Trying to Recreate the Cubic Formula

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Abstract: ***In this paper, we are going to see a variation in calculating a new cubic formula. As you may have read the title, suggests that I am going to try to recreate the cubic formula. This paper, along with the formula, also tries to avoid the occurrence of imaginary unit i. I am going to carry out the work with the help of quadratic equations and quadratic formulas.***

Keywords: Equation: A mathematical expression/statement with an *equal* sign. Cubic Equation: An equation with the highest degree of 3.

Quadratic Equation: An equation with the highest power of 2.
Quadratic formula: A formula that is used to find the variable x in any quadratic polynomial.
Cubic formula: A formula that is used to find the variable x in any cubic function/polynomial/equation.

1. Introduction

In this paper, we are going to see a variation in calculating a new cubic formula [1]. As you may have read the title, suggests that I am going to try to recreate the cubic formula by transposing and using quadratic formulas in the cubic equation [2]. This paper, along with the formula, also tries to avoid the occurrence of imaginary unit i. I am going to carry out this work with the help of quadratic equations [3] and quadratic formulas [4].

2. Work

Variation One; General Form 1

$ax^3 + bx^2 + cx + d = 0$
$(ax^3 + bx^2 + cx) + d = 0$
$x\,(ax^2 + bx + c) + d = 0$

Here I am going to put the quadratic formula in the bracket equation.

$$x\,(a[\frac{-b\pm\sqrt{b^2-4ac}}{2b}]^2 + b[\frac{-b\pm\sqrt{b^2-4ac}}{2b}] + c) = -d$$

$$x\,(a[\frac{(-b)^2+b^2-4ac\pm-2b\sqrt{b^2-4ac}}{2b}]^2 + b[\frac{-b\pm\sqrt{b^2-4ac}}{2b}] + c) = -d$$

$$x\,(a[\frac{(2b^2-4ac\pm-2b\sqrt{b^2-4ac}}{4b^2}] + b[\frac{-b\pm\sqrt{b^2-4ac}}{2b}] + c) = -d$$

$$x = \frac{-d}{(a[\frac{2b^2-4ac\pm-2b\sqrt{b^2-4ac}}{4b^2}] + b[\frac{-b\pm\sqrt{b^2-4ac}}{2b}] + c)}$$

$$If\ \frac{2b^2-4ac\pm-2b\sqrt{b^2-4ac}}{4b^2} = \frac{p}{q},$$

$$\frac{-b\pm\sqrt{b^2-4ac}}{2b} = \frac{m}{n}$$

$$x = \frac{-d}{\frac{ap}{q}+\frac{bm}{n}+c}$$

$$x = \frac{-d}{\frac{apn+bqm}{qn}+c}$$

$$x = \frac{-d}{\frac{apn+bqm}{qn}+c}$$

$$x = \frac{-d}{\frac{apn+bqm+qnc}{qn}}$$

$$x = -d \cdot \frac{qn}{apn+bqm+qnc}$$

$$x = \frac{-dqn}{apn+bqm+qnc}$$

Putting *p, q, m and n*

Variation Two; Form 2; Leading Coefficient 1

$$x = \frac{-d(4b^2)(2b)}{a(2b^2-4ac\pm-2b\sqrt{b^2-4ac}[2b])+b(4b^2[-b\pm\sqrt{b^2-4ac}])+c(4b^2[2b])}$$

$$x = \frac{-8db^3}{a(2b^2-4ac\pm-2b\sqrt{b^2-4ac}[2b])+b(4b^2[-b\pm\sqrt{b^2-4ac}])+8cb^3}$$

$$x = \frac{-8db^3}{\{a(2b^2-4ac\pm-2b\sqrt{b^2-4ac}[2b])+b(4b^2[-b\pm\sqrt{b^2-4ac}])\}+8cb^3}$$

$$x = \frac{-d}{\{a(2b^2-4ac\pm-2b\sqrt{b^2-4ac}[2b])+b(4b^2[-b\pm\sqrt{b^2-4ac}])\}+c}$$

$$x = \frac{-d}{\{a(2b^2-4ac\pm-2b\sqrt{b^2-4ac}[2b])+b(4b^2[-b\pm\sqrt{b^2-4ac}])\}+c}$$

