

# Unit 3 - Week 1 - Obtaining power gain and need for nonlinearity

**Course outline**

How does an NPTEL online course work?

**Week 0**

**Week 1 - Obtaining power gain and need for nonlinearity**

- Introduction to the course
- Obtaining power gain
- Obtaining power gain using a linear two port?
- One port(two terminal) nonlinear element
- Nonlinear circuit analysis
- Small signal incremental analysis-graphical view
- Small signal incremental analysis
- Incremental equivalent circuit
- Large signal characteristics of a diode
- Analysis of diode circuits
- Small signal model of a diode

**Quiz : Assignment 1**

- Analog Circuits: Week 1 Feedback form
- Assignment 1 Solutions

**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**

**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**

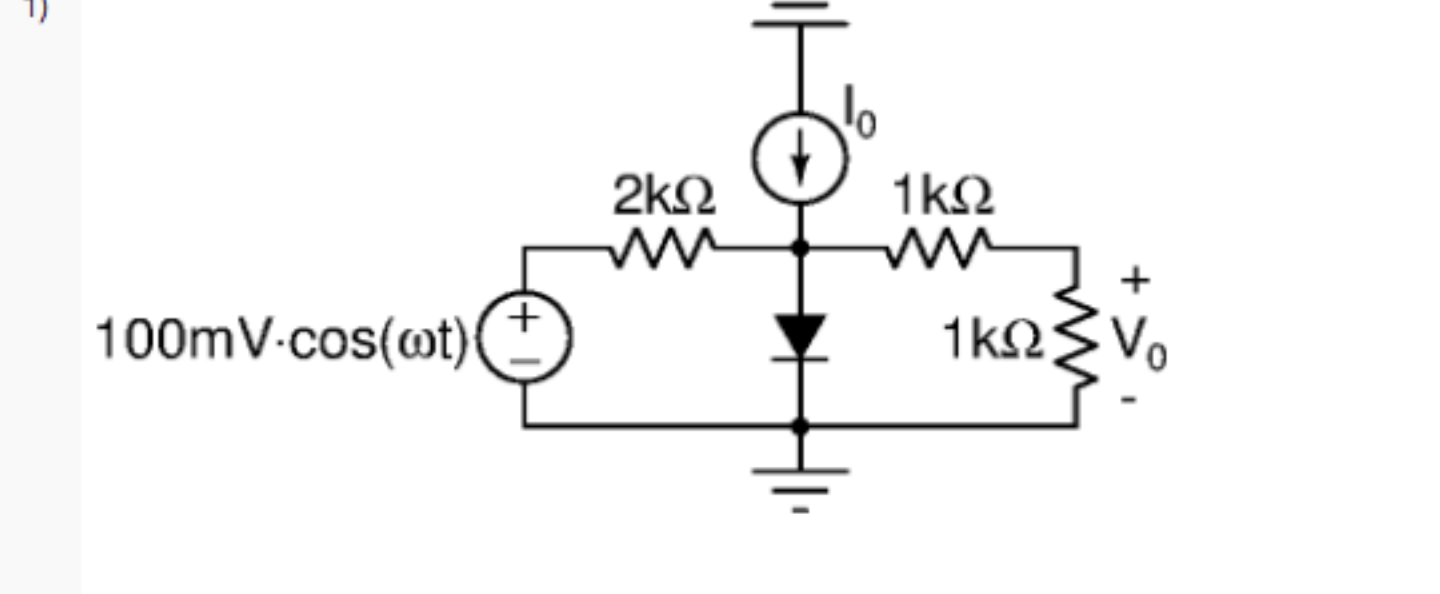
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## Assignment 1

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment.

Due on 2020-02-12, 23:59 IST.



