Accelerated Geom/Alg.2 **Name_____**
Solving with Word Problems with Rational Expressions

Let's Get to "Work":

Rational Equations can be used to model some interesting real life phenomena. Distance, rate, and time problems as well as multi-person work problems are particularly suited to be modeled with a rational equation.

"Work" Problems

Two are better than one when it comes to completing a job. We can use rational equations to help us figure just how much better two can do a job than one person acting alone.

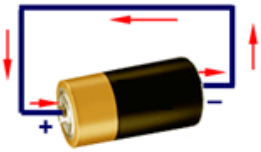
Jonah can paint a house by himself in 12 hours. Steve can do the same job in eight hours. How long will it take them to complete the job together? To help us answer this question we first need to think about how much of the job Jonah and Steve can do in one hour.

1. Let's let t = hours of work it takes to do job together. Create an equation to find out how much of the job they complete together in one hour.

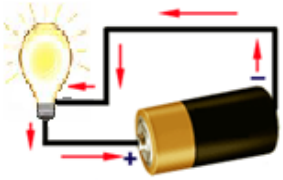
2. Let's try another problem. Paul can paint a room two times as fast as Jamie. Working together they can paint the room in three hours. How long would it take each of them to paint the room alone?

Resistance Learning Task

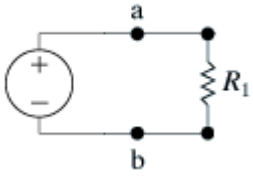
We use electricity every day to do everything from brushing our teeth to powering our cars. Electricity results from the presence and flow of electric charges. Electrons with a negative charge are attracted to those with a positive charge. Electrons cannot travel through the air. They need a path to move from one charge to the other. This path is called a circuit. A simple circuit can be seen in the connection of the negative and positive ends of a battery.



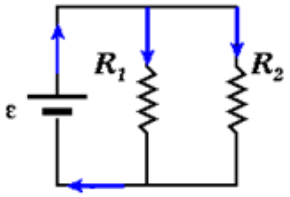
When a circuit is created, electrons begin moving from the one charge to the other. In the circuit below, a bulb is added to the circuit. The electrons pass through the filament in the bulb heating it and causing it to glow and give off light.

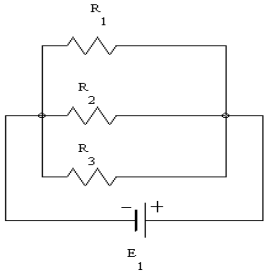


Electrons try to move as quickly as possible. If a circuit is not set up carefully, too many electrons can move across at one time causing the circuit to break. We can limit the number of electrons crossing over a circuit to protect it. Adding objects that use electricity, such as the bulb in the above circuit, is one way to limit the flow of electrons. This limiting of the flow of electrons is called resistance. It is often necessary to add objects called resistors to protect the circuit and the objects using the electricity passing through the circuit. In the circuit below, R_1 represents a resistor.

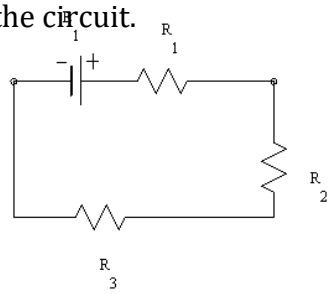


More than one resistor can be placed on a circuit. The placement of the resistors determines the total effect on the circuit. The resistors in the diagram below are placed in parallel (this refers to the fact that there are no resistors directly between two resistors, not to the geometric definition of parallel). Parallel resistors allow multiple paths for the electricity to flow. Two examples of parallel resistors are shown below.





The resistors in the next circuit below are not parallel. These resistors are placed in **series** because the electricity must travel through all three resistors as it travels through the circuit.



Resistance is measured in units called ohms and must always be a positive number. The omega symbol, Ω, is used to represent ohms.

For *n* **resistors in parallel**, R_1, R_2, R_3, etc. the total resistance, R_T, across a circuit can be found using the equation:

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots + \frac{1}{R_n}$$

For *n* **resistors is series**, R_1, R_2, R_3, etc. the total resistance, R_T, across a circuit can be found using the equation:

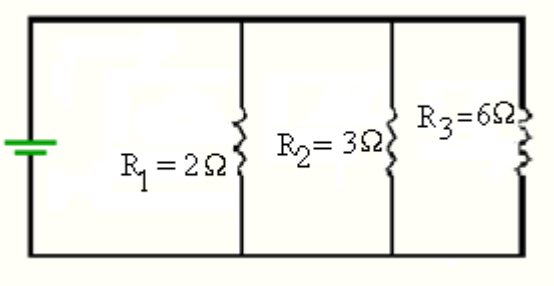
$$R_T = R_1 + R_2 + R_3 + \cdots + R_n$$

1. What is the total resistance for a circuit with three resistors in series if the resistances are 2 ohms, 5 ohms, and 4 ohms, respectively?

