



OL Academy

MATHS101

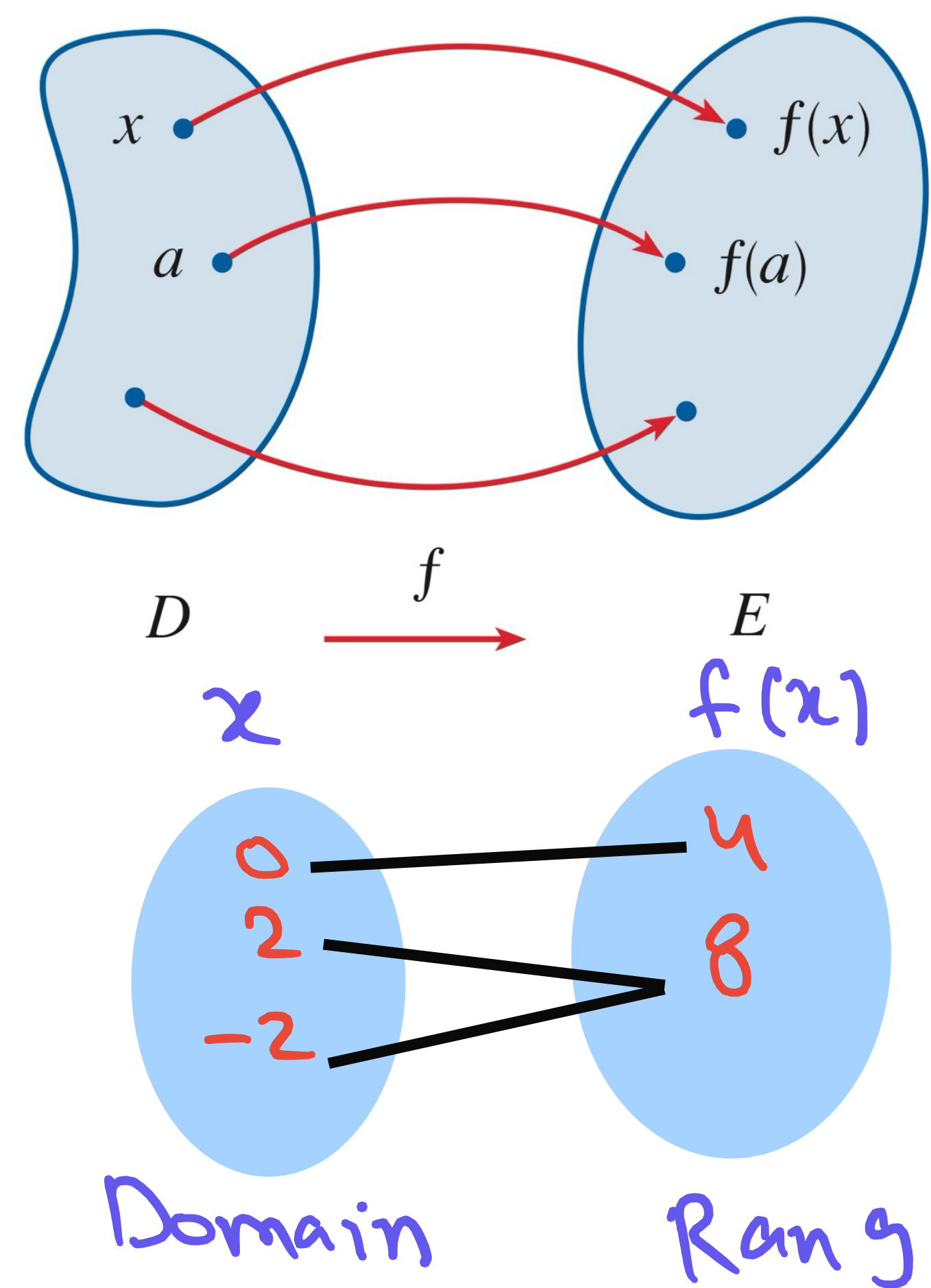
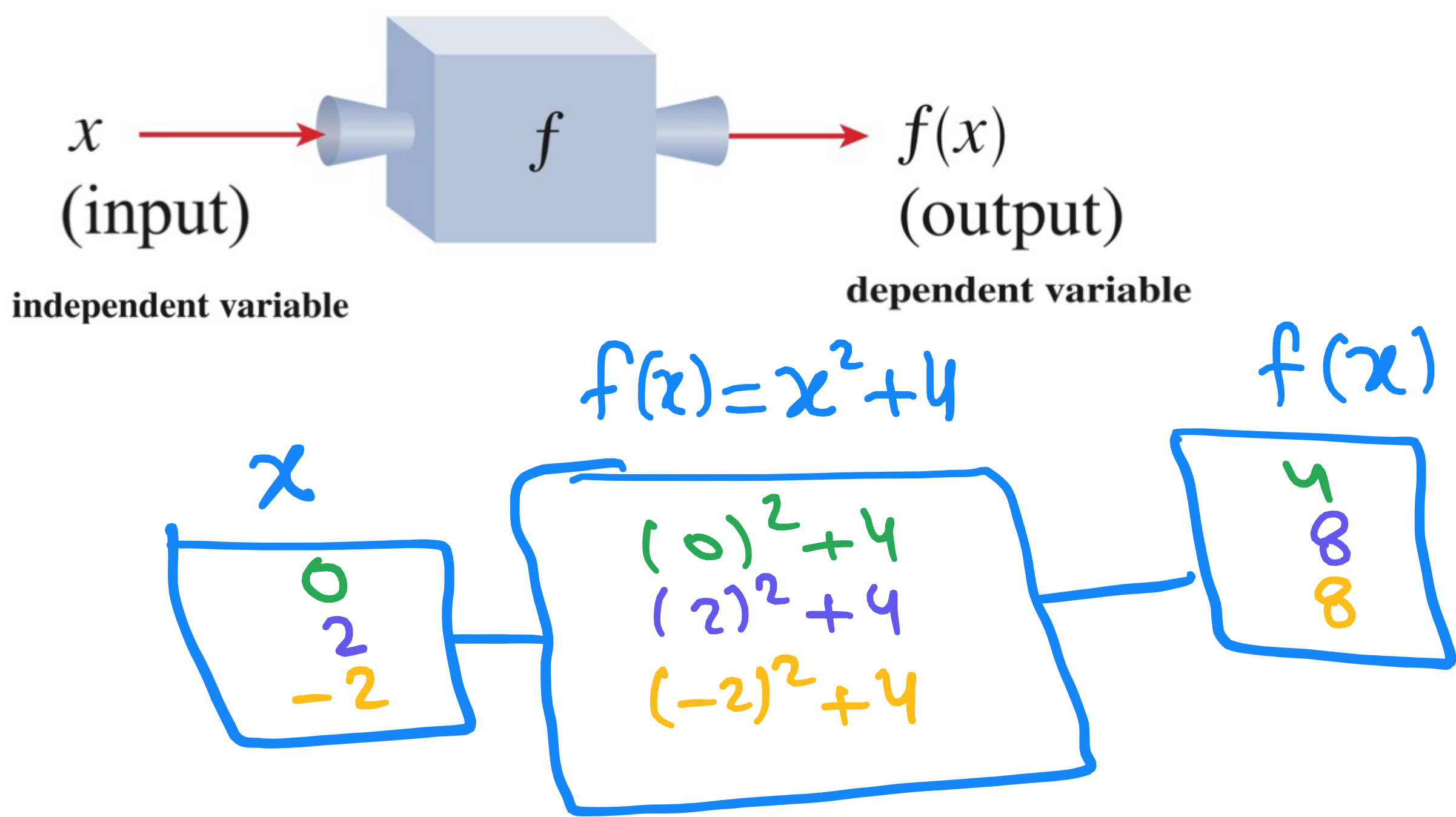
Lesson 1

