**Literal Equations**

1. The formula $F=\frac{9}{5}C+32$ gives the temperature in degrees Fahrenheit if you know the temperature in degrees Celsius. What if you knew the temperature in degrees Fahrenheit instead? It would be useful to also have a formula for degrees Celsius in terms of degrees Fahrenheit. What is the formula for *C* in terms of *F*?

Use the formula to convert 86° Fahrenheit to Celsius.

1. Speaking of Fahrenheit, biologists use the formula $n=4F-156$ to find the number of cricket chirps per minute, *n*, based on the ambient temperature in degrees Fahrenheit, *F*. Solve this equation instead for *F*. What would the ambient temperature be if the crickets chirp at a rate of about 120 chirps per minute?
2. The Old Farmers’ Almanac suggests that we instead use the formula $F=n+40$ where *F* is degrees Fahrenheit and *n* is the number of cricket chirps in 14 seconds. Use the Fahrenheit temperature you got in question 2 to determine the number of chirps per minute using the Farmers’ Almanac formula.
3. A. E. Dolbear, a professor of physics at Tufts, published his first equation relating temperature and cricket chirps in 1897. At that time people wanted a formula that would predict cricket chirps based on the temperature. Then people became interested in predicting the temperature based on the number of cricket chirps—they wanted to use the crickets as a thermometer!!!!! Different species chirp at different rates. Below are formulas for temperature based on cricket chirps per minute for three cricket species. Solve each formula for *n*. (There are several internet sites that offer a cricket chirp converter. Can you find some? Are there even more formulas?)

Field Cricket: $T=50+(n-40)/4$

Snowy Tree Cricket: $T=50+(n-92)/4.7$

Common Tree Katydid: $T=60+(n-19)/3$

1. An interesting geometric formula is $S=\left(n-2\right)∙180$. This formula gives you the total angle measure, *S*, of a regular polygon with *n* sides. Suppose you googled cool math terms and found that the sum of the angles of a hendecagon is 1620. Unfortunately, your computer crashed before you were able to see how many sides a hendecagon has. How could you use the formula to find the answer? Briefly explain your thinking. (Hendecagons have two other names—Can you find them?)
2. The equation $E=IR\_{1}+IR\_{2}$ describes an electrical circuit with two resistors *R*­1 and *R*­2 in series. *E* is the symbol usually reserved for voltage, *I* is for current, and *R* is for resistance. How could you solve this formula for *I*? Briefly explain how you arrived at your answer. Would it have been easier or harder to solve for *R*­1? Try it.

Why would you want to solve the formula for *I*? What variables would you have to know the value of in order to determine *I*?

As an extended challenge, if you had a third resistor in the series the formula would be $E=IR\_{1}+IR\_{2}+IR\_{3}$*.* Solve this formula for *I*.

1. The surface area of an object is the total area of its surfaces. For example, a cylinder has a top, bottom, and sides. The top and bottom are circles and the side is a rectangle when opened up. You may remember that the formula to find the surface area, *S*, of a cylinder is
$S=2πr^{2}+2πrh$. What if you know the surface area and radius, but not the height? Solve the equation for *h*.
2. The equation $A=P+Prt$ relates the amount of money in an account, *A*, with the principal amount invested *P*, simple interest rate *r*, and length of the investment, *t*. Solve this literal equation for *r* and then solve it for *t*.

Solving for *P* is more of a challenge. Try it if you dare.

1. Velocity associated with a constant acceleration is related to time by the equation

 $v=v\_{0}+at$, where *v*0 is the initial velocity, *a* is acceleration, and *t* is time. For example, if *v*0 is 50 meters per second and *a* = – 9.8 meters per second squared, then $v=50-9.8t$. This represents the velocity of an object thrown upward with initial velocity of 50 meters per second and being acted upon by gravity. Solve the formula for *t*. This gives the time at which a certain velocity will occur.

We ordinarily think of acceleration as a constant related to the mass of the earth. Now solve the equation for *a*. This would allow us to calculate the acceleration caused by an object such as an unknown planet if we knew initial velocity and the time related to a specific velocity.