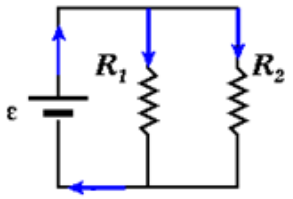
2. What is the total resistance for a circuit with two parallel resistors, one with a resistance of 3 ohms and the other with a resistance of 7 ohms?

3. What is the total resistance for a circuit with four resistors in parallel if the resistances are 1 ohm, 3 ohms, $\frac{5}{2}$ ohms, and $\frac{3}{5}$ ohms, respectively?

4. What is the total resistance for the circuit to the right?

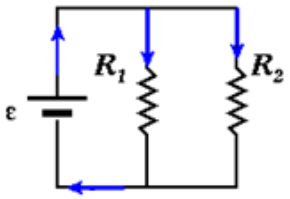


5. A circuit with a total resistance of $\frac{28}{11}$ has two parallel resistors. One of the resistors has a resistance of 4 ohms. Let *x* represent the resistance of the other resistor, and write an equation for the total resistance of the circuit. Solve the equation to find the resistance in the second resistor. Check your answer.

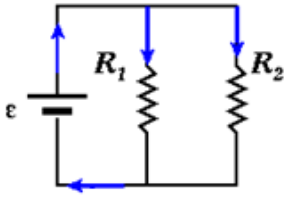


6. A circuit has been built using two parallel resistors.

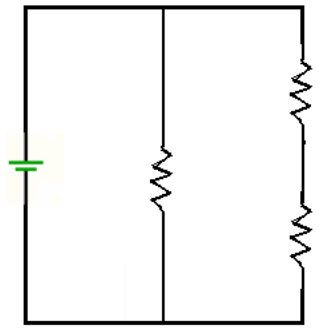
a. One resistor has twice the resistance of the other. If the total resistance of the circuit is $\frac{3}{4}$ ohms, what is the resistance of each of the two resistors?



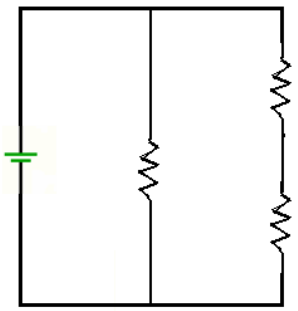
b. One resistor has a resistance of 4 ohms. If the total resistance is one-third of that of the other parallel resistor, what is the total resistance?



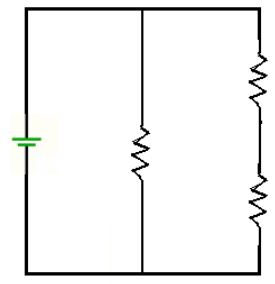
7. A circuit has been built using two paths for the flow of the current; one of the paths has a single resistor and the other has two resistors in series as shown in the diagram at the right.
Assume that, for the two resistors in series, the second has a resistance that is three times the resistance of the first one in the series. The single resistor has a resistance that is 6 ohms more than the resistance of the first resistor in series, and the total resistance of the circuit is 4 Ω. Write an equation to model this situation, and solve this equation. What is the solution set of the equation? What is the resistance of the each of the resistors?



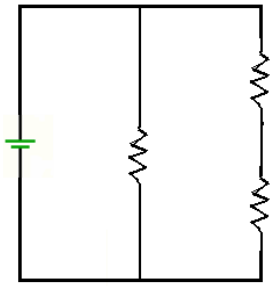
8. Assume that, for the two resistors in series, the second has a resistance that is 3 ohms more than twice the resistance of the first one in the series. The single resistor has a resistance that is 1 ohm more than the resistance of the first resistor in series, and the total resistance of the circuit is 3 Ω. Write an equation to model this situation, and solve this equation. What is the solution set of the equation? What is the resistance of the each of the resistors?



9. Assume that, for the two resistors in series, the second has a resistance that is 2 ohms more than the first one in the series. The single resistor has a resistance that is 3 ohms more than the resistance of the first resistor in series, and the total resistance of the circuit is 2 Ω. Write an equation to model this situation, and solve this equation. What is the solution set of the equation? What is the resistance of the each of the resistors?



10. Assume that, for the two resistors in series, the second has a resistance that is 4 ohms more than the first one in the series. The single resistor has a resistance that is 3 ohms less than the resistance of the first resistor in series, and the total resistance of the circuit is 4 Ω. Write an equation to model this situation, and solve this equation. What is the solution set of the equation? What is the resistance of the each of the resistors?



11. A circuit has three resistors in parallel. The second resistor has a resistance that is 4 ohms more than the first. The third resistor has a resistance of 8 ohms. The total resistance is one-half the resistance of the first resistor. Find each of the unknown resistances.

12. How many hours will it take Sam, Joe, and Peter to build a model airplane together if it takes Sam 3 hours to build one alone, Joe takes twice as long as Joe, and Peter two more hours than Joe?