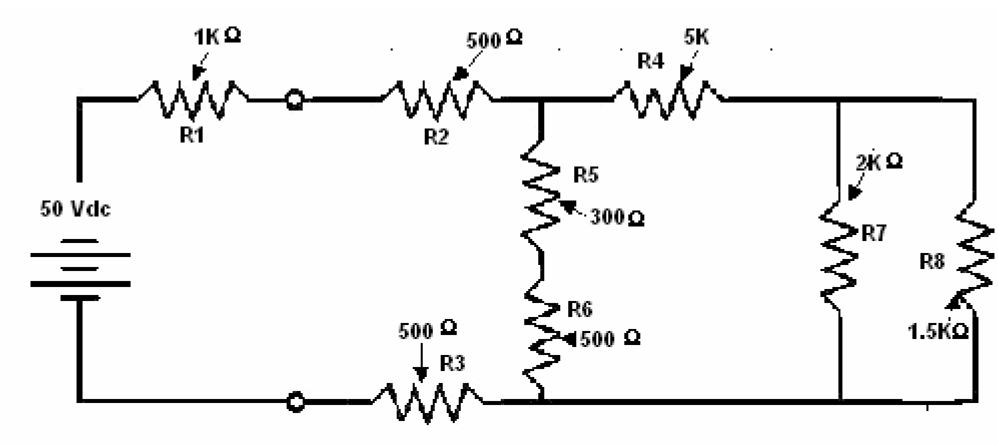
Solving Series-Parallel Circuits.



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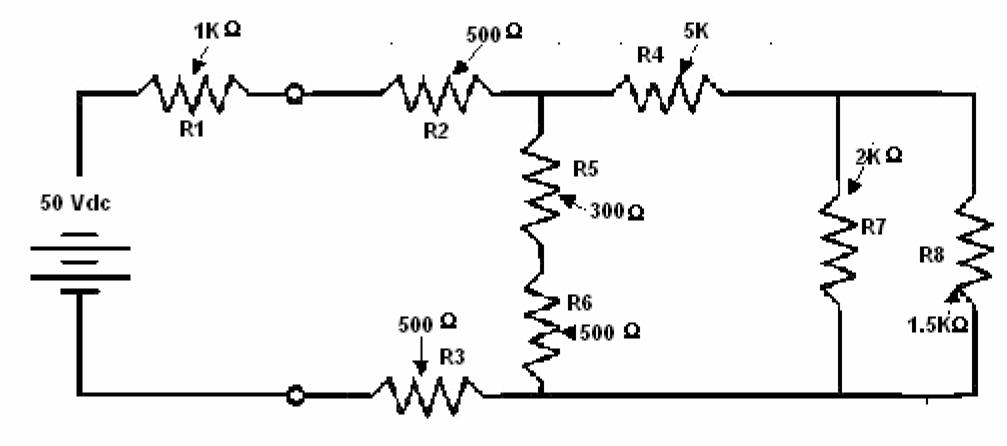
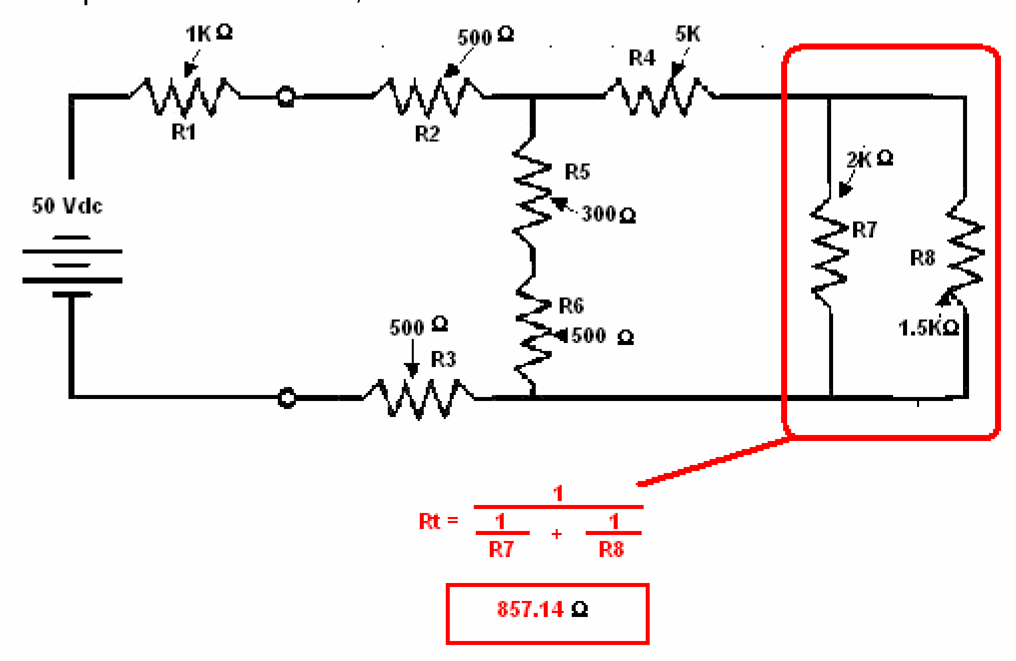
Here is how to solve the series-parallel circuit on the exam sample.

