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2019W1_ELEC_201_101102
Assignment ASN6 due 11/06/2019 at 11:59pm PST

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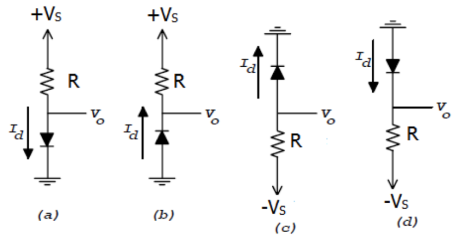
1. (3 points)

In the circuits below, and assuming that the diodes are ideal, determine the voltage V_o, in volts, and the current I_D, in mA, for each (a), (b), (c) and (d).

R = 3 $k\Omega$, V_s = 6 volts

Figure:



(a) V_o = ___ V

I_D = ___ mA

(b) V_o = ___ V

I_D = ___ mA

(c) V_o = ___ V

I_D = ___ mA

(d) V_o = ___ V

I_D = ___ mA

Correct Answers:

- 0
- 2
- 6
- 0
- −6
- 0
- 0
- 2

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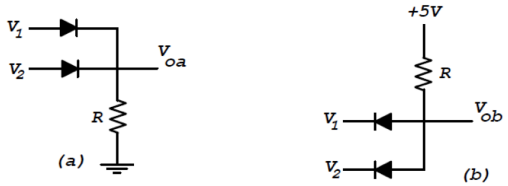
2. (2 points)

For the two configurations in the figure, and assuming that inputs V_1 and V_2 can be either 5V (true) or 0V (false), and considering also that any voltage below 2.5V deemed a true logic value, demonstrate that one of them is a logic OR gate and the other is a logic AND gate (which is which?). Suggestion: build a truth table for all possible inputs and outputs.

Figure:



(a) [?/OR /AND]

(b) [?/OR /AND]

Correct Answers:

- OR
- AND

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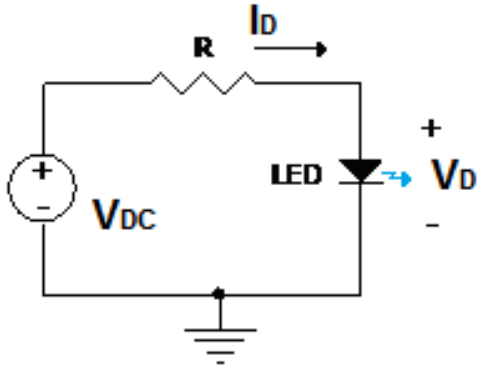
3. (2 points)

The blue LED in the circuit below exhibits a constant voltage drop of 3V when forward bias. Assuming V_{DC} = 10 V, compute the value of R for a diode current I_D = 6 mA.

Note: In this problem, you may only submit numerical answers accurate to 0.02% or better. (i.e. If 4 is the correct answer, 3.9999 will be marked as correct, but 2+2 will be marked as incorrect.)

Diode circuit



R = ___ Ω

Correct Answers:

- 1166.67

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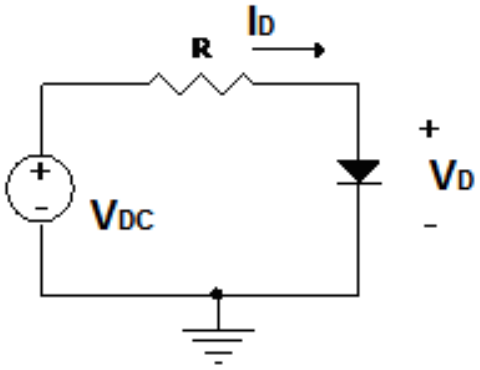
4. (6 points)

The silicon diode in the figure below has an Is = 9.27e-10 A and n = 1.5. Compute the diode operating point, if R = 9000 Ω and V_{dc} = 10.7 volts. Assume that V_T = 0.025 volts.

Note: In this problem, you may only submit numerical answers accurate to 0.02% or better. (i.e. If 4 is the correct answer, 3.9999 will be marked as correct, but 2+2 will be marked as incorrect.)

