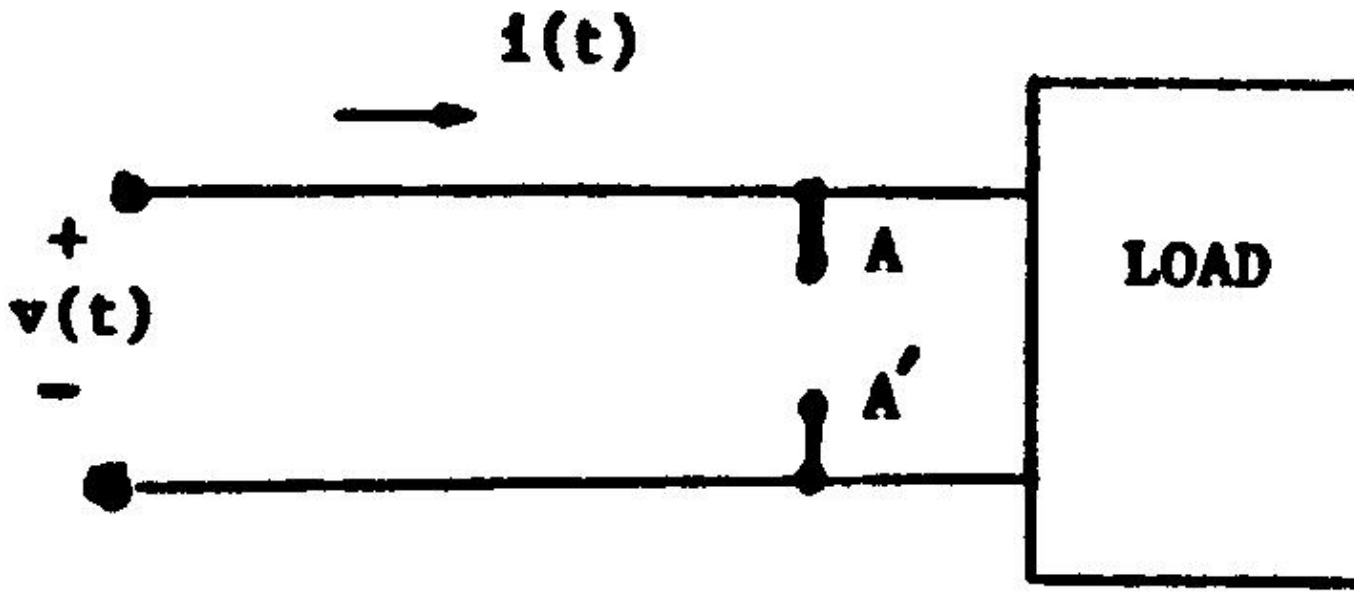
EE40 Spring 98 Final Exam (without solution)

1



v(t)=110*squr(2)*cos(w*t+10 degree)