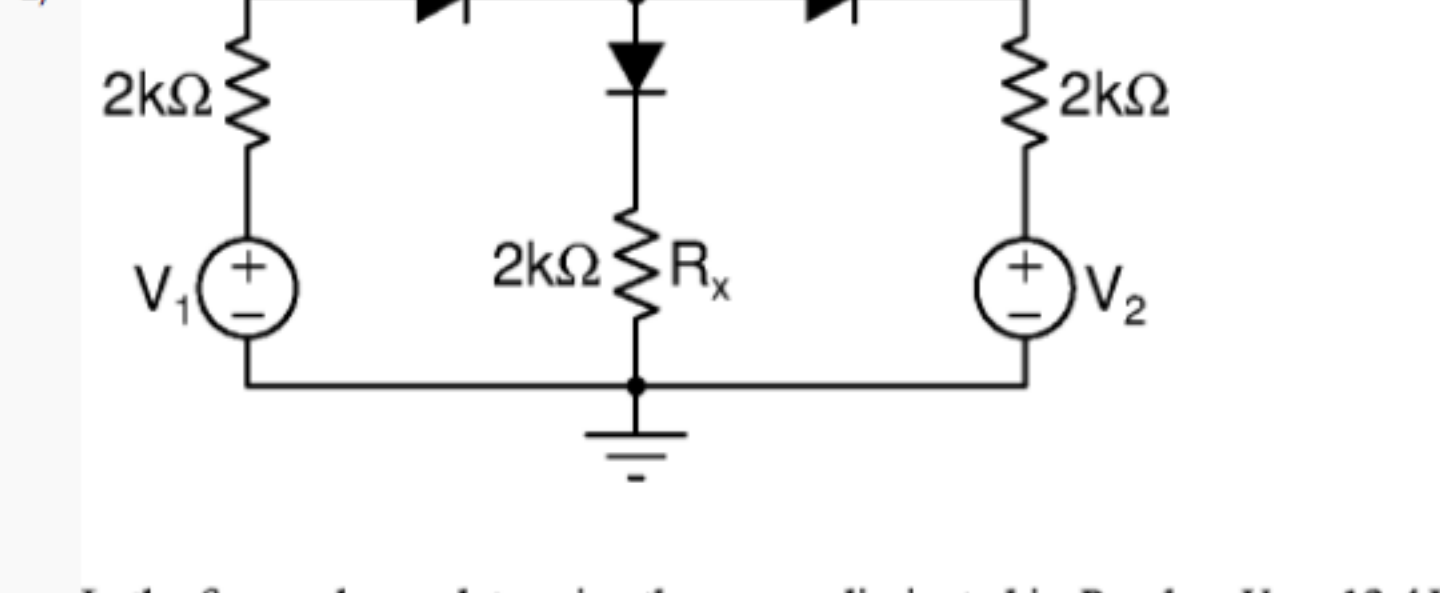
In the figure above, determine the amplitude of the sinusoidal component of  $V_o$  when  $I_0 = 2.7 \text{ mA}$ .

