

Unit 9 - Week 7 - Opamp controlled sources; Virtual short; Swing limits; Summary of amplifiers

Course outline

How does an NPTEL online course work?

Week 0

Week 1 - Obtaining power gain and need for nonlinearity

Week 2 - Nonlinear two ports; MOS transistor; Common source amplifier

Week 3 - Common source amplifier using the MOS transistor

Week 4 - Biasing a MOS transistor at a fixed drain current; CS amplifier using drain feedback bias and current mirror bias

Week 5 - CS amplifier using source feedback bias; Controlled sources using a MOS transistor-VCVS

Week 6 - Controlled sources continued-VCCS, CCCS, CCVS

Week 7 - Opamp controlled sources; Virtual short; Swing limits; Summary of amplifiers

- VCVS using an opamp
- CCVS using an opamp
- Negative feedback and virtual short in an opamp
- Negative feedback and virtual short in a transistor
- Constraints on controlled sources using opamps and transistors
- Summary of basic amplifiers
- Quick tour of amplifying devices
- Signal swing limits in amplifiers
- Swing limit due to transistor entering triode region
- Swing limit due to transistor entering cutoff region
- Swing limit calculation example
- Swing limits-more calculations

Quiz : Assignment 7

- Assignment 7 Solutions
- Analog Circuits: Week 7 Feedback form

Week 8 - pMOS transistor; Converting pMOS circuits to nMOS

Week 9 - Common source amplifier with active load; CMOS inverter

Week 10 - Differential pair with current mirror load; Single-stage opamp

Week 11 - Two-stage opamp; Opamp characteristics

Week 12 - Bipolar transistors

Lecture Notes

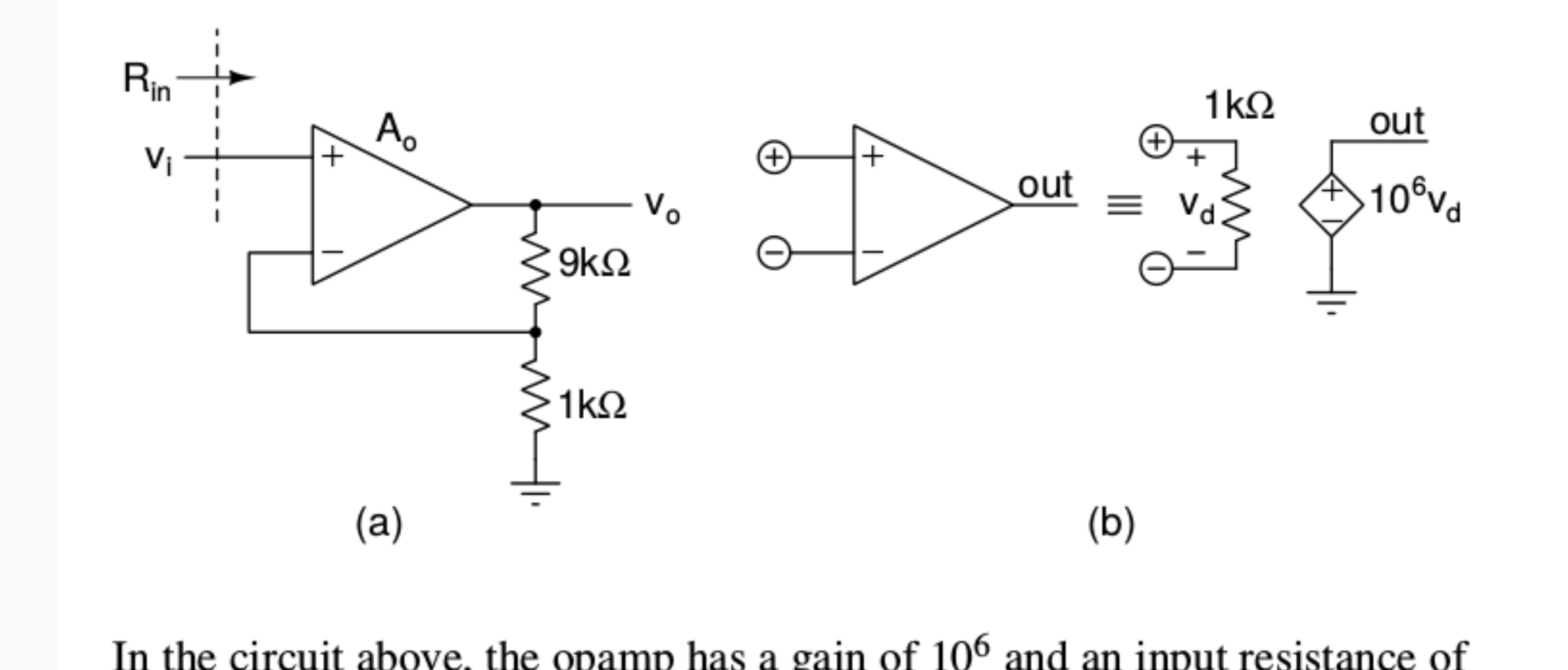
Text Transcripts

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Assignment 7

The due date for submitting this assignment has passed. **Due on 2020-03-18, 23:59 IST.**
As per our records you have not submitted this assignment.



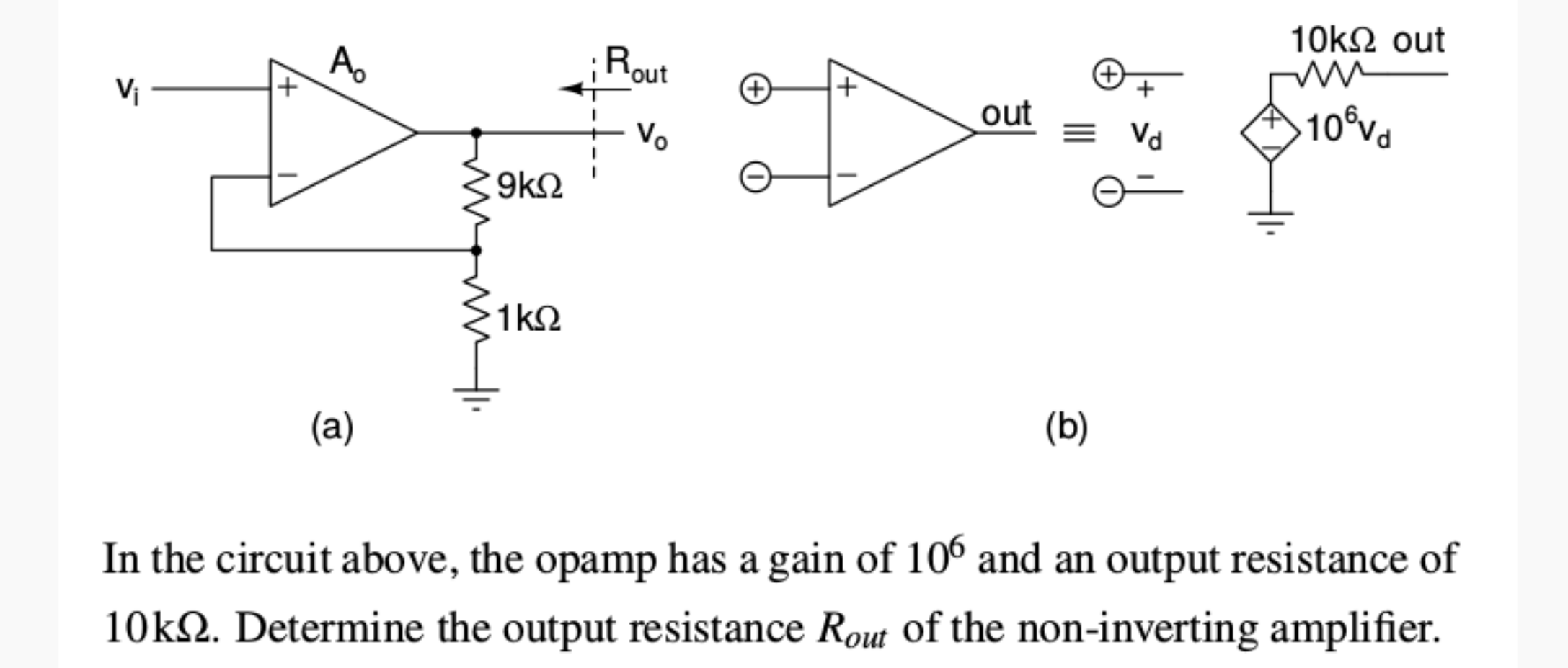
In the circuit above, the opamp has a gain of 10^6 and an input resistance of $1\text{ k}\Omega$. Determine the input resistance R_{in} of the non-inverting amplifier.

