Festive Algebra Fun! **by John at trailalexander.com**

Reveal a Hidden Christmas Message

This is a little festive algebra fun. Feel free to use this in a Christmas card and impress friends and family!

1 Before We Start- A Logarithmic Rule

If we have an equation such that y = e^x, then we can take the inverse of the exponential function (e). This is called the natural log (written as ln, or log_e), and it will cancel e and bring down x.

Applying the natural log to both sides of the above equation we obtain:

$$ln(y) = ln(e^x)$$
$$ln(y) = x$$

We see that the natural log has cancelled the exponential on the RHS and isolated x. This also works in reverse. If we have an equation such that y = ln(x), we can use the exponential function to solve for x. This rule will come in handy!

2 The Christmas Equation

Here it is:

$$y = \frac{\ln\left(\frac{x}{m} - sa\right)}{r^2}$$

To begin, we'll eliminate the denominator on the RHS by multiplying both sides by r^2:

$$yr^2 = ln(\frac{x}{m} - sa)$$

We can now cancel the natural log (ln) on the RHS by using the rule I mentioned earlier. Take the exponential function (e) and raise it to both sides of the equation:

$$e^{yr^2} = e^{ln(\frac{x}{m} - sa)}$$
$$e^{yr^2} = \frac{x}{m} - sa$$

Now, we will eliminate the denominator on the RHS by multiplying both sides by m:

$$me^{yr^2} = (\frac{x}{m} - sa)m$$
$$me^{yr^2} = x - sam$$

You may be able to see what the message will be! The final stage is to use the commutative property of multiplication. This means that we can rearrange the order and still get the same answer. We will also expand r^2. So, we obtain:

$$me^{rry} = x - mas$$