(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) 0.30,0.32

1 point



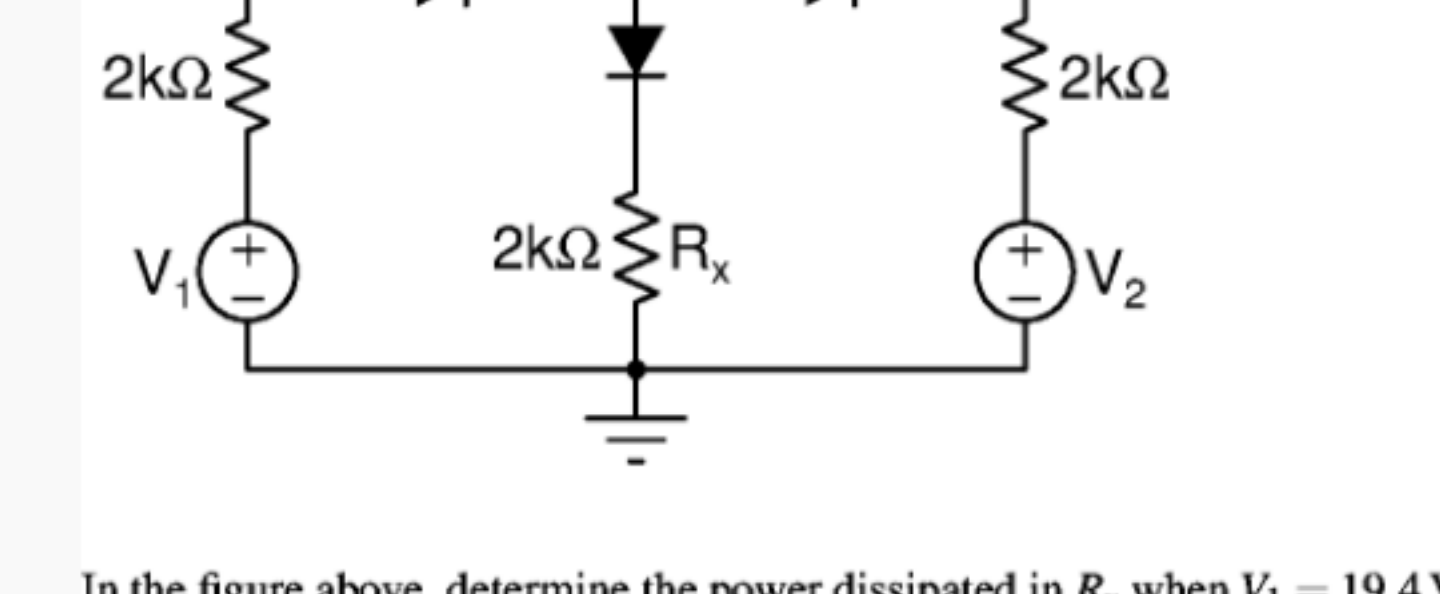
In the figure above, determine the power dissipated in  $R_x$  when  $V_1 = 13.4 \text{ V}$ ,  $V_2 = 18 \text{ V}$ .

(The answer must be in milliwatts (mW). Round off fractional answers to one decimal place.)

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Numeric) 18

1 point



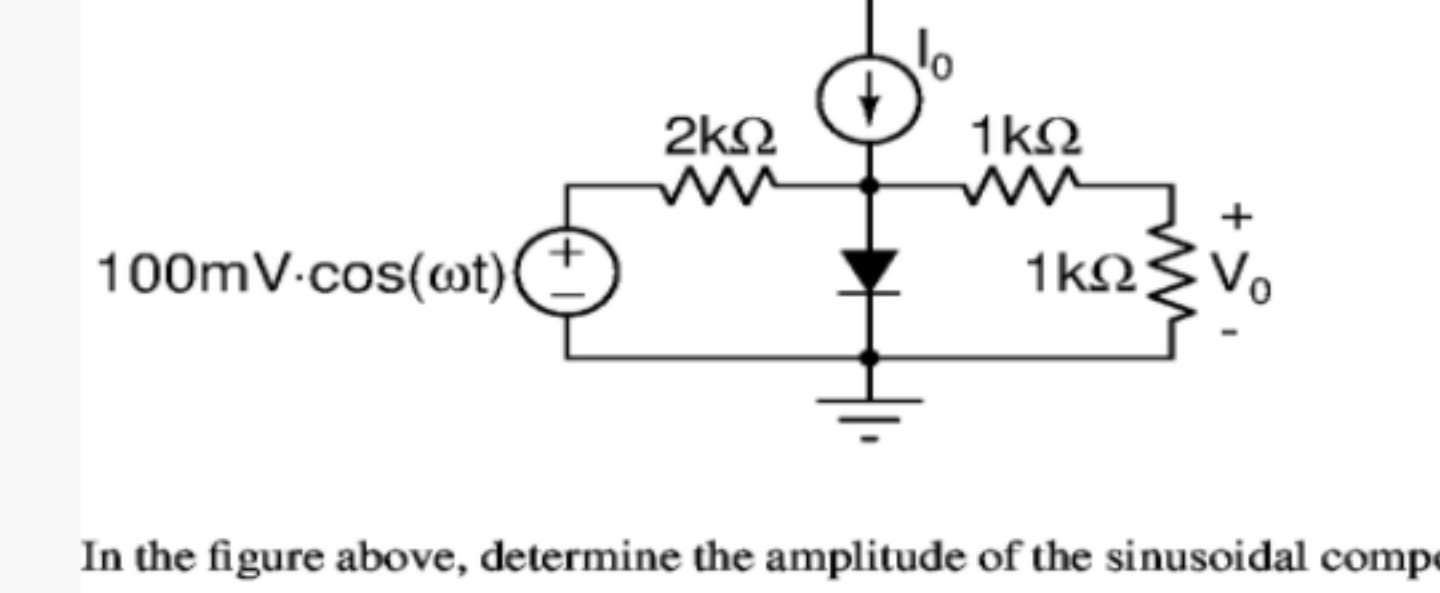
In the figure above, determine the power dissipated in  $R_x$  when  $V_1 = 19.4 \text{ V}$ ,  $V_2 = 6 \text{ V}$ .

