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Observations on Binary Cubic Equation

 $x^2 - 3xy = 4(y^2 + y^3)$

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Abstract: The non-homogeneous polynomial equation of degree three with two unknowns given by $x^2 - 3x y = 4(y^2 + y^3)$ is studied to determine its distinct integer solutions. Some connections between the solutions are presented. Second order Ramanujan numbers are obtained through integer solutions of the given binary cubic equation.

Keywords: Binary cubic equation ,Non-homogeneous cubic equation, Integer solutions, Second order Ramanujan numbers

Notations

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$$t_{m,n} = n[1 + \frac{(n-1)(m-2)}{2}]$$

$$P_n^5 = \frac{n^2(n+1)}{2}$$

$$S_n = 6n(n-1) + 1$$

$$Th_n = 3*2^n - 1$$

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