$$x^3 + \frac{b}{a}x^2 + \frac{c}{a}x + \frac{d}{a} = 0$$

$$x(x^2 + \frac{b}{a}x + \frac{c}{a}) + \frac{d}{a} = 0$$

$$x(x^2 + \frac{b}{a}x + \frac{c}{a}) = -\frac{d}{a}$$

$$x = -\frac{d}{a} \times \frac{1}{x^2+\frac{b}{a}x+\frac{c}{a}}$$

$$x = -\frac{d}{a(x^2+\frac{b}{a}x+\frac{c}{a})}$$

$$x = -\frac{d}{a([\frac{-b\pm\sqrt{b^2-4ac}}{2a}]^2 + \frac{b}{a}[\frac{-b\pm\sqrt{b^2-4ac}}{2a}]+\frac{c}{a})}$$

$$x = -\frac{d}{a([\frac{(-b\pm\sqrt{b^2-4ac})^2}{(2a)^2}] + \frac{b}{a}[\frac{-b\pm\sqrt{b^2-4ac}}{2a}]+\frac{c}{a})}$$

$$x = -\frac{d}{a([\frac{(-b)^2+b^2-4ac\pm-2b\sqrt{b^2-4ac}}{4a^2}] + \frac{b}{a}[\frac{-b\pm\sqrt{b^2-4ac}}{2a}]+\frac{c}{a})}$$

$$x = -\frac{d}{a([\frac{2b^2-4ac\pm-2b\sqrt{b^2-4ac}}{4a^2}] + [\frac{b(-b\pm\sqrt{b^2-4ac})}{2a^2}]+\frac{c}{a})}$$

Let $\frac{2b^2-4ac\pm-2b\sqrt{b^2-4ac}}{4a^2}$ **be** $\frac{p}{q}$ **, and**

$\frac{b(-b\pm\sqrt{b^2-4ac})}{2a^2}$ **be** $\frac{m}{n}$**.**

$$x = -\frac{d}{a([\frac{p}{q}] + [\frac{m}{n}]+\frac{c}{a})}$$

$$x = -\frac{d}{a[\frac{p}{q}] + a[\frac{m}{n}]+a[\frac{c}{a}]}$$

$$x = -\frac{d}{\frac{ap}{q} + \frac{am}{n}+c}$$

$$x = -\frac{d}{(\frac{ap}{q} + \frac{am}{n})+c}$$

$$x = -\frac{d}{\frac{apn+amq}{qn}+c}$$

$$x = -\frac{d}{\frac{apn+amq\ +qnc}{qn}}$$

$$x = \frac{-dqn}{apn+amq+qnc}$$

$$x = \frac{-d}{apn+amq+c}$$

Putting p, q, m and n

$$x = \frac{-d}{a(2b^2-4ac\pm-2b\sqrt{b^2-4ac}[2a^2])+a(b(-b\pm\sqrt{b^2-4ac})[4a^2])+c}$$

$$x = \frac{-d}{a[(2b^2-4ac\pm-2b\sqrt{b^2-4ac}[2a^2])+(b(-b\pm\sqrt{b^2-4ac})[4a^2])]+c}$$

3. Conclusion

In summary, I have tried to recreate the cubic formula using quadratic formulas and certain algebraic properties. I have performed the calculations on two different forms of cubic equations. The first form was the most common and popular form, the general form; and the

In the second form, I used the Lead Coefficient One.

Here I didn't use constant = 0 or otherwise the whole calculation will be 0.

For example, let my calculation in the denominator be h. So it would Be

$$x = \frac{0}{h} = 0$$

That is completely true.

References

[1] Cubic Formula by Gerolamo Cardano, near about 1545]

[2] Cubic equations: Babylonians(20th - 16th Century BC), Greeks, Chinese, Indians, and Egyptians..]

[3] Babylonian mathematicians, 2000 BC] [4: René Descartes in La Géométrie in 1637]

Author Profile

Rishikesh Biswas, a superordinary 8th grader in India, has contributed little to the field of mathematics by doing nothing much by just publishing four research papers (excluding this one) and a book. Besides that, the author plays tabla (Indian Classical Musical Instrument) and has a national scholarship in it from the Ministry of Culture. The author has played chess in nationals as well.