(The answer must be in milliwatts (mW). Round off fractional answers to one decimal place.)

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Numeric) 32

1 point



In the figure above, determine the amplitude of the sinusoidal component of  $V_o$  when  $I_0 = -2.7 \text{ mA}$ .

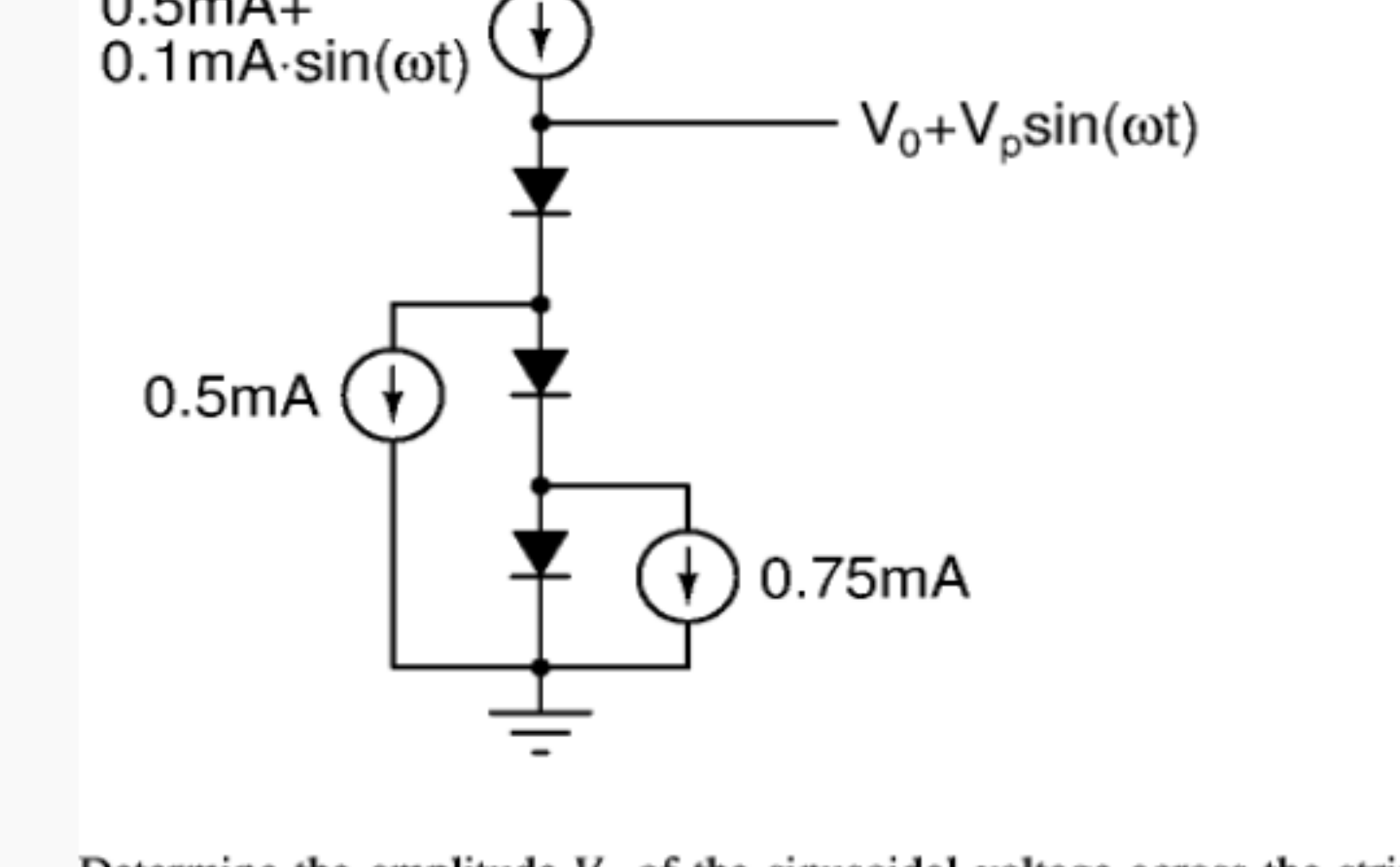
(To think about: Possible application of a circuit such as the above.)