(The answer must be in **megohms (MΩ)**. Round off fractional answers to the nearest integer.)

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Numeric) 100

1 point



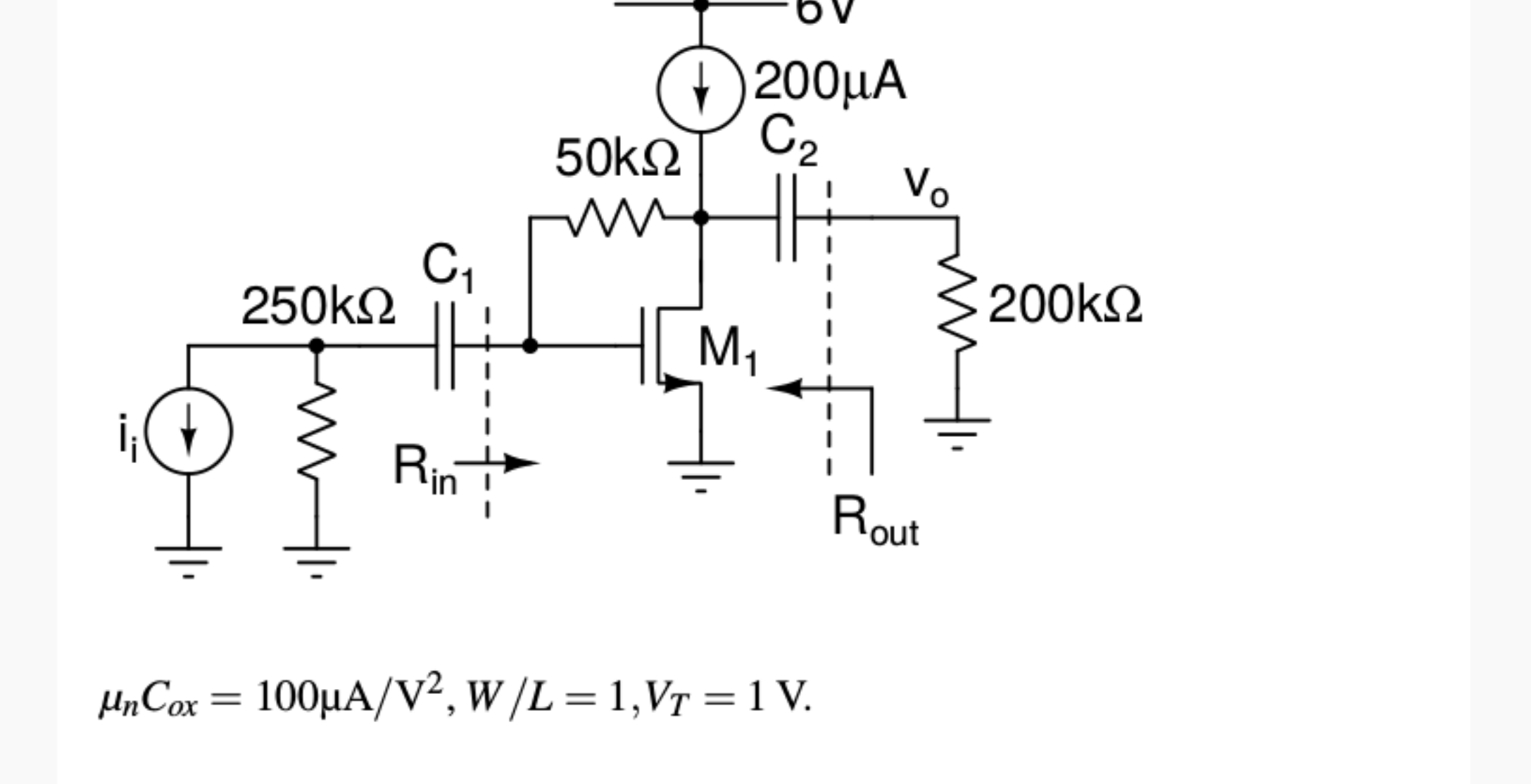
In the circuit above, the opamp has a gain of 10^6 and an output resistance of $10\text{ k}\Omega$. Determine the output resistance R_{out} of the non-inverting amplifier.