Diode circuit



(a) Diode operating current : ___ *mA*

(b) Diode operating voltage : ___ *V*

Correct Answers:

- 1.1305
- 0.525524

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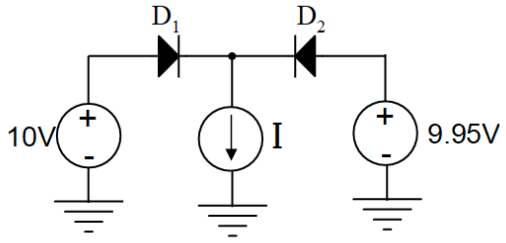
5. (6 points)

The silicon diodes in the figure below have an Is = 8.32e-10 A and n = 2. Compute the diodes operating point, if I = 5.6 mA. Assume that V_T = 0.025 volts.

Note: In this problem, you may only submit numerical answers accurate to 0.02% or better. (i.e. If 4 is the correct answer, 3.9999 will be marked as correct, but 2+2 will be marked as incorrect.)

Diode circuit



(a) Diode 1 operating current : ___ *mA*

(b) Diode 1 operating voltage : ___ *V*

(c) Diode 2 operating current : ___ *mA*

(d) Diode 2 operating voltage : ___ *V*

Correct Answers:

- 4.09393
- 0.770447
- 1.50607
- 0.720447

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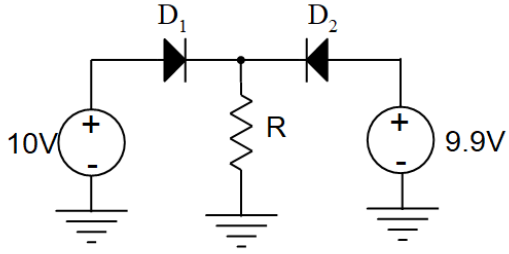
6. (6 points)

The silicon diodes in the figure below have an Is = 8.32e-10 A and n = 2. Compute the diodes operating point, if R = 1831 Ω. Assume that V_T = 0.025 volts.

Note: In this problem, you may only submit numerical answers accurate to 0.02% or better. (i.e. If 4 is the correct answer, 3.9999 will be marked as correct, but 2+2 will be marked as incorrect.)

Diode circuit



(a) Diode 1 operating current : ___ *mA*

(b) Diode 1 operating voltage : ___ *V*

(c) Diode 2 operating current : ___ *mA*

(d) Diode 2 operating voltage : ___ *V*

Correct Answers:

- 4.43791
- 0.774481
- 0.600606
- 0.674481

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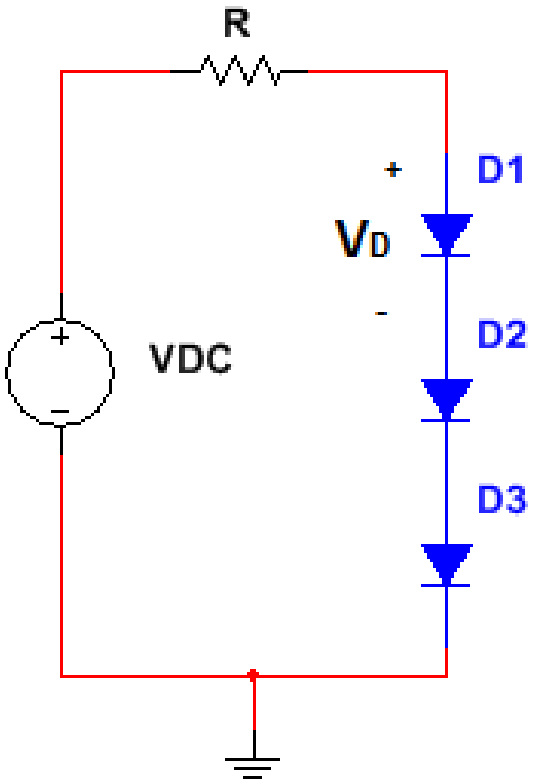
7. (6 points)

In the circuit below the three diodes are identical with Is = 8.32e-07 mA, n = 2, V_T = 0.025 V, and VDC = 7.5 V. if I_D = 1.1 mA, compute V_D (the voltage drop accross any of the diodes) and R.