(The answer must be in millivolts (mV). Round off fractional answers to one decimal place.)

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Numeric) 25

1 point



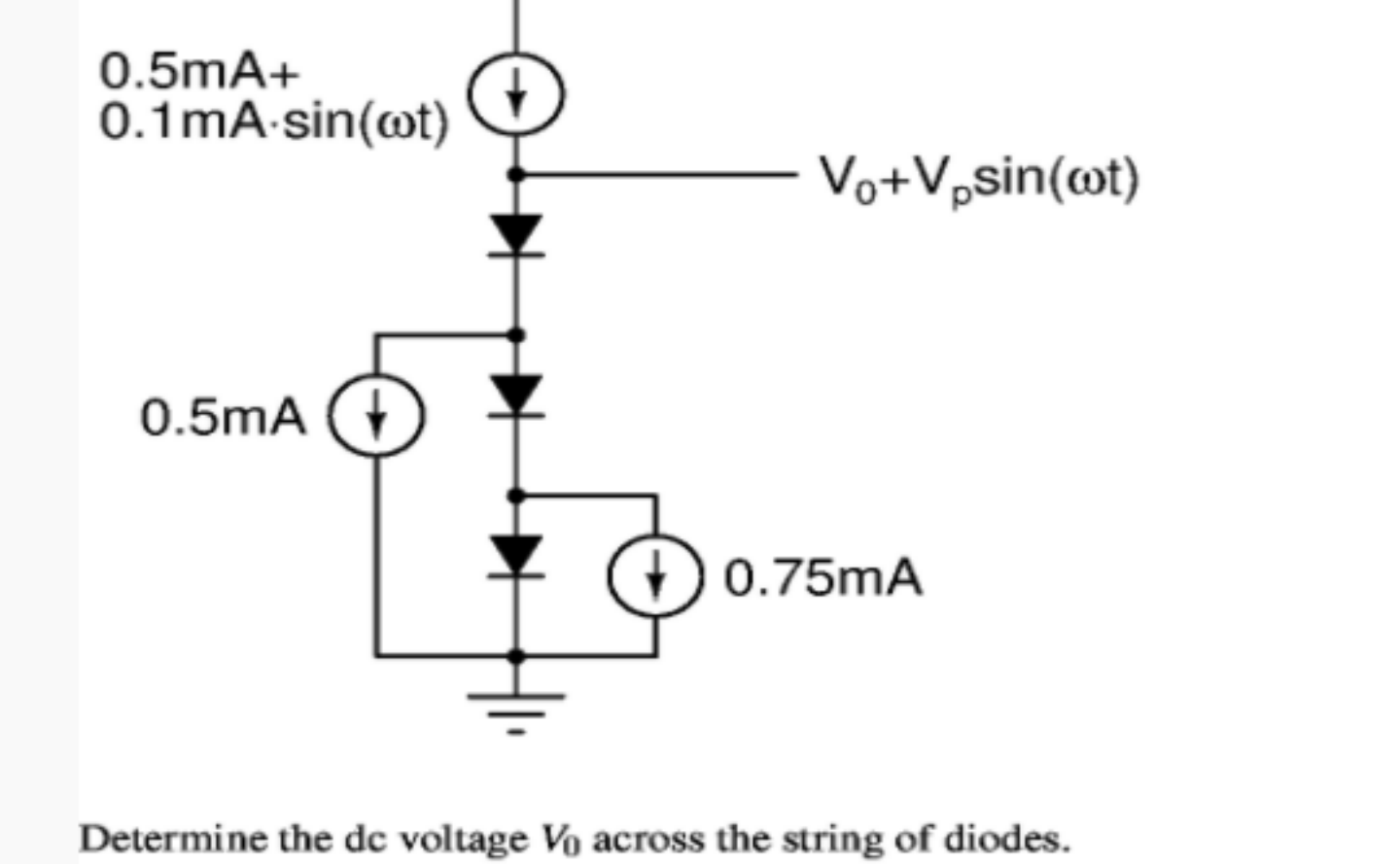
Determine the amplitude  $V_p$  of the sinusoidal voltage across the string of diodes.

