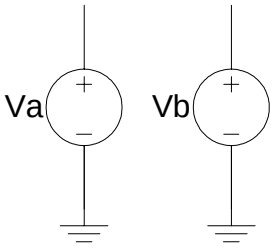
EE 40

Midterm 2 Practice Problems

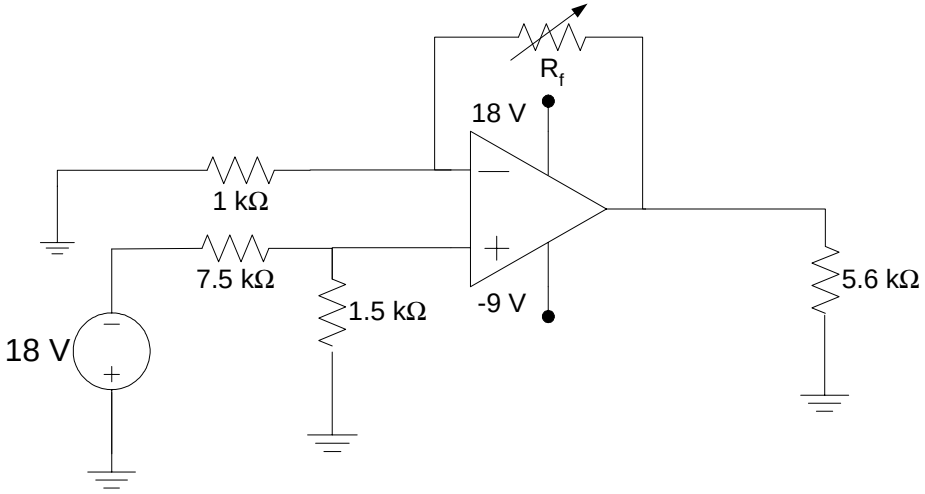
Problem 1:



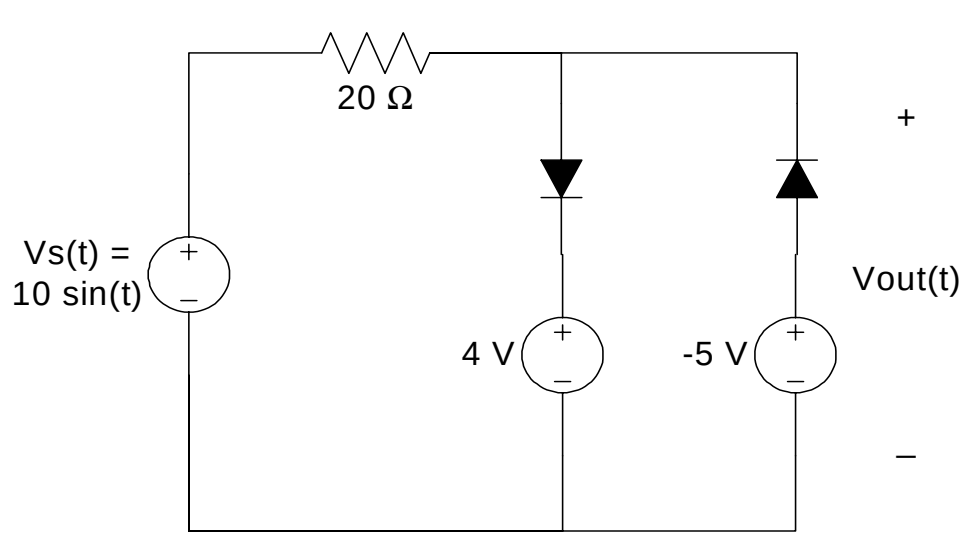
Given two input voltages Va and Vb, which cannot be detached from ground, design an ideal operational amplifier circuit which has 4Va–5Vb as its output voltage. Assume that the amplifier will always be operating in its linear region (i.e., ignore the rail voltages).

Problem 2:

The feedback resistor R_f is adjusted so that the ideal operational amplifier saturates (hits a rail). What is the value of R_f?



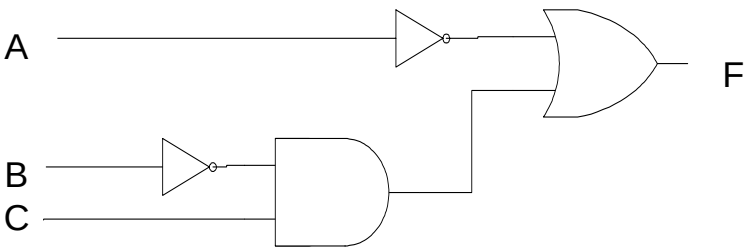
Problem 3:



Find and compare Vout(t) using the ideal model, large signal model, and small signal model for the diodes.

Let $V_F = 0.7$ V and $R_D = 20\ \Omega$.

Problem 4:



Each gate in the circuit at left has a delay t_p.

A, B and C simultaneously switch to logic 1 after being logic 0 for a long time.

Draw a timing diagram showing the transitions for the output F.

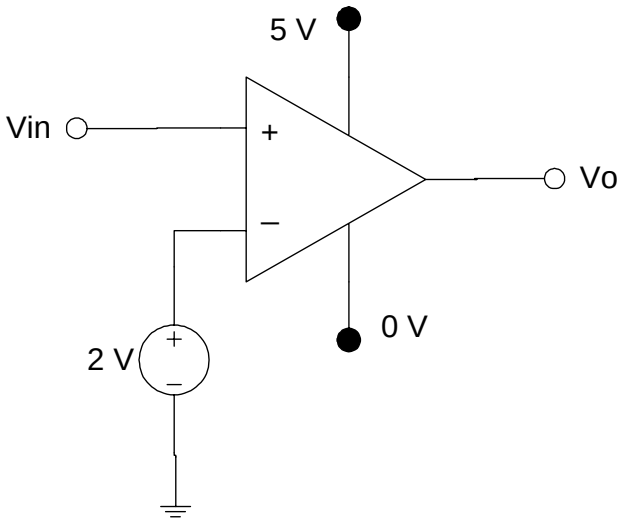
Problem 5:

A	B	C	F
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

a) Use the sum-of-products method to write a Boolean function for the output F in terms of A, B, and C.

b) Simplify the result from a) to use the fewest number of gates.

Problem 6:



Consider the amplifier at the left to be realistic, with A = 100,000, $R_i = \infty\ \Omega$, and $R_O = 0\ \Omega$.

Find the range of Vin for which the amplifier output does not hit a rail.