Note: In this problem, you may only submit numerical answers accurate to 0.02% or better. (i.e. If 4 is the correct answer, 3.9999 will be marked as correct, but 2+2 will be marked as incorrect.)



(a) V_D **:** ____ V

(b) **R :** ____ Ω

Correct Answers:

- 0.704737
- 4896.17

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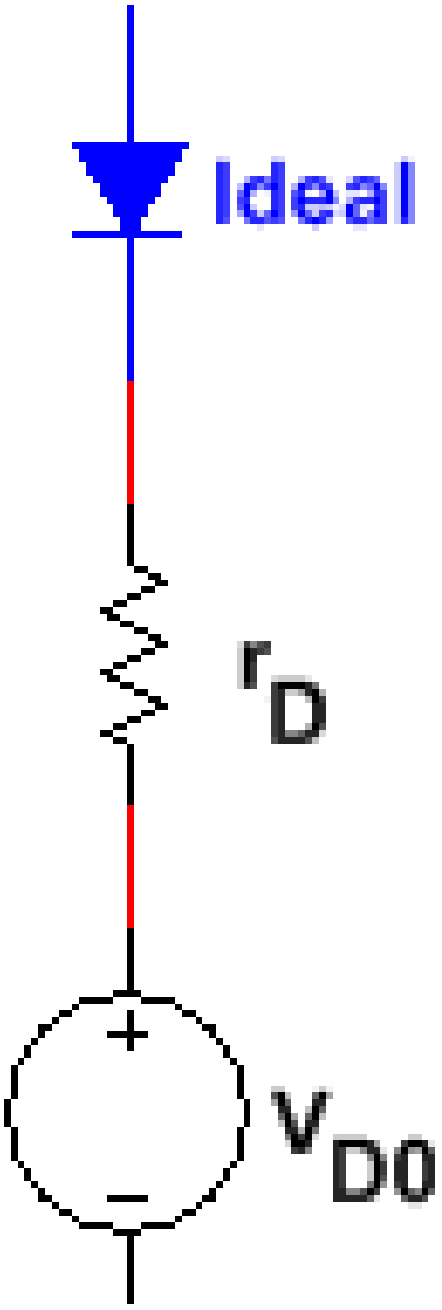
8. (5 points)

A diode has a voltage drop of 0.6V @ 1.9mA with n = 2 and V_T = 0.025V. Find the piecewise model for the diode such that it is exact both at 1.9mA and 12mA.

Note: In this problem, you may only submit numerical answers accurate to 0.02% or better. (i.e. If 4 is the correct answer, 3.9999 will be marked as correct, but 2+2 will be marked as incorrect.)



(a) r_D **:** ____ Ω

(b) v_{D0} **:** ____ *Volts*

Correct Answers:

- 9.12402
- 0.582664

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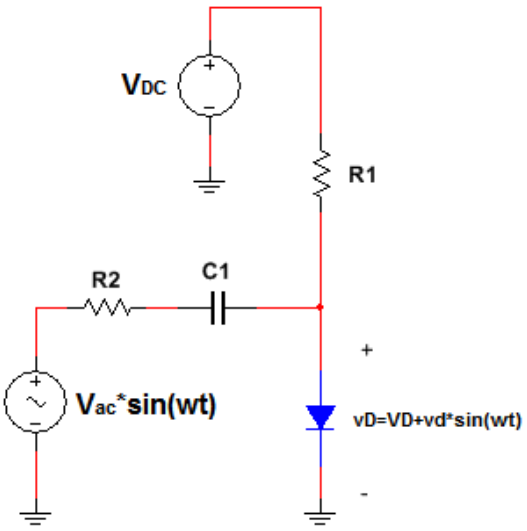
9. (12 points)

The diode in the circuit shown exhibits a VD=0.7V @ 1.8mA, n=2, VT=0.025V. In the circuit VDC=11.1V, R1=2000 Ω, R2=15000 Ω, and Vac=1V. Assume C1 has infinite capacitance and is operating at steady state. Calculate the total diode voltage vD=VD+vd*sin(wt).

