TEJ Parallel-Circuit Calculations

Student worksheet | GUESS, calculator discipline, and handwritten evidence

Technology Commons

2026-10-07

Student: _____ **Class:** _____ **Date:** _____

Solve all six questions by hand using GUESS. Show the general equation, rearrangement, substitution with units, full calculator value, and final rounded result. Keep unrounded values in the calculator until the last step. Submit clear front and back photographs of each solution.

> **!** References you may use
>
> Electronics Quick Reference · Electronics Reference Handbook · Casio fx-991ES PLUS manual

Parallel-circuit rules and earlier equations

Rule	Equation	What it means
Branch voltage	$V_T = V_1 = V_2 = \cdots$	Every branch is connected across the same two nodes.
Current at a node	$I_T = I_1 + I_2 + \cdots$	Current entering a node equals current leaving it.
Equivalent resistance	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots$	A parallel network has less resistance than its smallest branch.
Two-resistor shortcut	$R_T = \frac{R_1 R_2}{R_1 + R_2}$	Use only when exactly two resistors are being combined.
Ohm's law	$V = IR$	Rearrange before substituting.
Electrical power	$P = VI = I^2R = \frac{V^2}{R}$	Choose the form that uses the quantities you know.
Total power	$P_T = P_1 + P_2 + \cdots = V_T I_T$	Branch powers add.

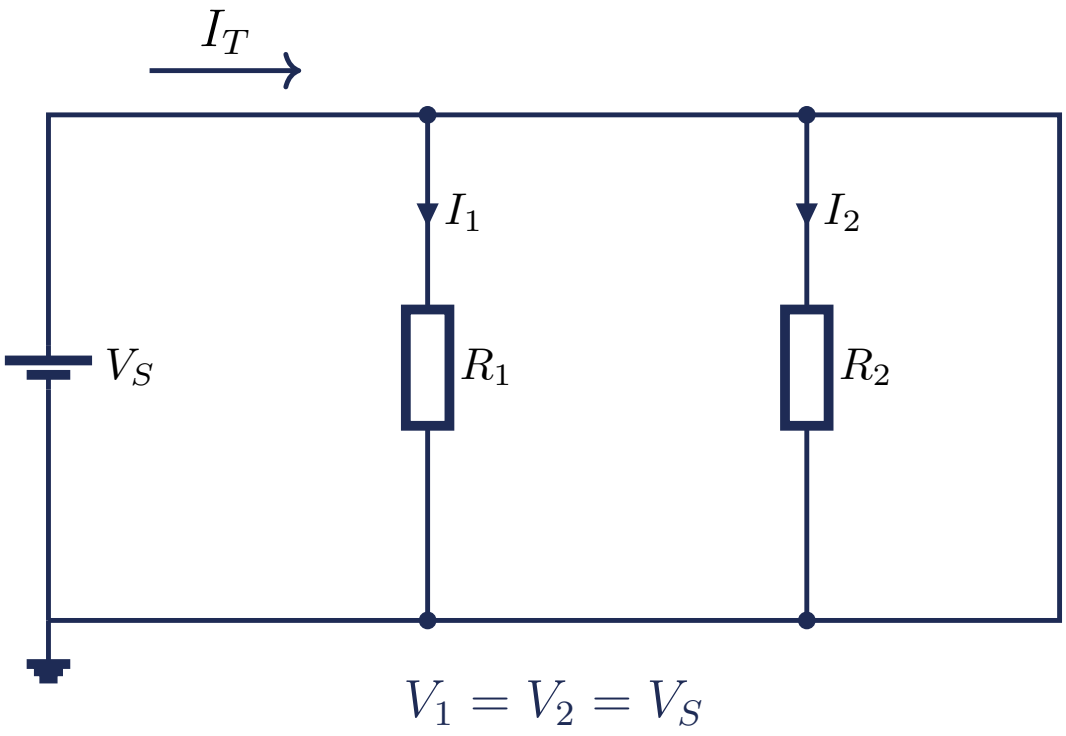


Figure 1: Three loads connected in parallel across one source.

> **Casio fx-991ES PLUS habit**
>
> Put the entire numerator and denominator in parentheses when needed. Use Ans for a dependent step so the calculator carries the full value. Write each calculator entry on its own line.