f=60Hz

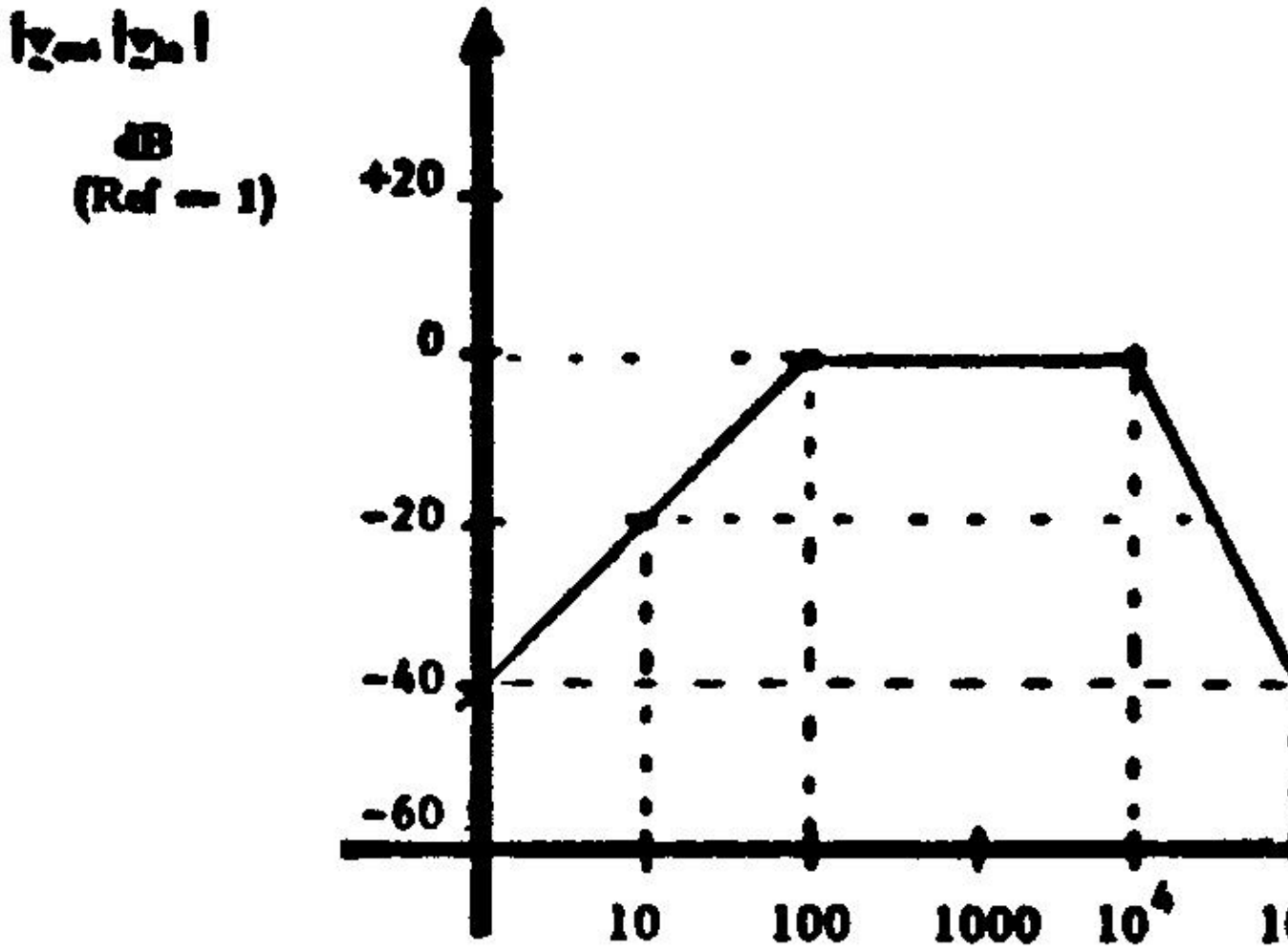
i(t)=2*squr(2)*sin(w*t+30 degree)

a) Find the time average power supplied to the load.

b) Find the impedance of the load.

c) Find the inductance or capacitance which when connected between terminals A and A' will make the current i(t) in phase with the voltage v(t).

2.