(The answer must be in **ohms (Ω)**. Round off fractional answers to one decimal place.)

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Numeric) 0.1

1 point



$\mu_n C_{ox} = 100\mu\text{A}/\text{V}^2, W/L = 1, V_T = 1\text{ V}.$

In the circuit above, determine the value of i_i at which M_1 enters triode region. Assume that the capacitors are shorts at the signal frequency.

(The answer must be in **microamperes (μA)**. Round off fractional answers to the nearest integer.)

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Range) -21,-20

1 point

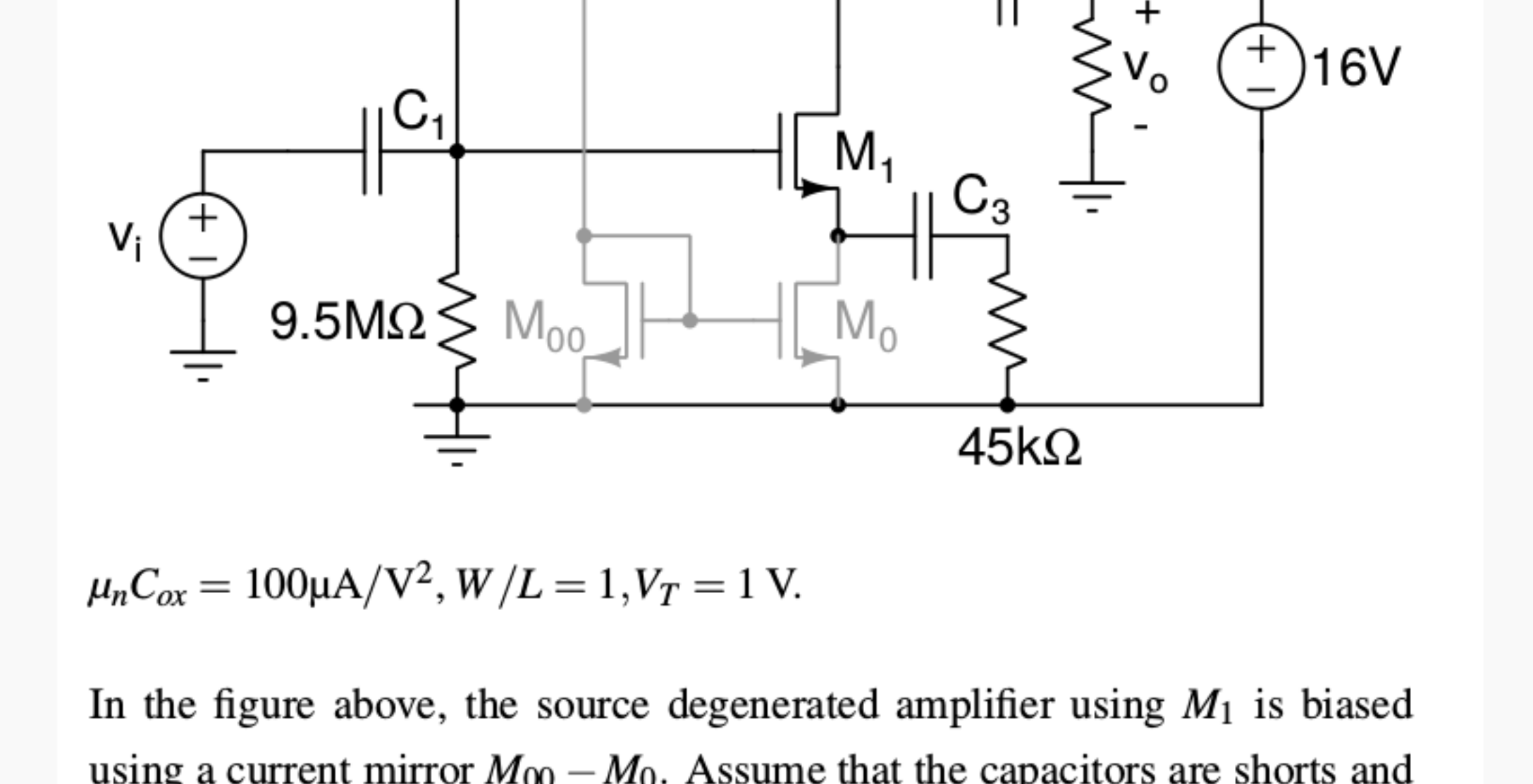
In the circuit above, determine the value of i_i at which M_1 just cuts off. Use the criterion based on the drain current. Assume that the capacitors are shorts at the signal frequency.