Note: In this problem, you may only submit numerical answers accurate to 0.02% or better. (i.e. If 4 is the correct answer, 3.9999 will be marked as correct, but 2+2 will be marked as incorrect.)



(a) VD : ___ *V*

(b) vd : ___ *V*

Correct Answers:

- 0.752789
- 0.000640787

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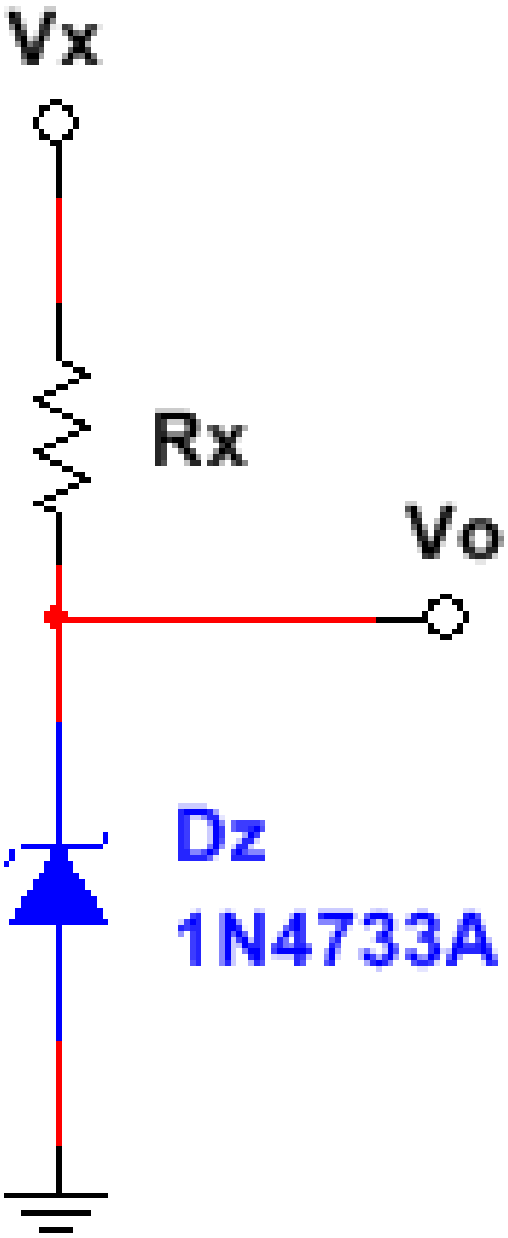
10. (5 points)

For the diode zener in the circuit below we know that V_Z=5.1 V, I_{ZT}=49 mA, and r_Z=7 Ω. If Vx=14 V and Rx=33 Ω, calculate Vo and Iz.

Note: In this problem, you may only submit numerical answers accurate to 0.02% or better. (i.e. If 4 is the correct answer, 3.9999 will be marked as correct, but 2+2 will be marked as incorrect.)



(a) I_Z **:** ___ *mA*

(b) V_o **:** ___ *V*

Correct Answers:

- 231.075
- 6.37453

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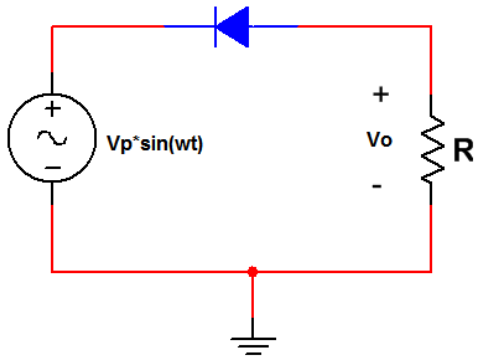
11. (5 points)

The diode in the half wave rectifier below can be represented as a voltage drop of V_{DO}=0.7 V in series with a resistor R_D=2 Ω.