(The answer must be in millivolts (mV). Round off fractional answers to one decimal place.)

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Numeric) 2.1

0 points



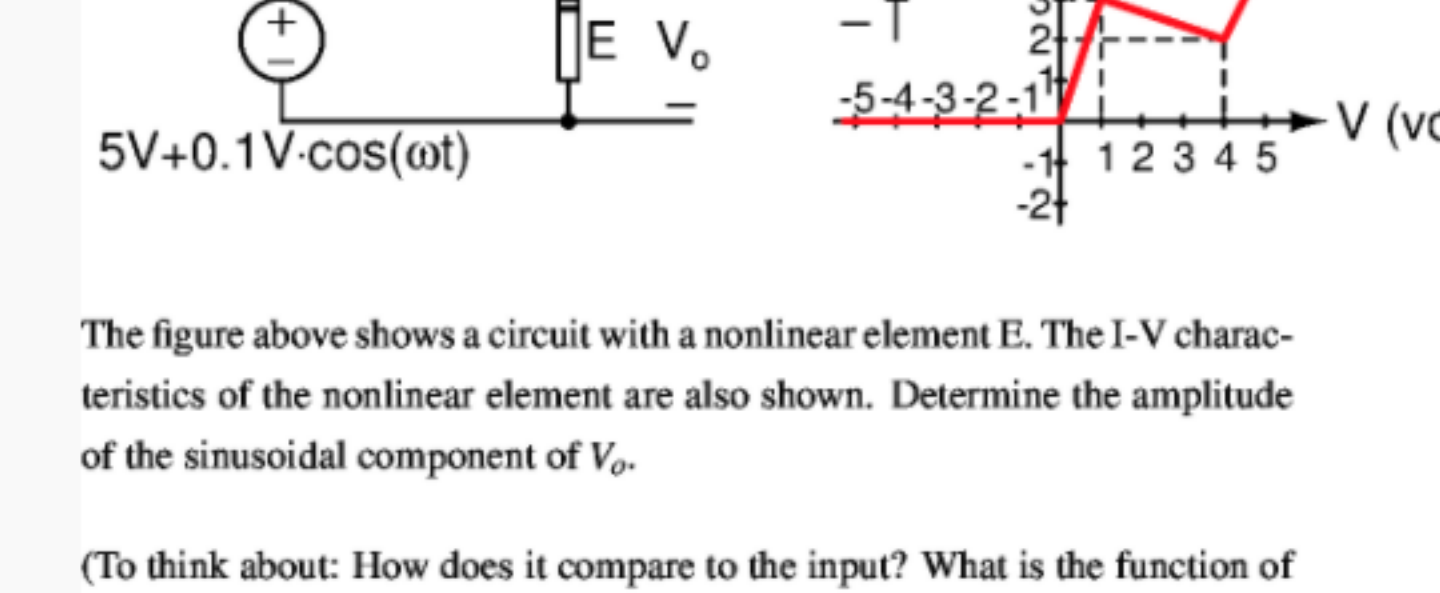
Determine the dc voltage  $V_0$  across the string of diodes.

