

$$1) (5x+4)^3 = (5x)^3 + 3(5x)^2(4) + 3(5x)(4)^2 + 4^3$$

$$= 125x^3 + 300x^2 + 240x + 64$$

1.2. function (fctn)

ex $f = \{(1, 2), (-2, 4), (3, -1)\}$

Function: Yes.

Domain: $\{1, -2, 3\}$

Range: $\{2, 4, -1\}$

ex $G = \{(1, 1), (1, 2), (1, 3), (2, 3)\}$

Fctn: No

D: $\{1, 2\}$

R: $\{1, 2, 3\}$

Function: No repeated x's.

ex. $H = \{(-4, 1), (-2, 1), (-2, 0)\}$

Fctn: No

D: $\{-4, -2\}$

R: $\{1, 0\}$

$$f(x) = -x^2 - 5x - 3$$

$$\begin{aligned} f(2) &= -(2)^2 - 5(2) - 3 \\ &= -4 - 10 - 3 \\ &= -17 \end{aligned}$$

$$f(x) = -x^2 + 5x - 3$$

$$\begin{aligned} f(2) &= -4 + 10 - 3 \\ &= 3 \end{aligned} \quad = \textcircled{2}$$

$$f(9) = -9^2 + 5(9) - 3$$

$$f(x) = x^2 - 2x + 7$$

$$\begin{aligned} f(-5) &= (-5)^2 - 2(-5) + 7 \\ &= 25 + 10 + 7 \\ &= 42 \end{aligned}$$

$$\begin{aligned} f(x+4) &= (x+4)^2 - 2(x+4) + 7 \\ &= x^2 + 8x + 16 - 2x - 8 + 7 \\ &= x^2 + 6x + 15 \end{aligned}$$

$$g(x) = 2x + 3$$

$$\begin{aligned} g(a+1) &= 2(a+1) + 3 \\ &= 2a + 2 + 3 \\ &= 2a + 5 \end{aligned}$$

$$f(x) = 2x^2 - x + 3$$

$$f(0) = 3$$

$$\begin{aligned} f(-7) &= 2(-7)^2 - (-7) + 3 \\ &= 2(49) + 7 + 3 \\ &= 98 + 10 \\ &= 108 \end{aligned}$$

$$\begin{aligned} f(5a) &= 2(5a)^2 - 5a + 3 \\ &= 50a^2 - 5a + 3 \end{aligned}$$

$$2(25a^2)$$

1.3. quadratic factors.

Complex numbers (\mathbb{C})

\mathbb{R}
real numbers

$$\sqrt{-1} = -i \quad i^2 = -1$$

$$\sqrt{-7} = \sqrt{7} i$$

$$\begin{aligned} \sqrt{-7} \sqrt{-7} &= (i\sqrt{7})(i\sqrt{7}) \\ &= -7 \end{aligned}$$

$$\begin{aligned} \sqrt{(-7)(-7)} &= \sqrt{49} \\ &= 7 \end{aligned}$$

Complex: $z = a + ib$

$$y = ax + b$$

Real part
Re

Imaginary part
Im

$$a, b \in \mathbb{R}$$

conjugate of z : $\bar{z} = a - ib$

$$d = x^2 - i + x^2$$

Square Root Property

$$u^2 = d \Rightarrow u = \pm \sqrt{d} \quad \left\{ \begin{array}{l} u = -\sqrt{d} \\ u = \sqrt{d} \end{array} \right.$$

Ex $3x^2 - 21 = 0$

$$3x^2 = 21$$

$$x^2 = 7$$

$$x = \pm \sqrt{7} \quad \left\{ \sqrt{7}, -\sqrt{7} \right.$$

Ex $5x^2 + 45 = 0$

$$5x^2 = -45$$

$$x^2 = -9$$

$$x = \pm \sqrt{-9}$$

$$= \pm 3i$$

$$\left\{ \sqrt{9} = 3 \right.$$

Ex $(x+5)^2 = 11$

$$x+5 = \pm \sqrt{11}$$

$$x = -5 \pm \sqrt{11}$$

$$\left\{ -5 - \sqrt{11}, -5 + \sqrt{11} \right.$$

$$\textcircled{2} \quad x^2 + \underline{6}x + \left(\frac{6}{2}\right)^2 = \left(x + \frac{6}{2}\right)^2$$