1. The circuit looks like this



2. First, solve for the "equivalent resistance of the parallel circuit on the right (R7 & R8). The parallel circuit of (R7 & R8) is in series with R4, but you cannot add them until you know the equivalent resistance of (R7 & R8). Use the reciprocal formula to find the equivalent resistance, which is 857.14Ω.



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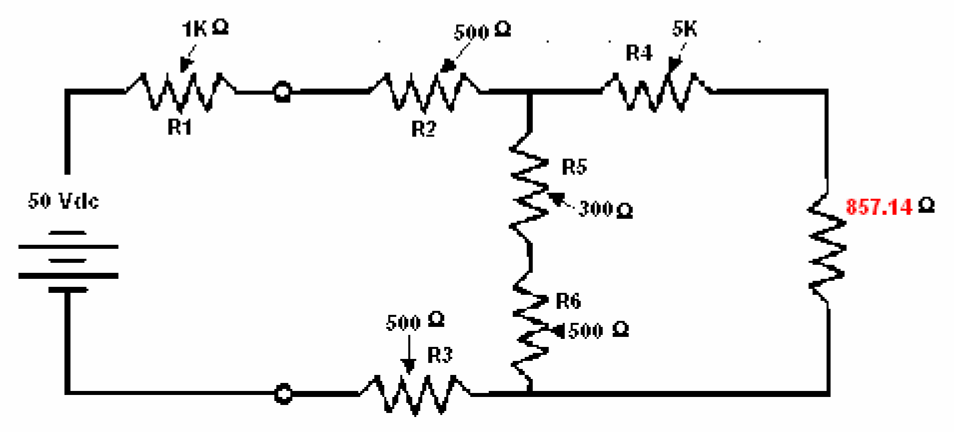
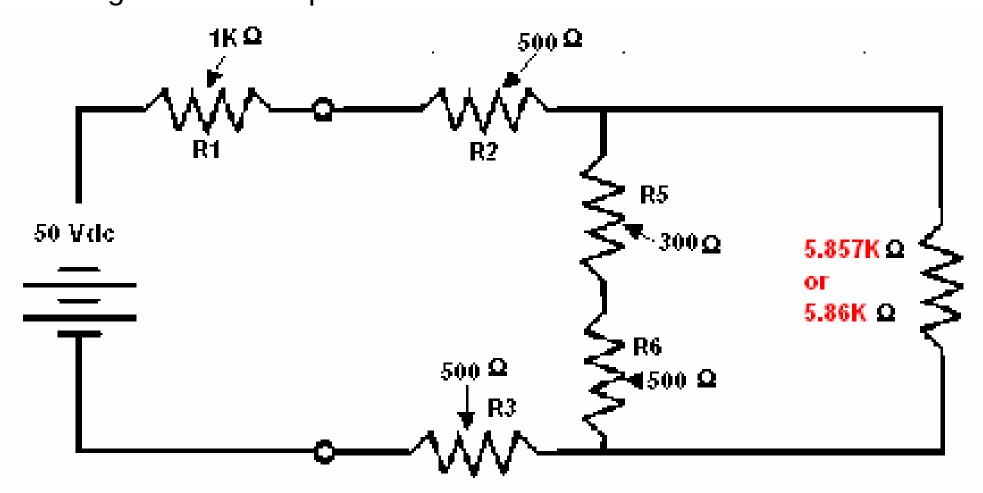
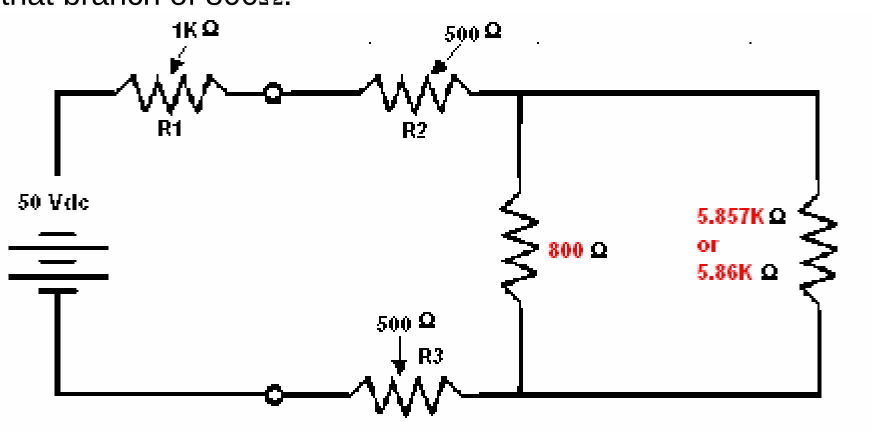
3. This reduces the circuit to this configuration.



