Tips, Formulae and shortcuts for Quadratic Equations

By

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Cracku Tip 1 – Quadratic Equations

- Quadratic Equations is one of the important topics for CAT
- The theory involved in this topic is very simple and students should be comfortable with the some basic formulas and concepts.
- The techniques like option elimination, value assumption can help to solve questions from this topic quickly.
- This pdf covers all the important formulas and concepts related to Quadratic Equations.

Cracku Tip 2 – Quadratic Equations

General Quadratic equation will be in the form of $ax^2+bx+c = 0$

The values of 'x' satisfying the equation are called roots of the equation.

- The value of roots, p and q = $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
- Sum of the roots = p+q = $\frac{-b}{a}$
- Product of the roots = p*q = $\frac{c}{a}$
- If c and a are equal then the roots are reciprocal to each other
- If b = 0, then the roots are equal and are opposite in sign.

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Cracku Tip 3 – Quadratic Equations

Let D denote the discriminant, $D = b^2-4ac$. Depending on the sign and value of D, nature of the roots would be as follows:

- D < 0 and |D| is not a perfect square:

Roots will be in the form of p+iq and p-iq where p and q are the real and imaginary parts of the complex roots. p is rational and q is irrational.

- D < 0 and |D| is a perfect square:

Roots will be in the form of p+iq and p-iq where p and q are both rational.

- D = 0

Roots are real and equal. X = -b/2a

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Cracku Tip 4 – Quadratic Equations

- D > 0 and D is not a perfect square:
Roots are conjugate surds

- D > 0 and D is a perfect square:
Roots are real, rational and unequal

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Cracku Tip 5 – Quadratic Equations

Signs of the roots: Let P be product of roots and S be their sum

- P > 0, S > 0 : Both roots are positive
- P > 0, S < 0 : Both roots are negative
- P < 0, S > 0 : Numerical smaller root is negative and the other root is positive
- P < 0, S < 0 : Numerical larger root is negative and the other root is positive

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Cracku Tip 6 – Quadratic Equations

- Minimum and maximum values of $ax^2+bx+c = 0$
- If a > 0: minimum value = $\frac{4ac-b^2}{4a}$ and occurs at x = -b/2a
- If a < 0: maximum value = $\frac{4ac-b^2}{4a}$ and occurs at x = -b/2a

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Cracku Tip 7 – Quadratic Equations

If $A_nX^n + A_{n-1}X^{n-1} + ... + A_1X + A_0 = 0$, then

- Sum of the roots = $-A_{n-1}/A_n$
- Sum of roots taken two at a time = A_{n-2}/A_n
- Sum of roots taken three at a time = $-A_{n-3}/A_n$ and so on
- Product of the roots = $[(-1)^n A_0]/A_n$

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Cracku Tip 8 – Quadratic Equations

Finding a quadratic equation:

- If roots are given: $(x-a)(x-b)=0 \Rightarrow x^2-(a+b)x+ab = 0$
- If sum s and product p of roots are given: $x^2-sx+p = 0$
- If roots are reciprocals of roots of equation $ax^2+bx+c = 0$, then equation is $cx^2+bx+a = 0$
- If roots are k more than roots of $ax^2+bx+c = 0$ then equation is $a(x-k)^2+b(x-k)+c = 0$
- If roots are k times roots of $ax^2+bx+c = 0$ then equation is $a(x/k)^2+b(x/k)+c = 0$

Cracku Tip 9 – Quadratic Equations

- Descartes Rules: A polynomial equation with n sign changes can have a maximum of n positive roots. To find the maximum possible number of negative roots, find the number of positive roots of f(-x).
- An equation where highest power is odd must have at least one real root

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