

삼차방정식의 근과 계수의 관계
(Vieta's Formula in Cubic Equations)

Vieta's Formula in Cubic Equations

▶ Start

▶ End

Vieta's Formula in Cubic Equations

▶ Start

▶ End

Let

Vieta's Formula in Cubic Equations

▶ Start

▶ End

Let α

Vieta's Formula in Cubic Equations

▶ Start

▶ End

Let α, β

Vieta's Formula in Cubic Equations

▶ Start

▶ End

Let α, β, γ

Vieta's Formula in Cubic Equations

▶ Start

▶ End

Let α, β, γ be the roots

Vieta's Formula in Cubic Equations

▶ Start

▶ End

Let α, β, γ be the roots of the equation.

Vieta's Formula in Cubic Equations

▶ Start

▶ End

Let α, β, γ be the roots of the equation.

$$ax^3 + bx^2 + cx + d = 0$$

Vieta's Formula in Cubic Equations

▶ Start

▶ End

Let α, β, γ be the roots of the equation.

$$ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0)$$

Vieta's Formula in Cubic Equations

▶ Start

▶ End

Let α, β, γ be the roots of the equation.

$$ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0)$$

α

Vieta's Formula in Cubic Equations

▶ Start

▶ End

Let α, β, γ be the roots of the equation.

$$ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0)$$

$$\alpha +$$

Vieta's Formula in Cubic Equations

▶ Start

▶ End

Let α, β, γ be the roots of the equation.

$$ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0)$$

$$\alpha + \beta$$

Vieta's Formula in Cubic Equations

▶ Start

▶ End

Let α, β, γ be the roots of the equation.

$$ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0)$$

$$\alpha + \beta +$$

Vieta's Formula in Cubic Equations

▶ Start

▶ End

Let α, β, γ be the roots of the equation.

$$ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0)$$

$$\alpha + \beta + \gamma =$$

Vieta's Formula in Cubic Equations

▶ Start

▶ End

Let α, β, γ be the roots of the equation.

$$ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0)$$

$$\alpha + \beta + \gamma = -\frac{b}{a}$$

Vieta's Formula in Cubic Equations

▶ Start

▶ End

Let α, β, γ be the roots of the equation.

$$ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0)$$

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$$\alpha\beta$$

Vieta's Formula in Cubic Equations

▶ Start

▶ End

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Vieta's Formula in Cubic Equations

▶ Start

▶ End

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$$\alpha\beta + \beta\gamma$$

Vieta's Formula in Cubic Equations

▶ Start

▶ End

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$$\alpha + \beta + \gamma = -\frac{b}{a}$$

$$\alpha\beta + \beta\gamma +$$

▶ Start

▶ End

Let α, β, γ be the roots of the equation.

$$ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0)$$

$$\alpha + \beta + \gamma = -\frac{b}{a}$$

$$\alpha\beta + \beta\gamma + \gamma\alpha =$$

Vieta's Formula in Cubic Equations

▶ Start

▶ End

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$$ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0)$$

$$\alpha + \beta + \gamma = -\frac{b}{a}$$

$$\alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a}$$

Vieta's Formula in Cubic Equations

▶ Start

▶ End

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$$ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0)$$

$$\alpha + \beta + \gamma = -\frac{b}{a}$$

$$\alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a}$$

α

▶ Start

▶ End

Let α, β, γ be the roots of the equation.

$$ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0)$$

$$\alpha + \beta + \gamma = -\frac{b}{a}$$

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$$\alpha\beta$$

Vieta's Formula in Cubic Equations

▶ Start

▶ End

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$$\alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a}$$

$$\alpha\beta\gamma$$

▶ Start

▶ End

Let α, β, γ be the roots of the equation.

$$ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0)$$

$$\alpha + \beta + \gamma = -\frac{b}{a}$$

$$\alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a}$$

$$\alpha\beta\gamma = -$$

Vieta's Formula in Cubic Equations

▶ Start

▶ End

Let α, β, γ be the roots of the equation.

$$ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0)$$

$$\alpha + \beta + \gamma = -\frac{b}{a}$$

$$\alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a}$$

▶ Proof

$$\alpha\beta\gamma = -\frac{d}{a}$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

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Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\left\{ \begin{array}{l} (x - \alpha)(x - \beta)(x - \gamma) = 0 \end{array} \right.$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \end{cases}$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$