4. Note that R4 (5KΩ) is now in series with an 857.14Ω resistor. You can now add them together for a equivalent resistor of 5.86KΩ.



5. The two series resistors (R5 & R6) can be added together for a total resistance of that branch of 800Ω.



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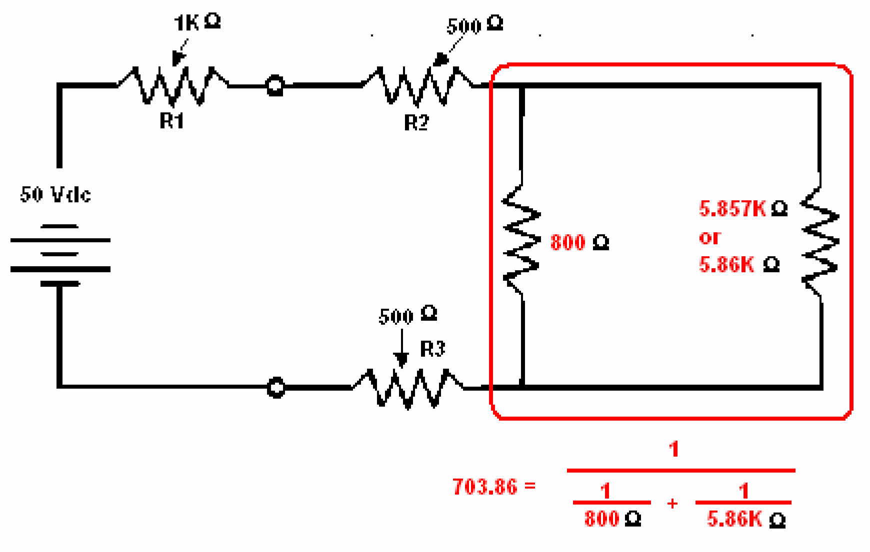
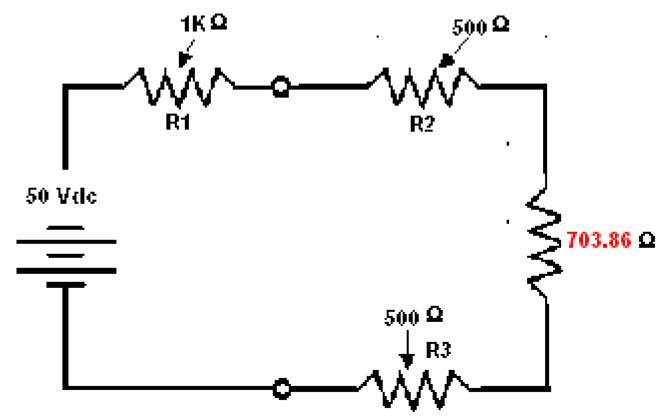
6. The 800Ω and 5.86KΩ resistance is in parallel and require the reciprocal formula to find the equivalent resistance of these two branches, which is 703.86Ω.



7. This reduces the original circuit to a simple series circuit where the Rt is equal to the sum of all the resistors (resistance) along the path.