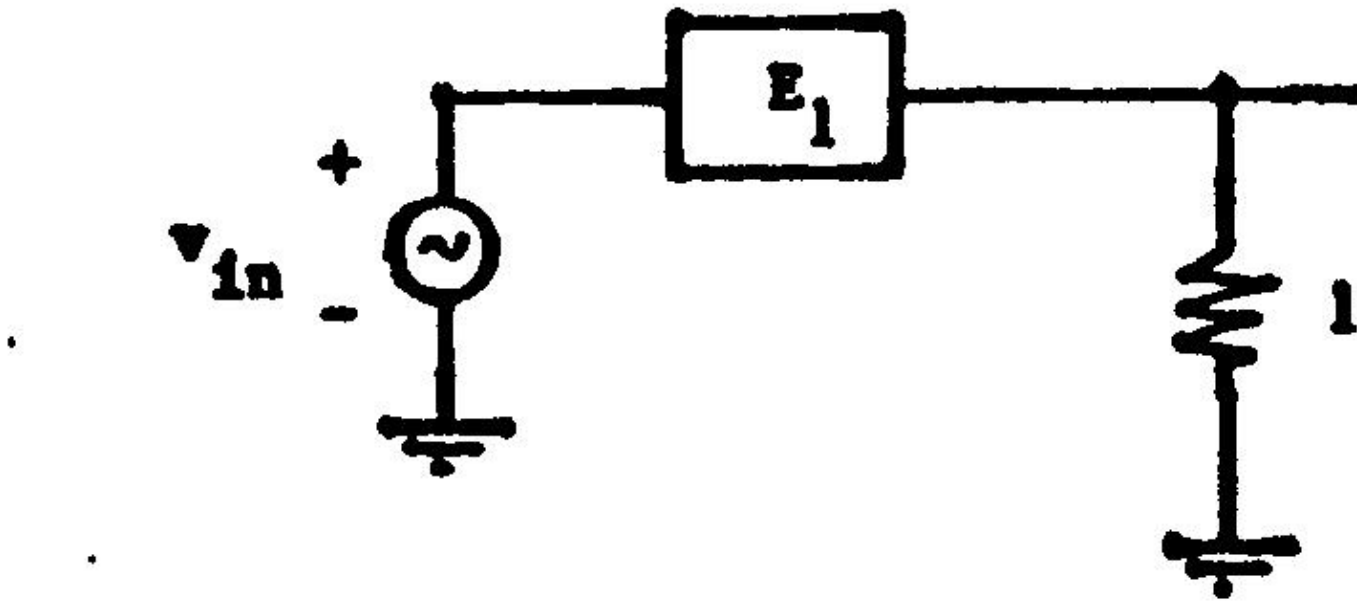


(a) (12 pts.) The ratio of output voltage amplitude to input voltage amplitude for a circuit as shown above. Find the mathematical expression for

$$|V_{out} / V_{in}|$$

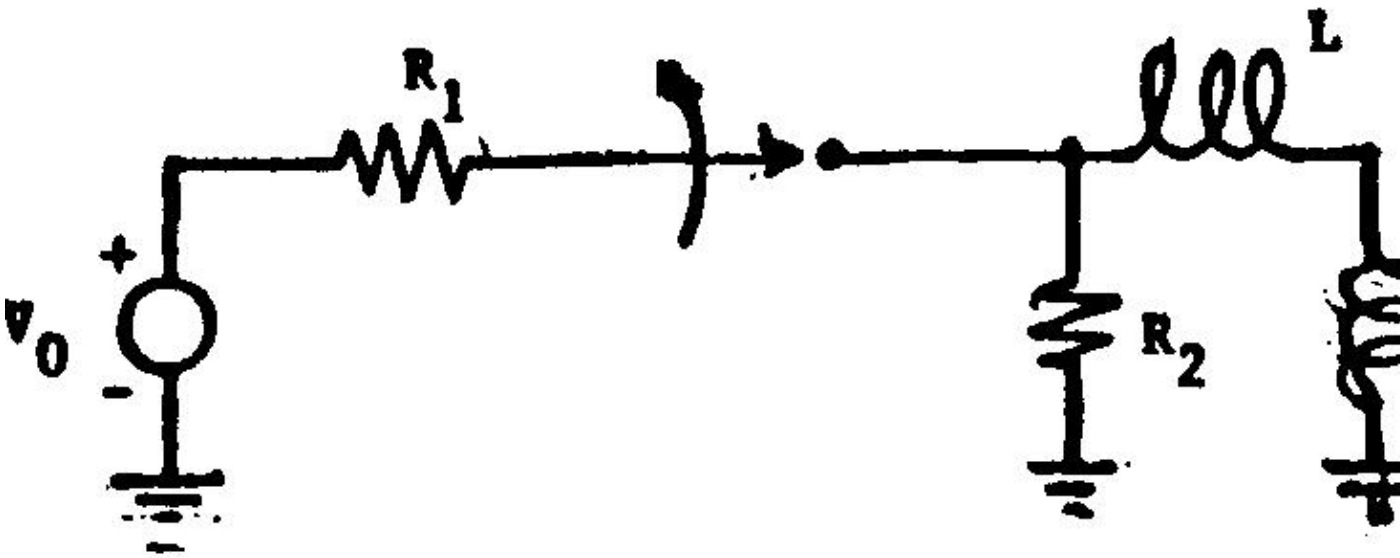
(b) (13 pts)

(b)(18 pts.)



What circuit element, with what value, should be used for E_1 to give the Bode plot of this figure?