(The answer must be in **microamperes (μA)**. Round off fractional answers to the nearest integer.)

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Range) 167,169

1 point



$\mu_n C_{ox} = 100\mu\text{A}/\text{V}^2, W/L = 1, V_T = 1\text{ V}.$

In the figure above, the source degenerated amplifier using M_1 is biased using a current mirror $M_0 - M_0$. Assume that the capacitors are shorts and the inductor is open at the signal frequency.

Determine the input voltage v_i at which M_1 enters triode region.

(The answer must be in **volts (V)**. Round off fractional answers to one decimal place.)

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Numeric) 2.5

1 point

In the above figure, determine the input voltage v_i at which M_1 just cuts off.

(The answer must be in **volts (V)**. Round off fractional answers to one decimal place.)

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Numeric) -10

1 point

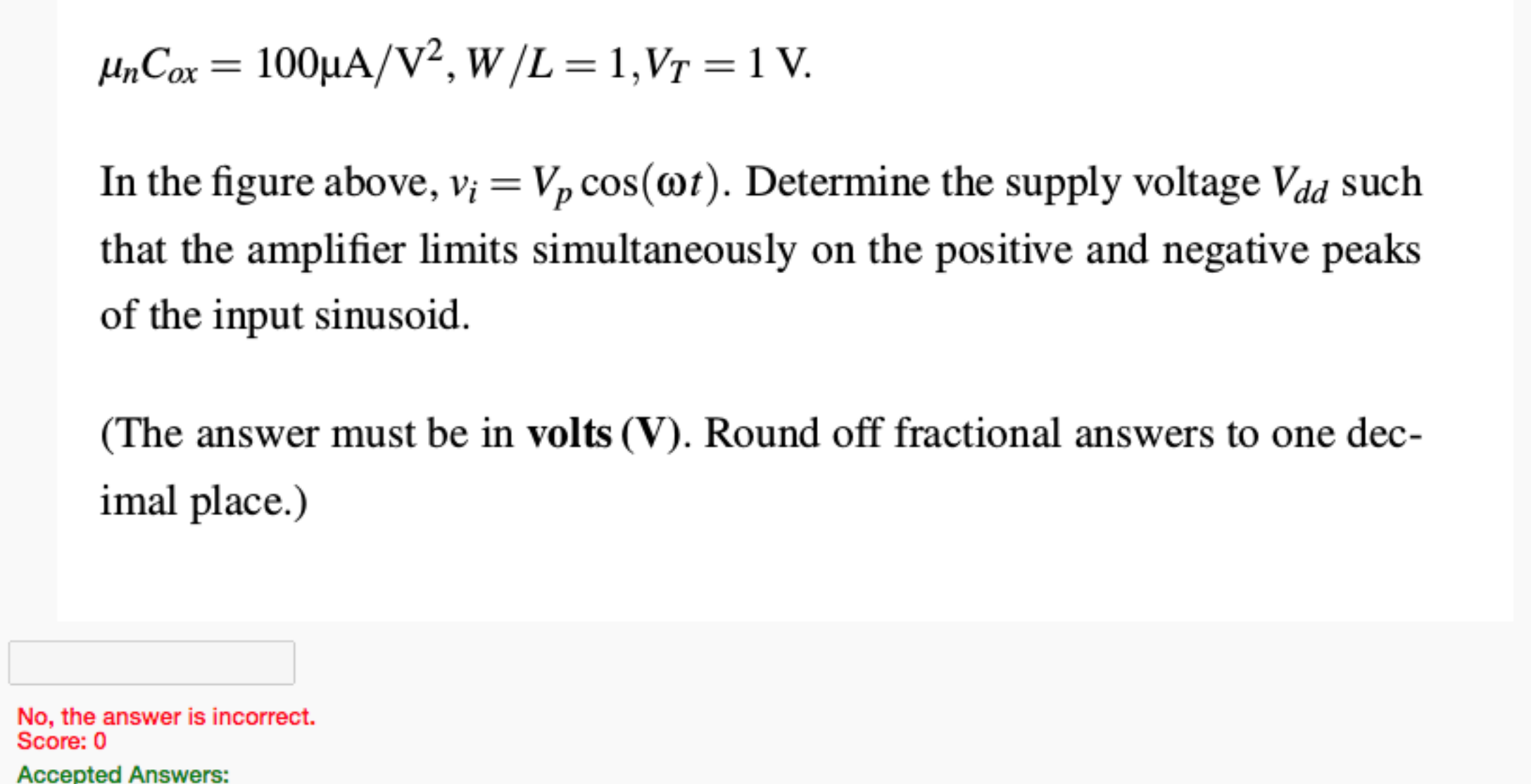
In the above figure, determine the input voltage v_i at which M_0 enters triode region.

(The answer must be in **volts (V)**. Round off fractional answers to one decimal place.)

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Numeric) -5

1 point



$\mu_n C_{ox} = 100\mu\text{A}/\text{V}^2, W/L = 1, V_T = 1\text{ V}.$

In the figure above, $v_i = V_p \cos(\omega t)$. Determine the supply voltage V_{dd} such that the amplifier limits simultaneously on the positive and negative peaks of the input sinusoid.

(The answer must be in **volts (V)**. Round off fractional answers to one decimal place.)

