V_{BC} =

(c) Find V_D.



V_D =

(d) Find V_E.



V_E =

Problem 3 Worksheet

Problem 4 (20 points)

For the circuit below, calculate the following quantities. (Note that the sign is important and the answer must appear in the box.) This is a DC, not a transient, problem.

(a) P_1, the power into (dissipated in) resistor R_1.

P_1 =

(b) P_2, the power into (dissipated in) resistor R_2.

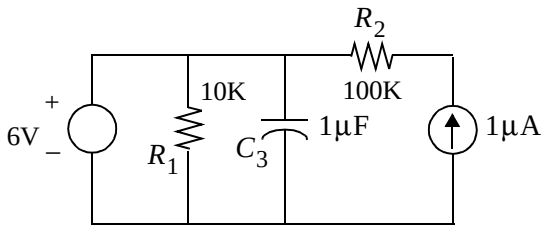
P_2 =

(c) P_3, the power into capacitor C_3.

P_3 =

(d) P_4, the power into the current source.

P_4 =

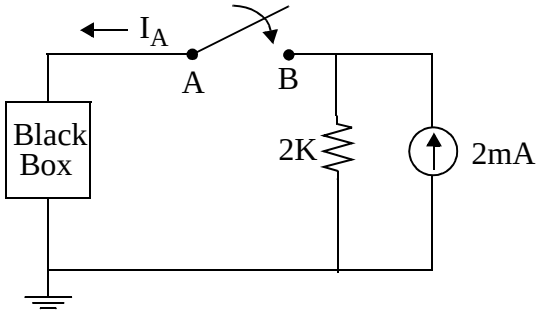


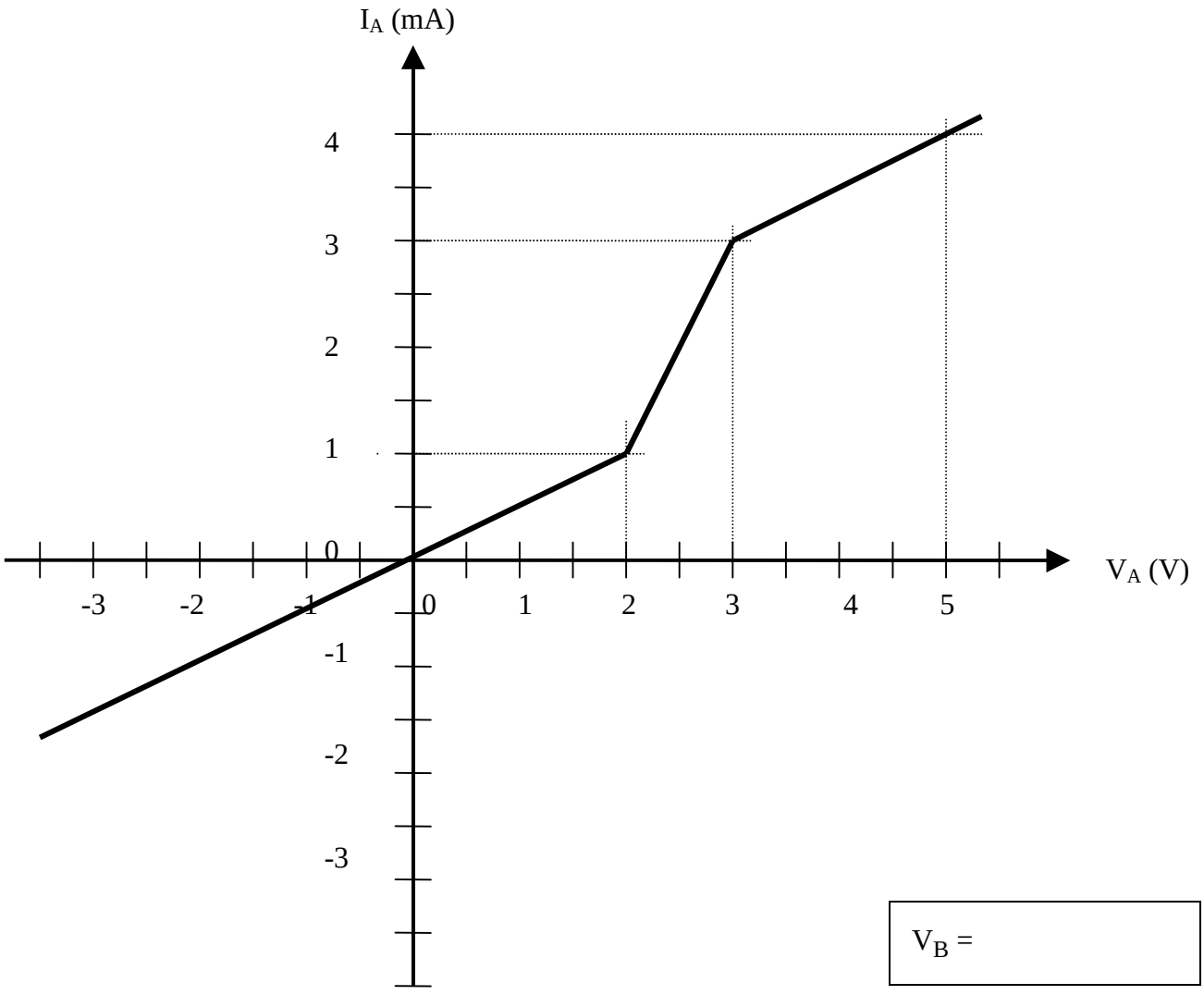
Problem 4 Worksheet

Problem 5 (20 points)

The circuit below consists of two parts: 1) a "black box" that has the nonlinear I-V characteristics shown on graph I_A versus V_A, and 2) a simple resistor in parallel with a current source. When the switch is open, it is obvious that $V_A = 0$ and $V_B = 4V$.

Use the load-line method to find the approximate value of V_B when the switch is closed. (IMPORTANT: You must show your work to receive credit.) (Also note: This is a DC problem, not a transient problem.)





$V_B =$

Problem 5 Worksheet