(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: Range) 17.5,18.2

0 points



The figure above shows a circuit with a nonlinear element E. The I-V characteristics of the nonlinear element are also shown. Determine the amplitude of the sinusoidal component of  $V_o$ .

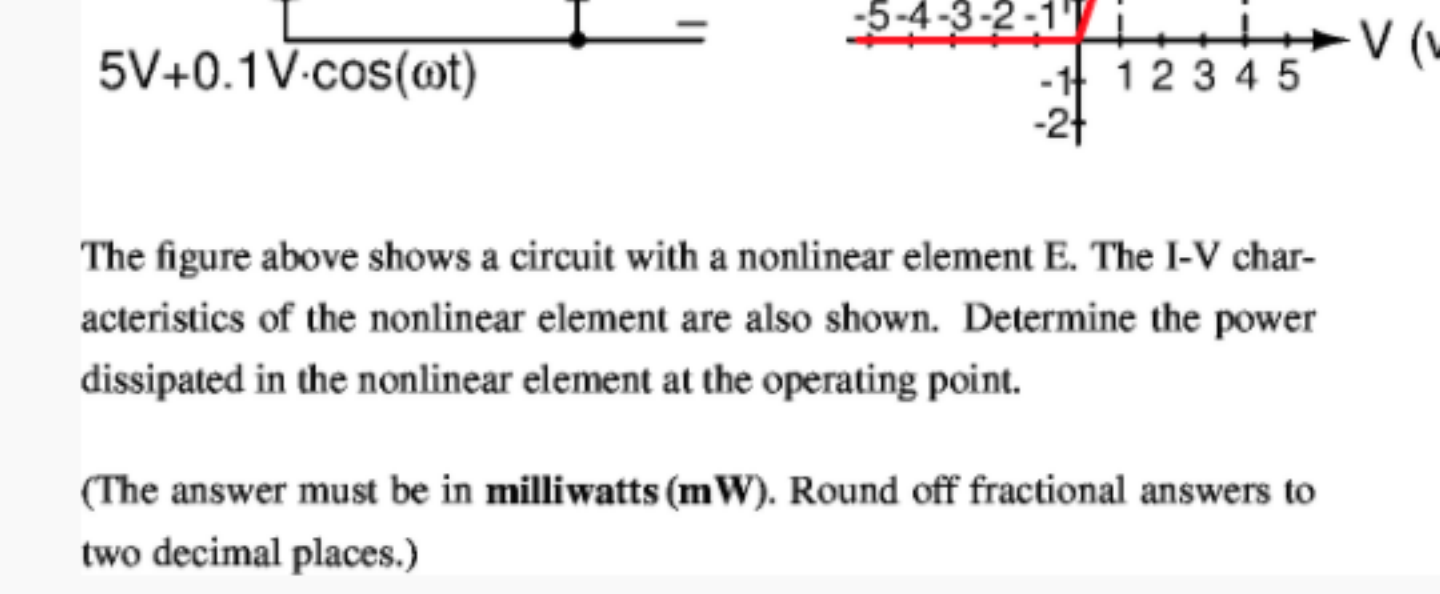
(To think about: How does it compare to the input? What is the function of the circuit?)