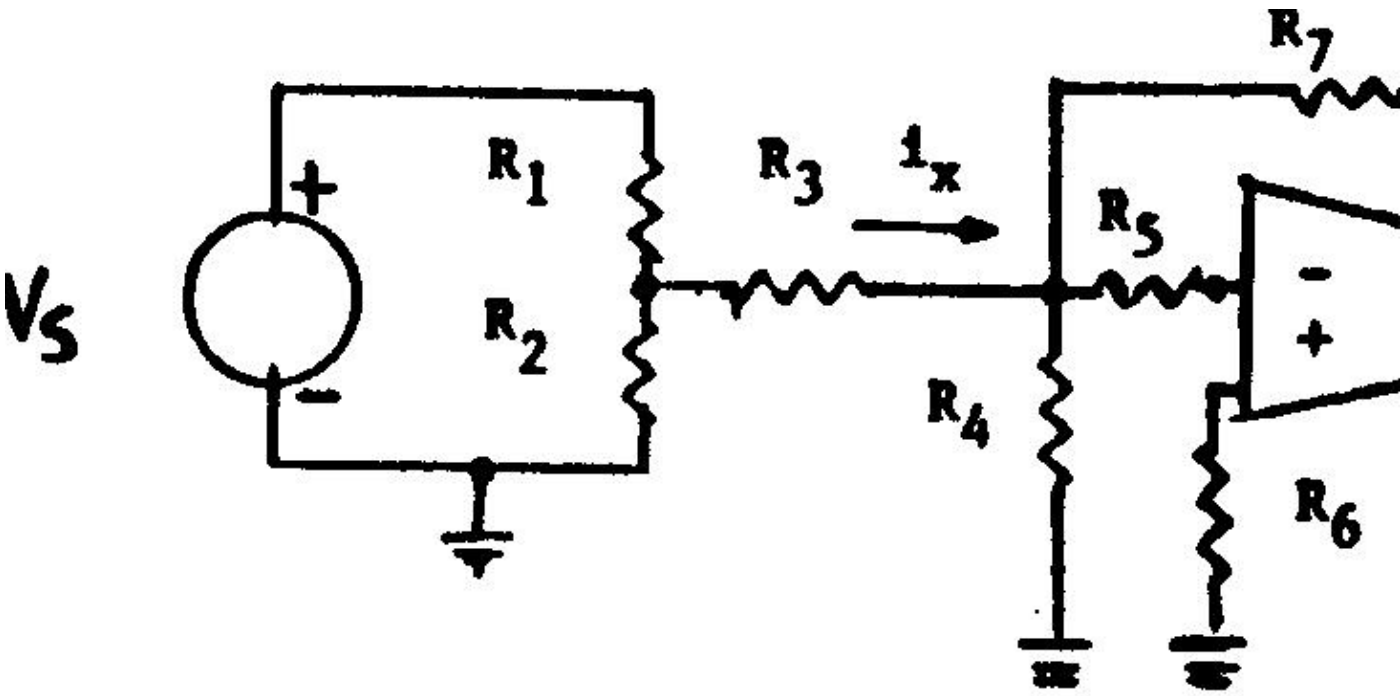
3 (20 pts)



Let V_0=60V, R_1=10,000 Omega, R_2=2,000 Omega, L=2mH. The switch is closed until time t=0, when it is opened. Make a reasonably accurate graph of