Question 1: Two parallel branches

A 15.0 V source is connected across $R_1 = 1.00\ \text{k}\Omega$ and $R_2 = 600\ \Omega$ in parallel. Find I_1, I_2, and I_T.

Use: $V_T = V_1 = V_2$; $I = V/R$; $I_T = I_1 + I_2$.

Source note: Adapted from Grob's *Basic Electronics*, 12th edition, Chapter 5, Example 5-1.

Front photo submission	Back photo submission
Insert a clear, upright photograph of the complete front.	Insert the back, even if it is blank.

Question 2: Current, resistance, and power

A 30.0 V source supplies three parallel resistors: $R_1 = 120\ \Omega$, $R_2 = 200\ \Omega$, and $R_3 = 300\ \Omega$. Find I_1, I_2, I_3, I_T, R_T, P_1, P_2, P_3, and P_T.

Use: $I = V/R$; $I_T = I_1 + I_2 + I_3$; $R_T = V_T/I_T$; $P = VI$; $P_T = P_1 + P_2 + P_3$.

Source note: Adapted from the Chapter 5 solved problems in the *Problems Manual for Use with Grob's Basic Electronics*.

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Question 3: Find an unknown branch resistance

An unknown resistor R_X is connected in parallel with a $12.0\ \text{k}\Omega$ resistor. Their equivalent resistance must be $8.00\ \text{k}\Omega$. Find R_X.

Use: $\frac{1}{R_T} = \frac{1}{R_X} + \frac{1}{R_1}$ or the two-resistor shortcut. Rearrange before substituting.

Source note: Adapted from the Chapter 5 word problems in the *Problems Manual for Use with Grob's Basic Electronics*.

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Question 4: Reduce, then solve

A 12.0 kΩ resistor and a 4.00 kΩ resistor are already connected in parallel. A third resistor R_X will be added in parallel so that the complete network has $R_T = 2.00$ kΩ. Find R_X.

Use: First combine 12.0 kΩ and 4.00 kΩ. Then treat that result and R_X as a new two-branch parallel network.

Source note: Adapted from the Chapter 5 word problems in the *Problems Manual for Use with Grob's Basic Electronics*.

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Question 5: Respect the component power ratings

A 1.00 kΩ, 0.500 W resistor is connected in parallel with a $100\ \Omega$, 1.00 W resistor. Find the largest safe source voltage for the network. At that voltage, find each branch current, total current, and total power. Identify which resistor sets the voltage limit.

Use: $V_{\text{max}} = \sqrt{P_{\text{max}} R}$ for each branch; choose the lower safe voltage. Then use $I = V/R$, $I_T = I_1 + I_2$, and $P_T = V I_T$.

Source note: Adapted from the Chapter 5 word problems in the *Problems Manual for Use with Grob's Basic Electronics*.

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Question 6: Total power and resistance ratios

Three resistors are connected in parallel across 120 V and use 288 W in total. Their values satisfy $R_2 = 3R_1$ and $R_2 = 2R_3$. Find I_T, R_T, R_1, R_2, R_3, every branch current, and every branch power. Verify both current and power totals.

Use: $I_T = P_T/V_T$; $R_T = V_T/I_T$; substitute the resistance ratios into the reciprocal-resistance equation; then use $I = V/R$ and $P = VI$.

Source note: Adapted from the Chapter 5 word problems in the *Problems Manual for Use with Grob's Basic Electronics*.

Front photo submission	Back photo submission
Insert a clear, upright photograph of the complete front.	Insert the back, even if it is blank.

Submission check

- ☐ All six questions use GUESS.
- ☐ Every circuit has a labelled hand-drawn schematic.
- ☐ General equations appear before rearrangement and substitution.
- ☐ Each calculator entry is on its own line.
- ☐ Full calculator values are shown before rounding.
- ☐ Final values use correct symbols, metric prefixes, units, and significant figures.
- ☐ Front and back photographs are upright and readable.

Question sources: Mitchel E. Schultz, *Grob's Basic Electronics*, 12th edition, Chapter 5, and the accompanying *Problems Manual*. Problems are paraphrased and organized into a new instructional progression.

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