Equations with one variable I

$$T_F = 9/5\ T_C + 32$$

Calculations involving a single variable come up in many different ways in astronomy, like the popular one to the left for converting centigrade degrees (Tc) into Fahrenheit degrees (Tf). Here are some more examples.

Problem 1 – To make the data easier to analyze, an image is shifted by X pixels to the right from a stating location of 326. Find the value of X if the new location is 1436 by solving $326 + X = 1436$.

Problem 2 – The temperature, T, of a sunspot is 2,000 C degrees cooler than the Sun's surface. If the surface temperature is 6,100 C, solve the equation for the sunspot temperature if $T + 2{,}000 = 6{,}100$.

Problem 3 – The radius, R (in kilometers) of a black hole is given by the formula $R = 2.9\ M$, where M is the mass of the black hole in multiples of the Sun's mass. If an astronomer detects a black hole with a radius of 18.5 kilometers, solve the equation $18.5 = 2.9M$ for M to find the black hole's mass.

Problem 4 – The sunspot cycle lasts 11 years. If the peak of the cycle occurred in 1858, and 2001 solve the equation $2001 = 1858 + 11X$ to find the number of cycles, X, that have elapsed between the two years.

Answer Key

1 – To make the data easier to analyze, an image is shifted by X pixels to the right from a stating location of 326. Find the value of X if the new location is 1436 by solving 326 + X = 1436.
Answer: X = 1438 – 326 so X = 1112.

2 – The temperature, T, of a sunspot is 2,000 C degrees cooler than the Sun's surface. If the surface temperature is 6,100 C, solve the equation for the sunspot temperature if T + 2,000 = 6,100.
Answer: T = 6,100 – 2,000 so T = 4,100 C.

3 – The radius, R (in kilometers) of a black hole is given by the formula R = 2.9 M, where M is the mass of the black hole in multiples of the Sun's mass. If an astronomer detects a black hole with a radius of 18.5 kilometers, solve the equation 18.5 = 2.9M for M to find the black hole's mass.
Answer: 18.5 = 2.9M so M = 8.5/2.9 so M = 6.4 times the mass of the sun.

4 – The sunspot cycle lasts 11 years. If the peak of the cycle occurred in 1858, and 2001 solve the equation 2001 = 1858 + 11X to find the number of cycles, X, that have elapsed between the two years.
Answer: 2001-1858 = 11X; 143 = 11X; X = 143/11 so X = 13