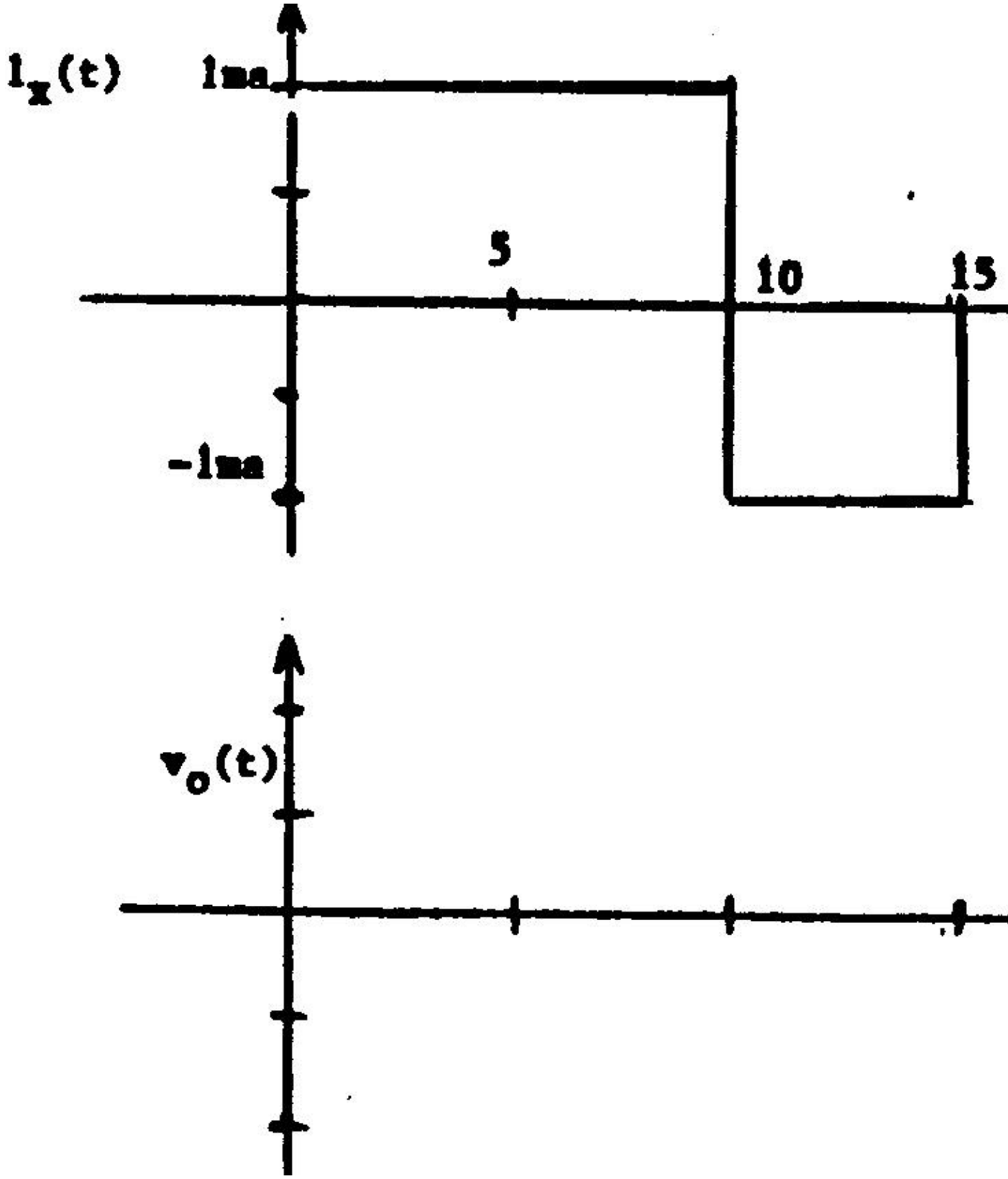
v(t) versus time.

4. (20 pts) Op-Amp.