Ex $x^2 + 4x - 1 = 0$

$$x^2 + 4x + \left(\frac{4}{2}\right)^2 = 1 + (4)$$

$$(x + 2)^2 = 5$$

$$x + 2 = \pm \sqrt{5}$$

$$\underline{x = -2 \pm \sqrt{5}}$$

$$ax^2 + bx + c = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$b^2 - 4ac > 0 \Rightarrow 2 \mathbb{R}$$

$$b^2 - 4ac < 0 \Rightarrow 2 \mathbb{C}$$

$$b^2 - 4ac = 0 \Rightarrow 2\text{-repeated value}$$

Solve $2x^2 + 2x - 1 = 0$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-2 \pm \sqrt{4 - 4(2)(-1)}}{2(2)}$$

$$= \frac{-2 \pm \sqrt{4+8}}{4} \quad \text{--- } 12 \quad \sqrt{4} = 2$$

$$4 \cdot 3$$

$$= \frac{-2 \pm 2\sqrt{3}}{4}$$

$$= \frac{2(-1 \pm \sqrt{3})}{4}$$

$$= \frac{-1 \pm \sqrt{3}}{2}$$

$$\frac{2+1}{1} = 2$$

$$\frac{2+1}{2} = \frac{3}{2}$$

Ex $x^2 - 4x = -2$

$$x^2 - 4x + 2 = 0$$

$$x = \frac{4 \pm \sqrt{16 - 4(2)}}{2}$$

$$b = 2 \times 4$$

$$= \frac{4 \pm 2\sqrt{2}}{2}$$

$$= 2 \pm \sqrt{2}$$

Ex

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

$$x = \frac{2 \pm \sqrt{4 - 4(2)}}{2}$$

$$= \frac{2 \pm \sqrt{-4}}{2}$$

$$= \frac{2 \pm 2i}{2}$$

$$= 1 \pm i$$

$$\frac{-2^2}{(-2)^2} 2^2$$

$$ax^2 + bx + c = 0$$

$$a + b + c = 0 \Rightarrow x = 1, \frac{c}{a}$$

Ex $2x^2 + x - 3 = 0$ $2 + 1 - 3$

$$x = 1, -\frac{3}{2}$$

$$a - b + c = 0 \Rightarrow x = -1, -\frac{c}{a}$$

Ex $2x^2 - x - 3 = 0$ $2 - (-1) - 3$

$$x = -1, \frac{3}{2}$$

$49 - 60$

Ex
①

$$x^2 = -25$$

$$x = \pm \sqrt{-25}$$
$$= \pm 5i$$

#4

$$4x^2 + 25 = 0$$

$$4x^2 = -25$$

$$x^2 = -\frac{25}{4}$$

$$\rightarrow \pm \sqrt{-\frac{25}{4}}$$

$$x = \pm \frac{5}{2}i$$

2

$$(x+3)^2 = -16$$

$$x+3 = \pm \sqrt{-16}$$

$$x = -3 \pm 4i$$

$$(4x-9)(4x+7) = 0$$

$$4x-9=0$$

$$4x=9$$

$$x = \frac{9}{4}$$

$$4x+7=0$$

$$4x=-7$$

$$x = -\frac{7}{4}$$

34

$$x^2 + 2x + 29 = 0$$

$$x = \frac{-2 \pm \sqrt{4 - 4(29)}}{2}$$

$$= \frac{-2 \pm \sqrt{4 - 116}}{2}$$

$$= \frac{-2 \pm i\sqrt{114}}{2}$$

$$\begin{array}{r} 29 \\ 4 \\ \hline 2 \ 116 \\ 4 \overline{) 114} \\ 34 \end{array}$$

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$$4x^2 + 4x + 13 = 0$$

$$x = \frac{-4 \pm \sqrt{16 - 4(4)(13)}}{8}$$

$$\begin{aligned} &16 - 16(13) \\ &16(1 - 13) \end{aligned}$$

$$= \frac{-4 \pm 4\sqrt{1-13}}{8}$$

$$12 \rightarrow 4 \times 3$$

$$= \frac{-4 \pm 4\sqrt{-12}}{8}$$

$$= \frac{-4 \pm 8i\sqrt{3}}{8}$$

$$= \frac{-1 \pm 2i\sqrt{3}}{2}$$

23

$$2x^2 + 3x - 4 = 0$$

$$x = \frac{-3 \pm \sqrt{9 - 4(2)(-4)}}{4}$$

$$\begin{aligned} &9 + 32 \\ &41 \end{aligned}$$

$$= \frac{-3 \pm \sqrt{41}}{4}$$

$$x^2 - 6x = -7$$

$$x^2 - 6x + 7 = 0$$

$$x = \frac{6 \pm \sqrt{36 - 4(7)}}{2}$$

$$= \frac{6 \pm \sqrt{8}}{2} \rightarrow 2\sqrt{2}$$

$$= \frac{6 \pm 2\sqrt{2}}{2}$$

$$= 3 \pm \sqrt{2}$$

$$57 \quad x^2 - 3x - 4 = 0$$

$$1 - (-1) - 4$$

$$x = -1, 4$$