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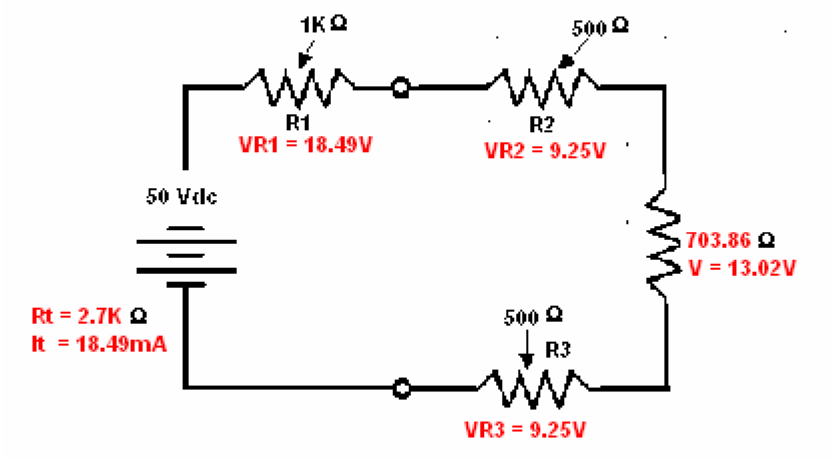
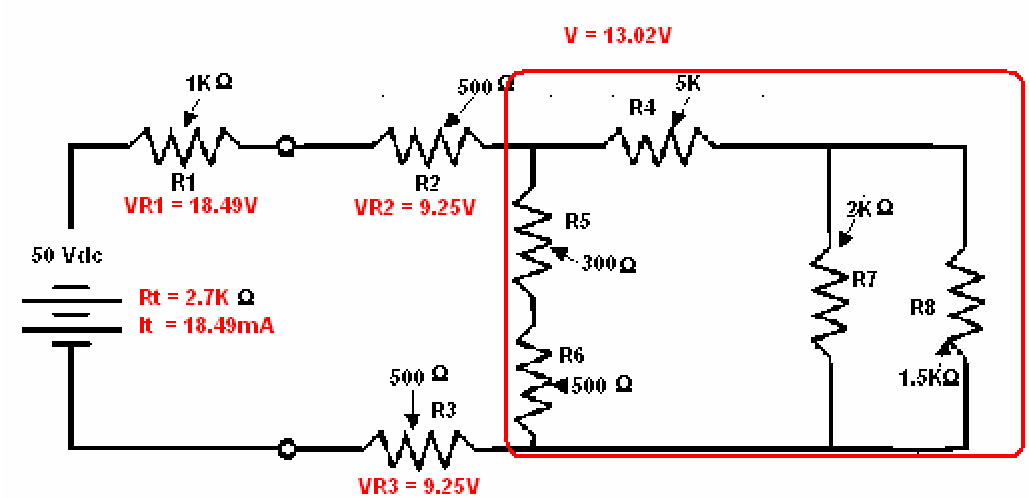
8. Resistance Total (Rt) is found to be 2.7KΩ and Current Total (It) is found to be 18.49mA. Since Current is the same throughout a series circuit, the voltage drops for each resistive component can now be found. Note that the 13.02V dropped by the 703.86Ω resistor is the voltage applied across the original parallel circuit.



9. At this point, apply these values back to the original circuit and begin solving for the remaining components. Note that the 18.49mA is common in R1, R2, and R3. At the point where the original parallel circuit begins (enclosed in red) the current divides.



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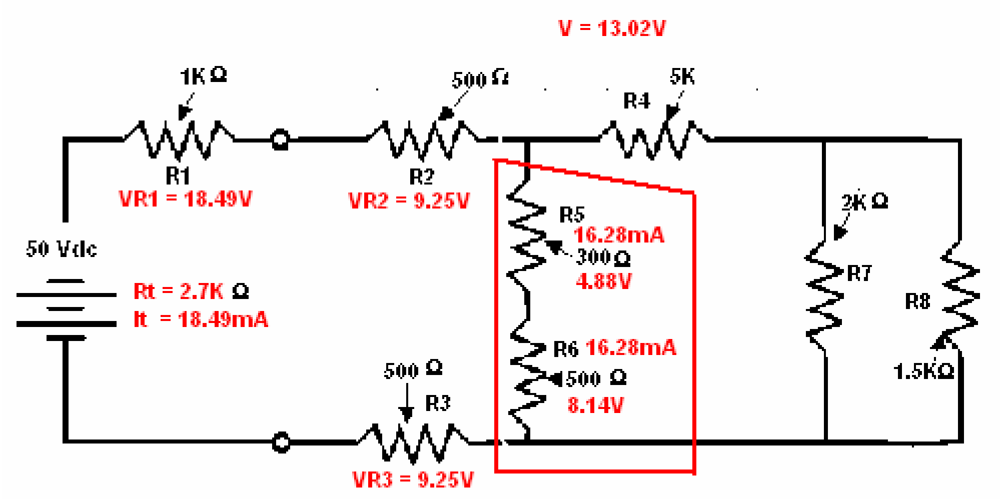
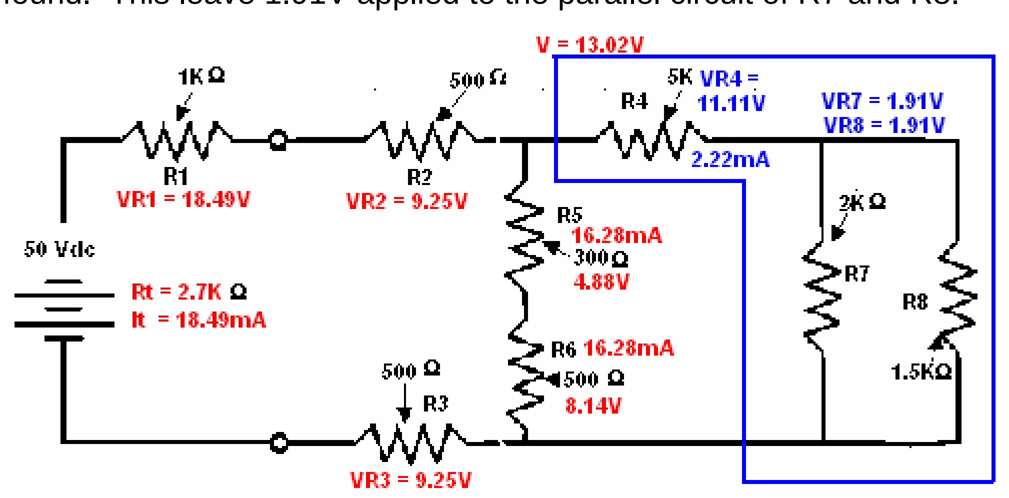
10. To find the current in the circuit branch consisting of R5 and R6, divide the 13.02Vdc by the resistance of that branch (800Ω). The current in this branch is found to be 16.28mA. This allows the voltages of R5 (4.88V) and R6 (8.14V) to be found.



