EE 420 - Electronics - 2

Name _____

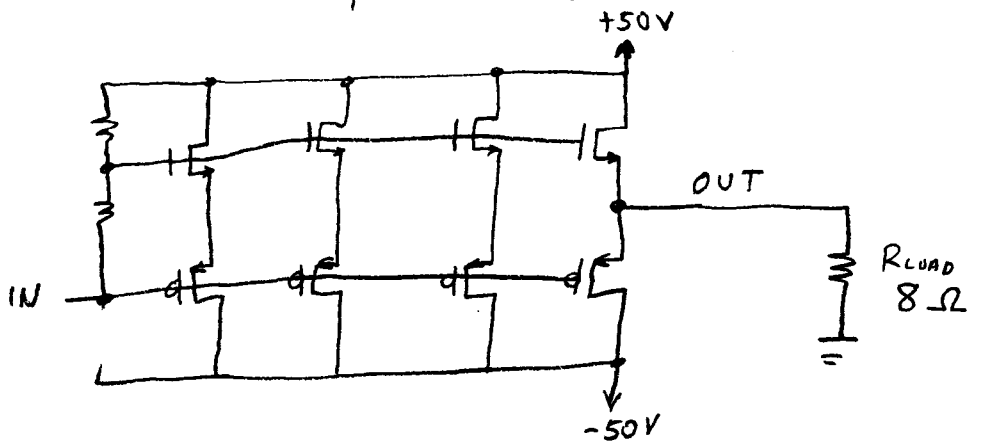
Number _____

1	_____
2	_____
3	_____
4	_____
Raw total	_____
Scaled	_____

Put your name only on the cover.

Put your number on all pages.

(1) Here is a power stage ....



Assuming that there is 2 volts across the devices at clipping -

(a) What is the maximum <u>sine wave</u> power?

(b) What is the worst power dissipation with a square wave?

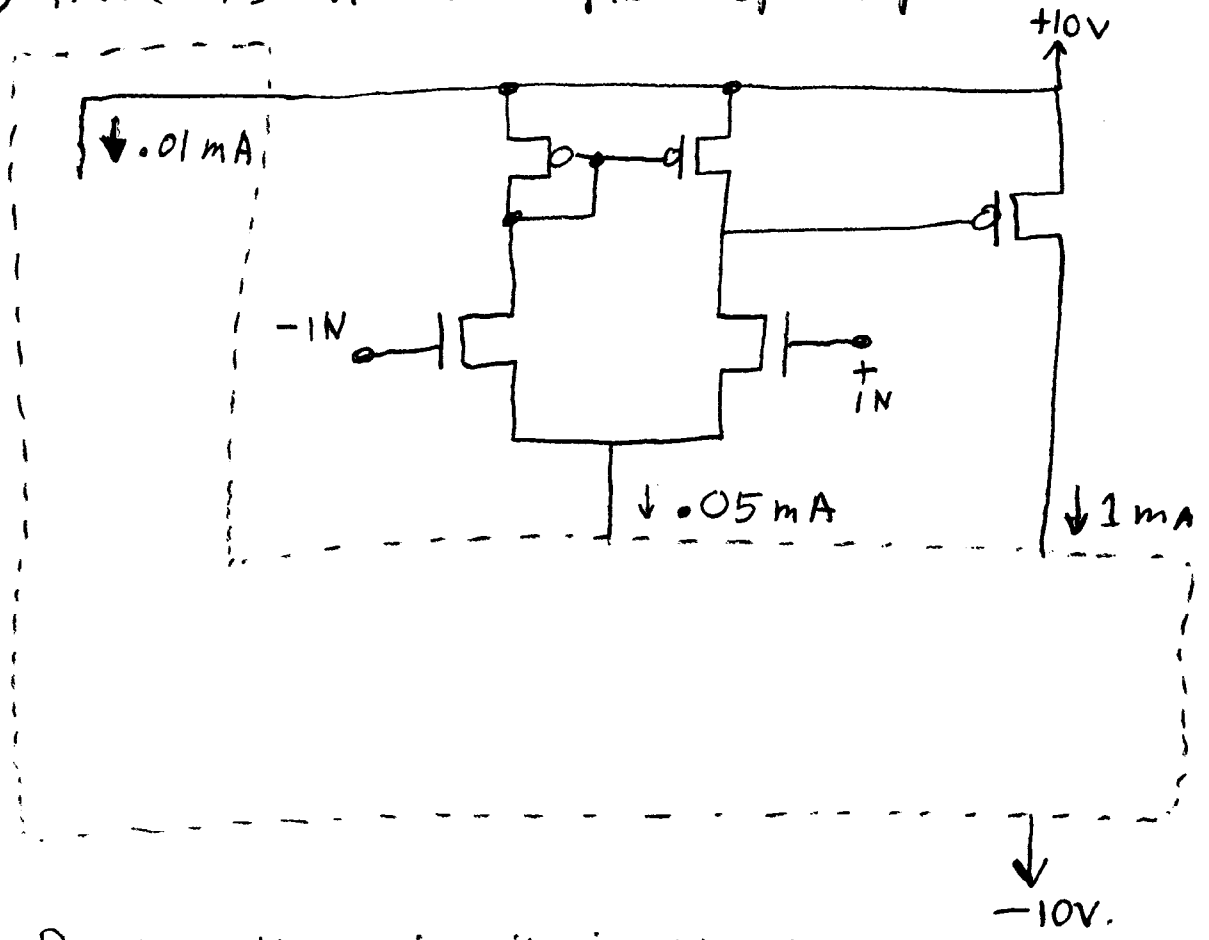
Total →

per device →

(c) What is the efficiency with the signal used in b?