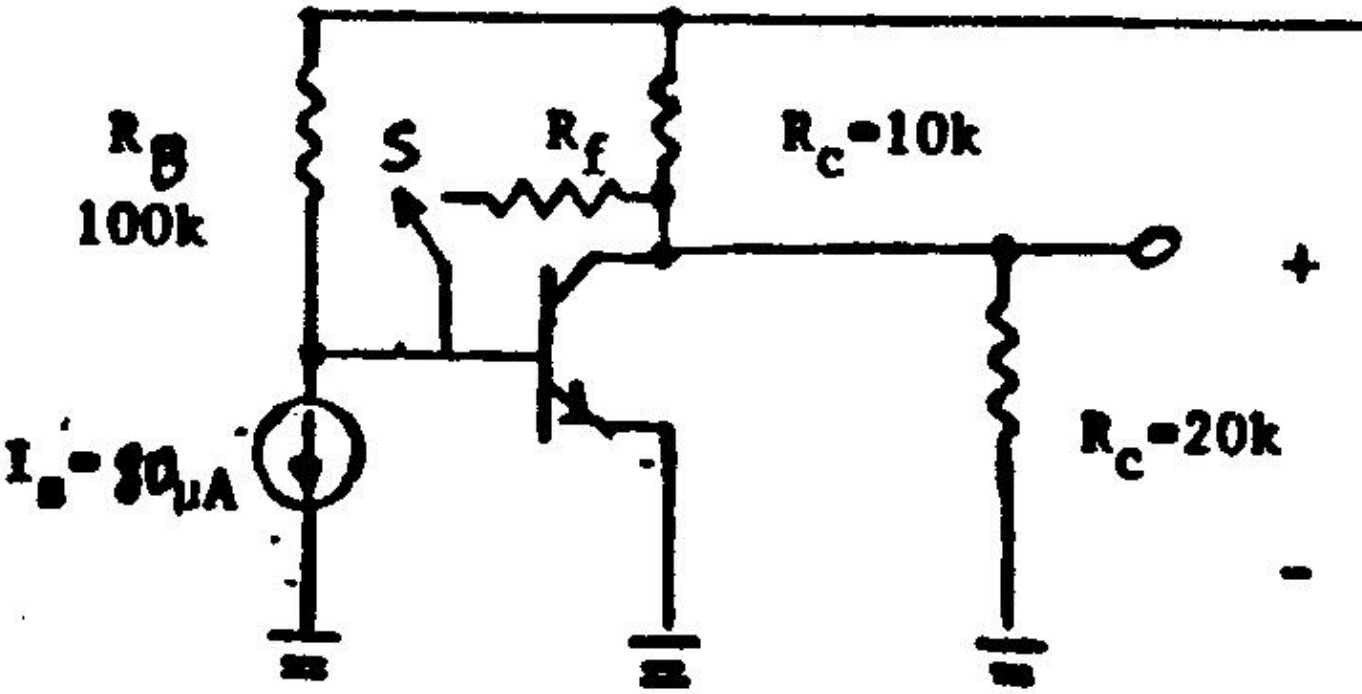
a) Find an algebraic expression for V_0/V_1

b) Sketch $V_0(t)$ when i_x is the waveform given below and all resistors are 10kOmega.