If Vp=13 V and R=33 Ω, calculate Vo, the peak voltage at the resistor R.

Note: In this problem, you may only submit numerical answers accurate to 0.02% or better. (i.e. If 4 is the correct answer, 3.9999 will be marked as correct, but 2+2 will be marked as incorrect.)



(a) V_o **:** ___ V

Correct Answers:

- -11.5971

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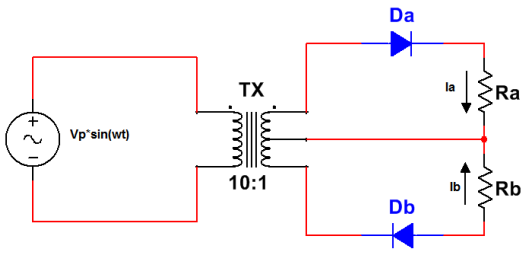
12. (5 points)

Both diodes in the circuit below can be represented as a voltage drop of V_{DO}=0.7 V in series with a resistor R_D=2 Ω. If Vp = 150 V, Ra=112 Ω, Rb=191 Ω, calculate the peak currents Ia and Ib. Assume the transformer ratio is 10:1 to the top winding of the transformer and 10:1 to the bottom winding of the transformer.

Note: In this problem, you may only submit numerical answers accurate to 0.02% or better. (i.e. If 4 is the correct answer, 3.9999 will be marked as correct, but 2+2 will be marked as incorrect.)



(a) I_a **:** ___ mA

(b) I_b **:** ___ mA

Correct Answers:

- 125.439
- -74.0933

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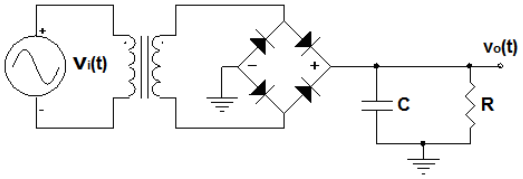
13. (5 points)

In the circuit below the transformer secondary delivers a sinusoid of V_s=14 V (rms) @ 60-Hz, the forward bias diodes are represented as a constant voltage drop V_D=0.7 V, and the load resistance R=170 Ω. a) Find the minimun value of C that results in a ripple voltage not larger than 0.5 V peak-to-peak. b) Calculate the average voltage at the output. c) Calculate the average load current.

Note: In this problem, you may only submit numerical answers accurate to 0.02% or better. (i.e. If 4 is the correct answer, 3.9999 will be marked as correct, but 2+2 will be marked as incorrect.)



(a) C **:** ___ μF

(b) V_L **:** ___ V

(c) I_L **:** ___ mA

Correct Answers:

- 1803.82
- 18.149
- 106.759

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14. (12 points)

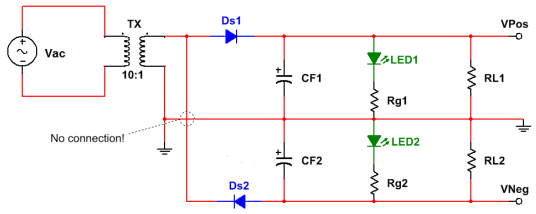
In the circuit below Vac is the power outlet voltage in North America: 120 Vrms @ 60 Hz. The forward bias diodes Ds1 and Ds1 are represented as a constant voltage drop V_D=0.7 V, CF1=1360 μF, CF2=1190 μF, the LEDs are also represented using a constant voltage drop of V_{LED}=2 V, $Rg1 = Rg2$=470 Ω, RL1=178 Ω, and RL2=122 Ω.

a. Calculate the average voltage at terminal VPos.
b. Calculate the ripple voltage at terminal VPos.
c. Calculate the average voltage at terminal VNeg.
d. Calculate the ripple voltage at terminal VNeg.

Tip: Use the Thnin equivalent circuit after the capacitor to calculate the load current.

