

PHYS-COIS 2250H – Electronics
Midterm: Monday 2nd March 2009.
Allowed: 1 hour, 50 mins. Calculator.

Answer all questions. Each question is worth equal marks. Show your working!

1.a) Given the information below, what would be the colours, and their ordering, of a resistor of $150\ \Omega$ and one of $150\ \text{M}\Omega$? (assume that three bands in total denote the resistance value)?

black	0
brown	1
red	2
orange	3
yellow	4
green	5
blue	6
violet	7
grey	8
white	9

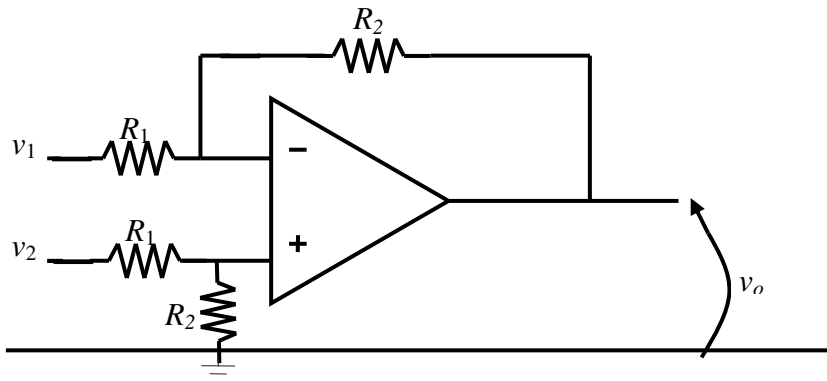
b) List the three parameters that determine the behaviour of a differential amplifier, and draw its *equivalent circuit*.

c) Use a truth table to verify one of DeMorgan's theorems, given below:

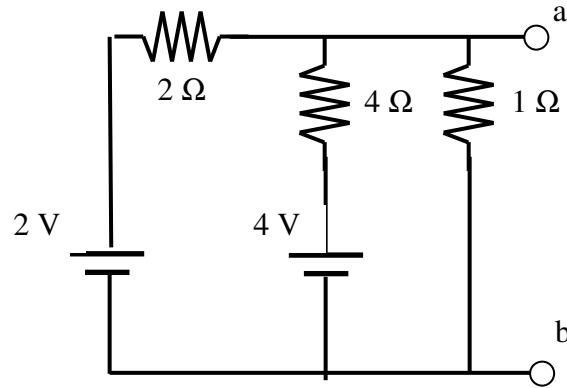
$$\overline{A \bullet B} = \overline{A} + \overline{B}$$

2. a) What are the basic assumptions used in solving negative-feedback operational amplifier circuits?

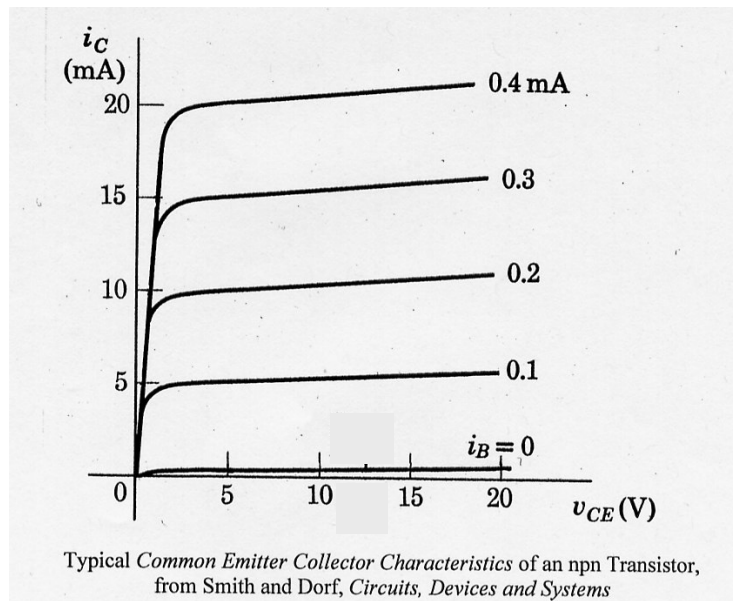
b) Prove that $v_o = \frac{R_2}{R_1}(v_2 - v_1)$ for the circuit below, stating where you use each of the assumptions in (a), if at all.



3. Derive and draw the Thevenin equivalent of the circuit below, across a-b



4. An npn transistor with the following common emitter collector characteristics is set up in the *common emitter configuration*, with a supply voltage of $V_{cc} = 20\text{ V}$, and a load resistance, R_L , of $2\text{ k}\Omega$.



a) Describe what is meant by an *npn transistor*, and draw the circuit symbol we use to represent it.

b) With the help of a diagram, explain what is meant by a *common emitter configuration*.

c) From the characteristics shown above, determine an approximate value of β for this transistor.

d) Given the values of V_{cc} and R_L above, what is the maximum value of the collector current that can flow through the transistor in this circuit?