5 (30 pts) Transistor Bias

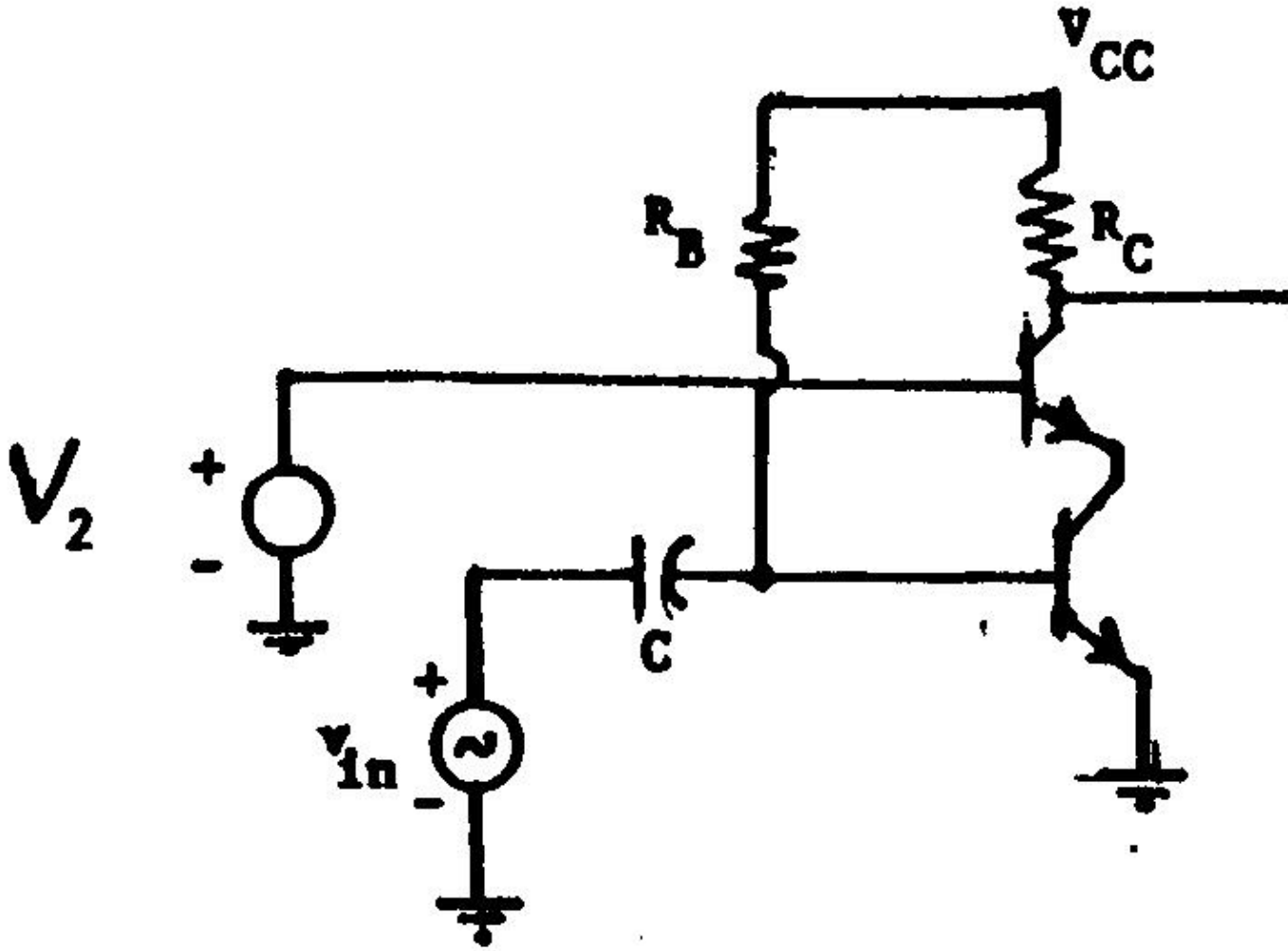
V. (30 points) Transistor Bias



a) Find V_{set} when the switch is open.

b) What value of R_f will make V_{set}=2V when the switch is closed?

6 (30 pts)



The above circuit is known as a "cascode" amplifier. Let R_B=7*10^5 , R_c=5000 , V_{cc}=10V, ß=20 (for both transistors), V_2=5V.

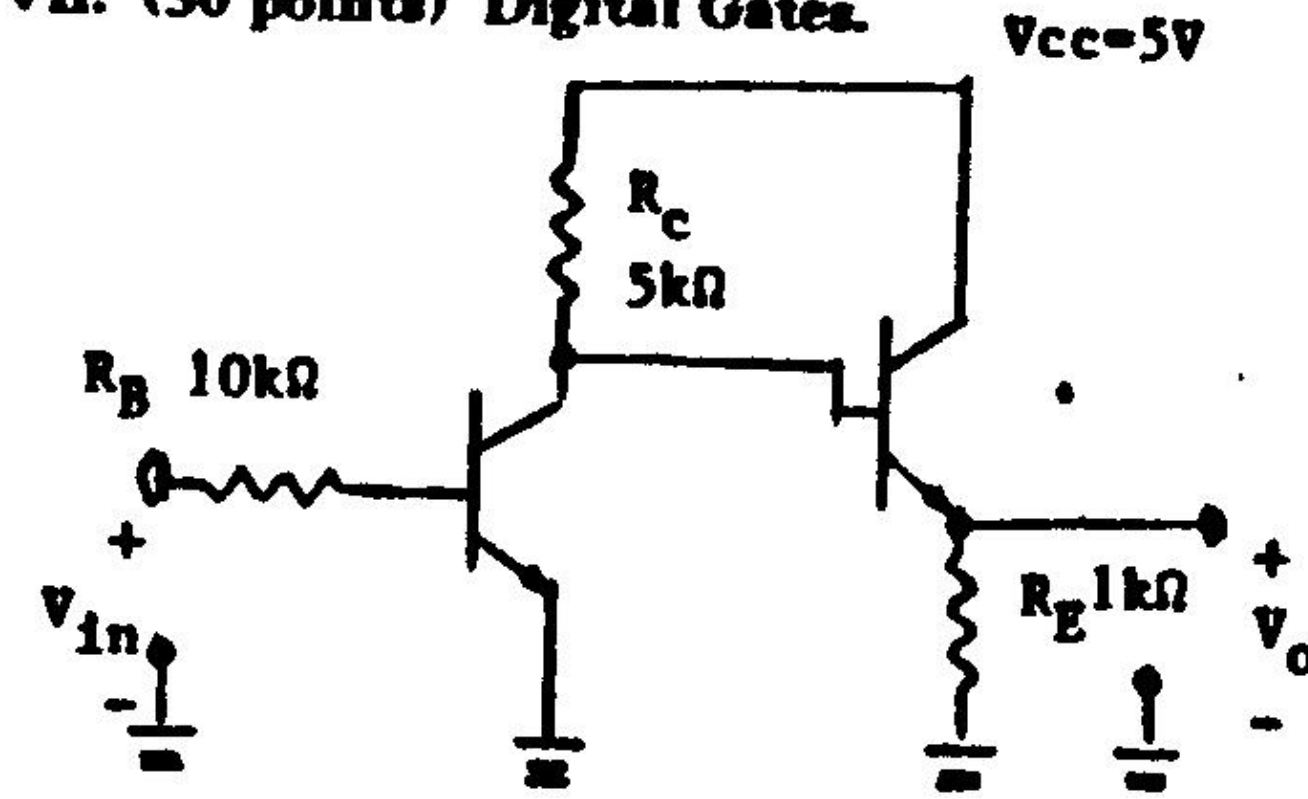
Assume that the impedance of C is nearly zero at the operating frequency.