(d) What device transconductance is necessary for 2 volts across the device at clipping?

(2) Here is an incomplete op-amp



Design the circuit in the box, using 4 N-channel MOSFETs. No other components.

You need to complete the schematic and determine the sizes

$W_{MIN} = L_{MIN} = 1\,\mu m$

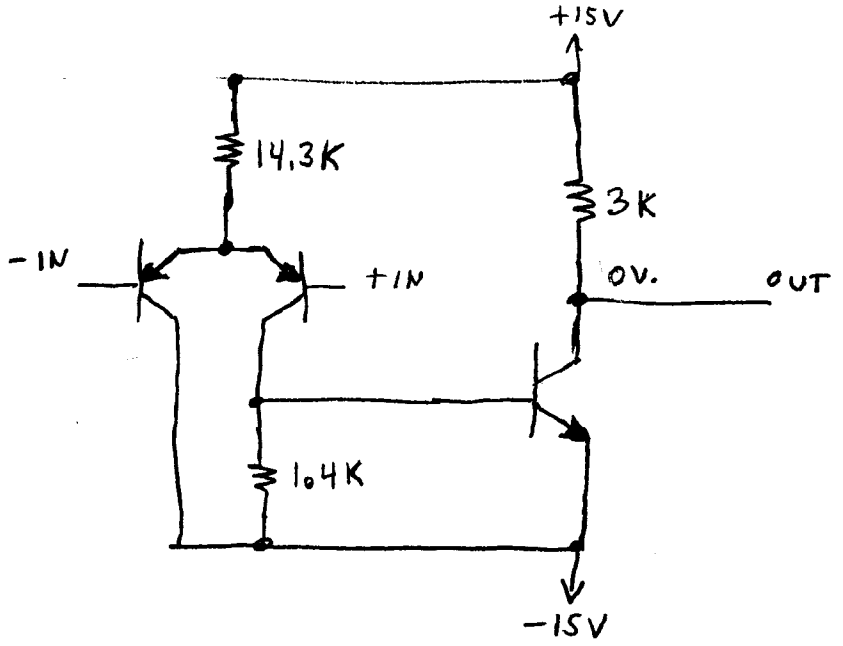
$K' = 20\ \frac{\mu A}{V^2}$

$V_{TH} = 2$

$\lambda = 0$

$I_D = \frac{1}{2} K' \frac{W}{L} (V_{GS} - V_{TH})^2$

(3)



All transistors:

$\beta = 500$

$V_A = \infty$

$g_m = \frac{I_C}{.026}$

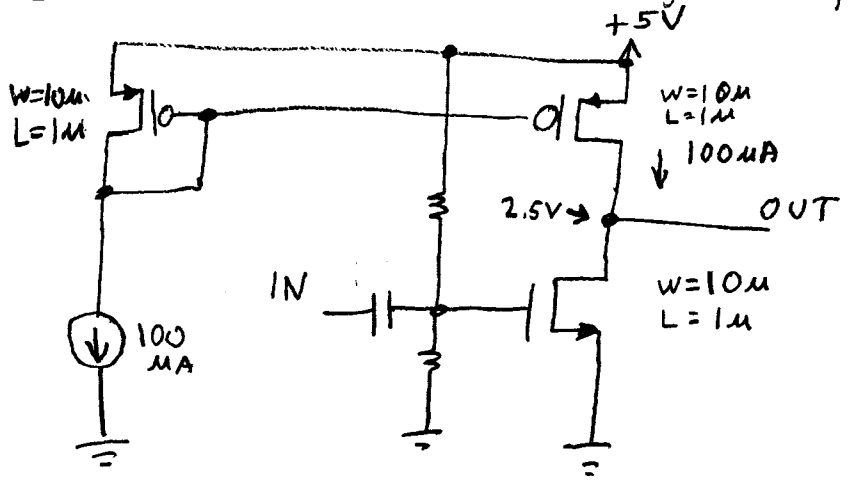
$r_\pi = \frac{.026}{I_B}$

What is the differential gain? (open loop)

What is the common mode gain?

Assume it is biased correctly. Show all work.

(4) Here's a one stage amplifier...



N channel device:

$K' = 20 \frac{\mu A}{V^2}$

$\lambda = .01$

P channel device:

$K' = 10 \frac{\mu A}{V^2}$

$\lambda = .01$

Both: $g_m = \sqrt{2K' \frac{W}{L} I_D}$

Assume that it is biased correctly.

What is gain $\frac{V_{out}}{V_{in}}$?

Hint: You need to find the effective R_{LOAD} based on λ for both devices. Then find g_m. Then g_m and R_{LOAD} will tell you the gain.