(The answer must be in millivolts (mV). Round off fractional answers to one decimal place.)

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Numeric) 150

1 point



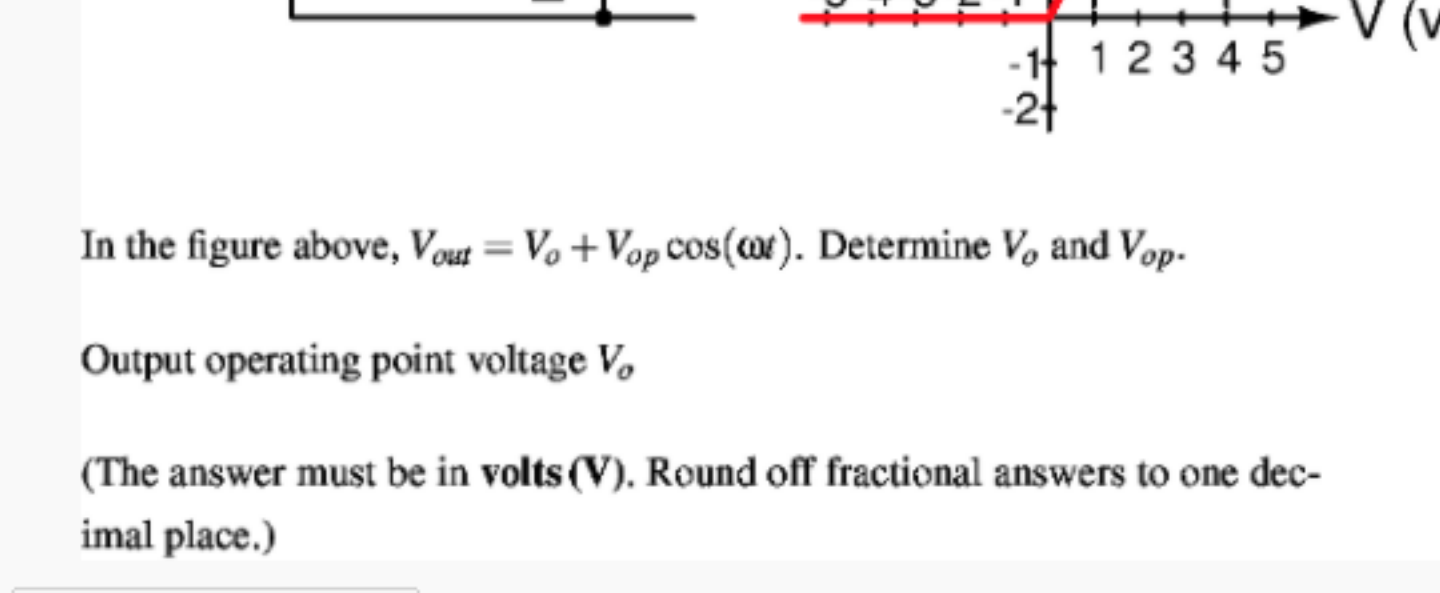
The figure above shows a circuit with a nonlinear element E. The I-V characteristics of the nonlinear element are also shown. Determine the power dissipated in the nonlinear element at the operating point.

(The answer must be in milliwatts (mW). Round off fractional answers to two decimal places.)

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Numeric) 6.25

1 point



In the figure above,  $V_{out} = V_o + V_{op} \cos(\omega t)$ . Determine  $V_o$  and  $V_{op}$ .

Output operating point voltage  $V_o$

(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) 3

1 point



No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Numeric) 1.5

1 point