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Numeric) 11.5

1 point

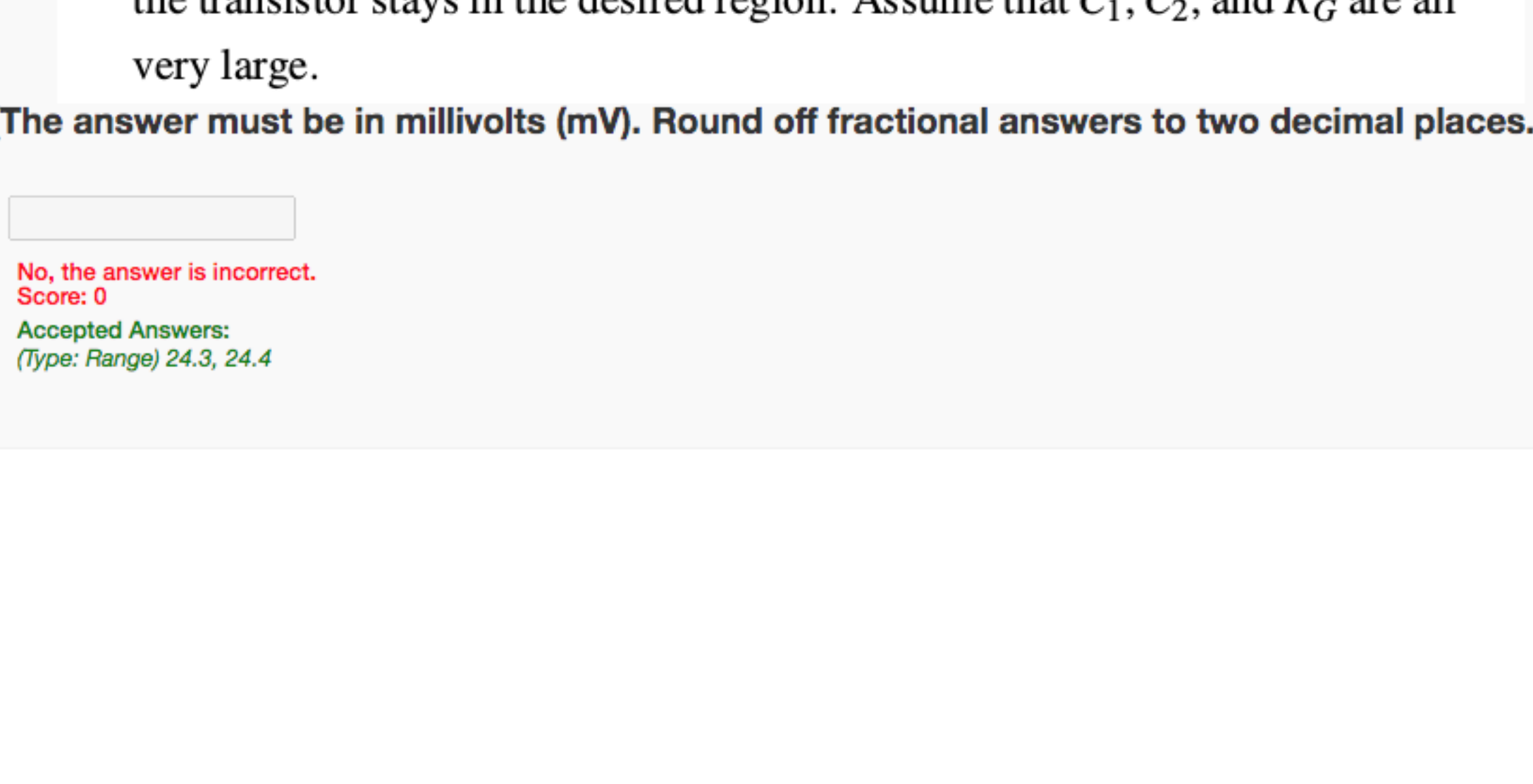
What is the maximum amplitude V_p that can be applied to the circuit with the above determined V_{dd} ?

(The answer must be in **volts (V)**. Round off fractional answers to one decimal place.)

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Numeric) 2.5

1 point



$\mu_n C_{ox} = 100\mu\text{A}/\text{V}^2, W/L = 1, V_T = 1\text{ V}.$

In the figure above, $v_i = V_p \cos(\omega t)$. Determine the maximum V_p such that the amplifier stays in the desired region. Assume that $C_1, C_2,$ and R_G are all very large.

(The answer must be in **millivolts (mV)**. Round off fractional answers to two decimal places.)

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Range) 24.3, 24.4

1 point