

Math Circle Problems for week 8

1. The roots of the equation:

$$x^2 - 30x + b = 0$$

are positive and one of them is the square of the other. If the roots are r and s with $r > s$ find $r - s + b$.

2. Show that

$$\binom{n}{k} - \binom{n}{k-1} + \binom{n}{k-2} - \dots + (-1)^k \binom{n}{0} = \binom{n-1}{k}$$

3. Show that

$$\binom{n}{0}^2 + \binom{n}{1}^2 + \binom{n}{2}^2 + \dots + \binom{n}{n}^2 = \binom{2n}{n}$$