11. To find the current in the circuit branch consisting of R4, R7 and R8 (enclosed in blue), divide the 13.02Vdc by the resistance of that branch (5.857KΩ). The current in this branch is found to be 2.22mA. This allows the voltages of R4 (11.11V) to be found. This leave 1.91V applied to the parallel circuit of R7 and R8.



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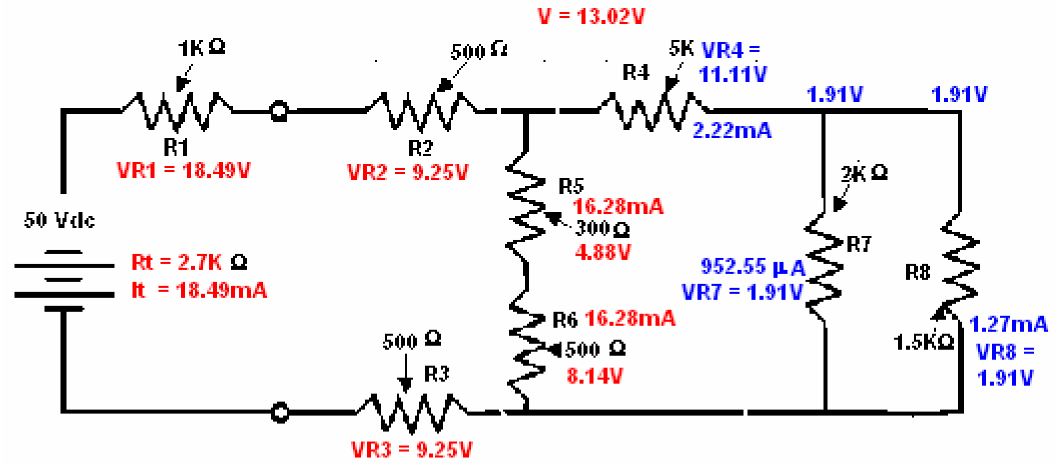
12. Since the voltage is common across the components of a parallel circuit, the 1.91Vdc is applied to both R7 and R8. To find the current for both branches, divide the voltage by the resistance of each branch. This shows that current in R7 is 952.55µA and current in R8 is 1.27mA.



13. To check the figures, use Kirchhoff's Voltage and Current Law.

14. Voltage applied should total up among the three series paths.
    Voltage applied = R1 + R2 + R5 + R6 + R3
    OR
    Voltage applied = R1 + R2 + R4 + R7 + R3
    OR
    Voltage applied = R1 + R2 + R4 + R8 + R3

15. Current from both parallel paths should equal total current
    Total Current of 18.49mA = 16.28mA (R5 & R6) + 2.22mA (R4)
    Current of R4 (2.22mA) = R7 (952.55µA) + R8 (1.27mA)