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Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$

$$\left\{ \begin{array}{l} x^3 \\ \end{array} \right.$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$

$$\begin{cases} x^3 - \end{cases}$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$

$$\begin{cases} x^3 - (\alpha + \beta + \gamma) \end{cases}$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$

$$\begin{cases} x^3 - (\alpha + \beta + \gamma) x^2 \end{cases}$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$
$$\left\{ \begin{array}{l} x^3 - (\alpha + \beta + \gamma)x^2 + \end{array} \right.$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$
$$\left\{ \begin{array}{l} x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha) \end{array} \right.$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$
$$\left\{ \begin{array}{l} x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x \end{array} \right.$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$
$$\left\{ \begin{array}{l} x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \end{array} \right.$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\left\{ \begin{array}{rcl} (x - \alpha)(x - \beta)(x - \gamma) & = & 0 \\ ax^3 + bx^2 + cx + d & = & 0 \quad (a \neq 0) \\ \\ x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \alpha\beta\gamma \end{array} \right.$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\left\{ \begin{array}{rcl} (x - \alpha)(x - \beta)(x - \gamma) & = & 0 \\ ax^3 + bx^2 + cx + d & = & 0 \quad (a \neq 0) \\ \\ x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \alpha\beta\gamma & = & \end{array} \right.$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$
$$\left\{ \begin{array}{l} x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \alpha\beta\gamma = 0 \end{array} \right.$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$
$$\begin{cases} x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \alpha\beta\gamma = 0 \\ x^3 \end{cases}$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$
$$\begin{cases} x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \alpha\beta\gamma = 0 \\ x^3 + \end{cases}$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$

$$\begin{cases} x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \alpha\beta\gamma = 0 \\ x^3 + \frac{b}{a} \end{cases}$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$

$$\begin{cases} x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \alpha\beta\gamma = 0 \\ x^3 + \frac{b}{a}x^2 \end{cases}$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$

$$\begin{cases} x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \alpha\beta\gamma = 0 \\ x^3 + \frac{b}{a}x^2 + x + \end{cases}$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$

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Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

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Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

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Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

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Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$

$$\begin{cases} x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \alpha\beta\gamma = 0 \\ x^3 + \frac{b}{a}x^2 + \frac{c}{a}x + \frac{d}{a} = 0 \end{cases}$$

$$\left\{ \begin{array}{l} \alpha + \beta \end{array} \right.$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$

$$\begin{cases} x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \alpha\beta\gamma = 0 \\ x^3 + \frac{b}{a}x^2 + \frac{c}{a}x + \frac{d}{a} = 0 \end{cases}$$

$$\left\{ \begin{array}{l} \alpha + \beta + \gamma \end{array} \right.$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

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$$\left\{ \begin{array}{l} \alpha + \beta + \gamma = \\ \end{array} \right.$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

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$$\left\{ \begin{array}{l} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \\ \\ \left\{ \begin{array}{l} x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \alpha\beta\gamma = 0 \\ x^3 + \frac{b}{a}x^2 + \frac{c}{a}x + \frac{d}{a} = 0 \\ \\ \left\{ \begin{array}{l} \alpha + \beta + \gamma = -\frac{b}{a} \end{array} \right. \end{array} \right. \end{array} \right.$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$

$$\begin{cases} x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \alpha\beta\gamma = 0 \\ x^3 + \frac{b}{a}x^2 + \frac{c}{a}x + \frac{d}{a} = 0 \end{cases}$$

$$\left\{ \begin{array}{l} \alpha + \beta + \gamma = -\frac{b}{a} \\ \alpha\beta + \beta\gamma + \gamma\alpha \end{array} \right.$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$

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$$\left\{ \begin{array}{l} \alpha + \beta + \gamma = -\frac{b}{a} \\ \alpha\beta + \beta\gamma + \gamma\alpha = \end{array} \right.$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$

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$$\left\{ \begin{array}{lcl} \alpha + \beta + \gamma & = & -\frac{b}{a} \\ \alpha\beta + \beta\gamma + \gamma\alpha & = & \frac{c}{a} \end{array} \right.$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$

$$\begin{cases} x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \alpha\beta\gamma = 0 \\ x^3 + \frac{b}{a}x^2 + \frac{c}{a}x + \frac{d}{a} = 0 \end{cases}$$

$$\left\{ \begin{array}{l} \alpha + \beta + \gamma = -\frac{b}{a} \\ \alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a} \\ \alpha\beta\gamma \end{array} \right.$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$

$$\begin{cases} x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \alpha\beta\gamma = 0 \\ x^3 + \frac{b}{a}x^2 + \frac{c}{a}x + \frac{d}{a} = 0 \end{cases}$$

$$\begin{cases} \alpha + \beta + \gamma = -\frac{b}{a} \\ \alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a} \\ \alpha\beta\gamma = \text{ } \end{cases}$$

Vieta's Formula in Cubic Equations

▶ Home

▶ Start

▶ End

$$\begin{cases} (x - \alpha)(x - \beta)(x - \gamma) = 0 \\ ax^3 + bx^2 + cx + d = 0 \quad (a \neq 0) \end{cases}$$

$$\begin{cases} x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \alpha\beta\gamma = 0 \\ x^3 + \frac{b}{a}x^2 + \frac{c}{a}x + \frac{d}{a} = 0 \end{cases}$$

$$\begin{cases} \alpha + \beta + \gamma = -\frac{b}{a} \\ \alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a} \\ \alpha\beta\gamma = -\frac{d}{a} \end{cases}$$

Github:

<https://min7014.github.io/math20210207001.html>

Click or paste URL into the URL search bar,
and you can see a picture moving.