(a) (15 pts) Construct a small-signal model.

(b) (15 pts) Find the small-signal voltage amplification |Vout / Vin|. (The answer should be a number)

7 (30 pts) Digital Gates.

VII. (30 points) Digital Gates.

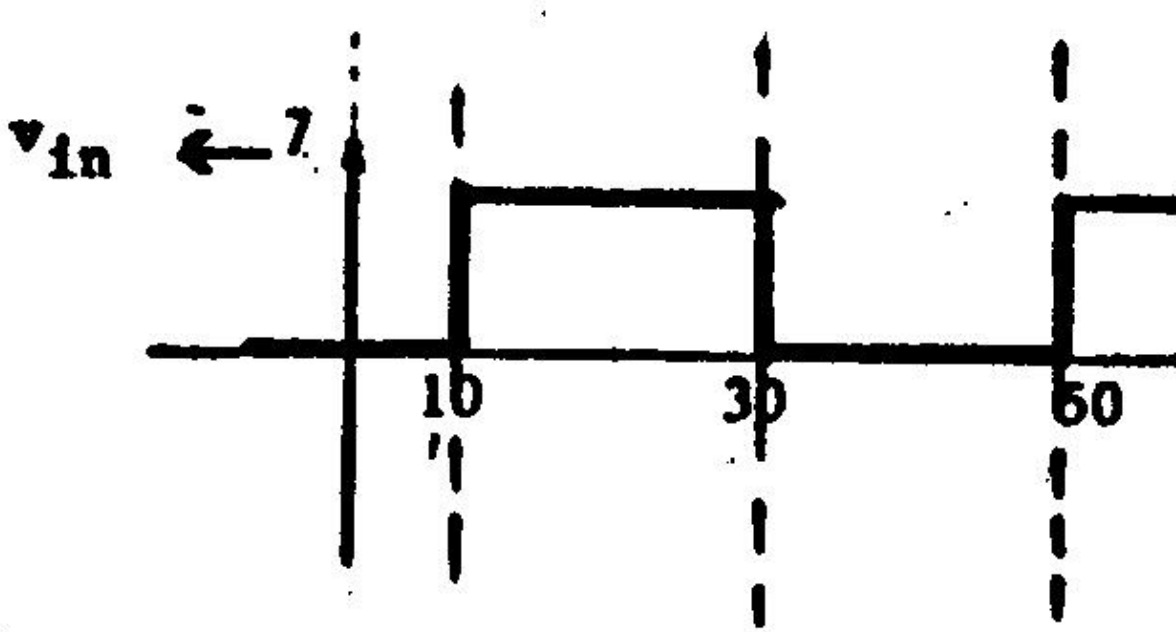


a) Sketch V_{out} vs V_{in} and label value.

b) Find the FANOUT (the maximum number of identical gates which could be attached to this gate and operated within the voltage specifications given above).

VIII.(20 pts.)

$R = 50k\Omega$
$C = 10^{-10}F$
$V_T = 3V$
Assume K (in the two equations for i_D)



(a) Sketch $i_{D1}(t)$ with switch S_1 open. (Y
shape.)