Note: In this problem, you may only submit numerical answers accurate to 0.02% or better. (i.e. If 4 is the correct answer,

3.9999 will be marked as correct, but 2+2 will be marked as incorrect.)



(a) V_{avePos} **:** ___ V

(b) V_{rPos} **:** ___ V

(c) V_{aveNeg} **:** ___ V

(b) V_{rNeg} **:** ___ V

Correct Answers:

- 15.5582
- 1.42467
- -15.2013
- 2.1385

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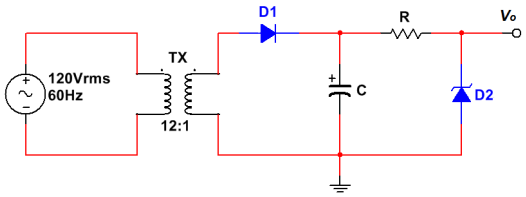
15. (10 points)

Diode D1 in the circuit below can be modeled as constant voltage drop V_D=0.7V. For the zener diode D2 V_Z=6.8V @ I_{ZT}=37mA with r_Z=3.5Ω. Also C=730 μF and R=103Ω.

a. Calculate the average voltage at terminal Vo in V.
b. Calculate the ripple voltage at terminal Vo in mV.

Note: In this problem, you may only submit numerical answers accurate to 0.02% or better. (i.e. If 4 is the correct answer, 3.9999 will be marked as correct, but 2+2 will be marked as incorrect.)



(a) V_{oDC} **:** ___ V

(b) V_{or} **:** ___ mV

Correct Answers:

- 6.8715
- 43.089

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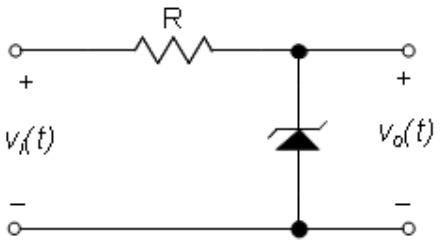
16. (5 points)

The zener diode in the shunt regulator circuit below is a 1N4739A with V_Z=9.1V @ I_{ZT}=28mA, r_Z=5Ω; also R=91Ω.

a. Calculate the line regulation.
b. Calculate the load regulation.
c. If the input voltage changes by 1.5 V, how much does the output voltage changes (in mV)?
d. If the output current changes by 10 mA, how much does the output voltage changes (in mV)?

Note: In this problem, you may only submit numerical answers accurate to 0.02% or better. (i.e. If 4 is the correct answer, 3.9999 will be marked as correct, but 2+2 will be marked as incorrect.)



(a) *Lineregulation* **:** ___

(b) *Loadregulation* **:** ___ Ω

(c) ΔV_o **:** ___ mV

(d) ΔV_o **:** ___ mV

Correct Answers:

- 0.0520833
- 4.73958
- 78.125
- 47.3958

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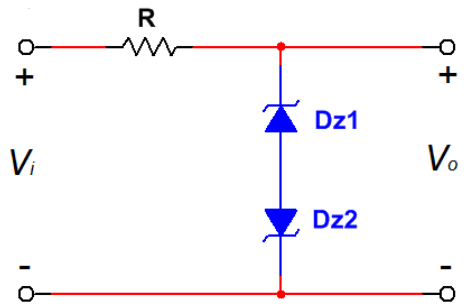
17. (5 points)

The zener diodes in the limiter circuit below are 1N4741A with V_Z=11V @ I_{ZT}=23mA, r_Z=8Ω; V_{D0}=0.65V when forward bias with a r_D=0.65Ω. If R=110Ω:

a. Calculate the V_o if V_i=3.5V.
b. Calculate the V_o if V_i=15V.
c. Calculate the V_o if V_i=-100V.

Note: In this problem, you may only submit numerical answers accurate to 0.02% or better. (i.e. If 4 is the correct answer, 3.9999 will be marked as correct, but 2+2 will be marked as incorrect.)



(a) V_o **:** ____ V

(b) V_o **:** ____ V

(c) V_o **:** ____ V

Correct Answers:

- 3.5
- 11.7236
- -17.9204