Functions & Factoring

■ Functions

A **function** f is a rule that assigns to each element x in a set D exactly one element, called $f(x)$, in a set E .

$$\begin{aligned} 4 + 6 &= 10 \\ 5 + 5 &= 10 \end{aligned}$$



Constant Function: $f(x) = C$

$$f(x) = 3$$

Linear Function: $f(x) = \underline{aX} + b$

Find the value of x :

a) $7 - 4x = 3$

$$-4x = 3 - 7$$

$$\Rightarrow (-4x = -4) \quad x \frac{1}{-4} \quad , \quad \div -4$$

$$x = \frac{-4}{-4} = 1$$

$$b) \left(\frac{6 + 3(x-5)}{2} = \frac{4x}{3} \right)$$

$$3(6 + 3(x-5)) = 2(4x)$$

$$3(6 + 3x - 15) = 8x$$

$$18 + 9x - 45 = 8x$$

$$\Rightarrow 9x - 8x = 45 - 18$$

$$x = 27$$

Algebraic Formulas

$$(a - b)^2 = a^2 - 2ab + b^2$$

$$(a + b)^2 = a^2 + 2ab + b^2$$

$$a^2 - b^2 = (a + b)(a - b)$$

$$(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$$

$$(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

$$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

$$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$

$$(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ac$$

$$\begin{aligned} \text{a) } (\underbrace{2x}_a + \underbrace{3}_b)^2 &= (2x)^2 + 2(2x)(3) + (3)^2 \\ &= 4x^2 + 12x + 9 \end{aligned}$$

$$b) (\underline{x^2 - 5})^2 = a^2 - 2ab + b^2$$

$$\overset{2 \times 2 = 4}{(x^2)^2} - 2(x^2)(5) + (5)^2 = x^4 - 10x^2 + 25$$

$$c) x^2 - \underline{9} \rightarrow a^2 - b^2 \rightarrow (x)^2 - (3)^2$$

$$(a+b)(a-b)$$

$$\sqrt{9} = 3$$

$$(\overbrace{x+3})(\underbrace{x-3}) \quad (x^2 - \cancel{3x} + \cancel{3x} - 9) = x^2 - 9$$

$$d) \underline{x^4} - \underline{16} \rightarrow a^2 - b^2 \Rightarrow (\underline{x^2})^2 - (\underline{4})^2$$

$$a = x \quad b = 2$$

$$\underline{(a-b)(a+b)}$$

$$(\underline{x^2 - 4})(x^2 + 4) \Rightarrow (x+2)(x-2)(x^2 + 4)$$

$$(\underline{x^2 - (2)^2})$$

Quadratic equation:

mode 5 3 ①

$$\underline{ax^2 + bx + c = 0}$$

التحليل ②

القانون العام ③

Solve:

$$a) \underline{x^2 - 3x = -2}$$

$$\underline{x_1 = 2, x_2 = 1}$$

$$\underline{x^2 - 3x + 2 = 0}$$

$$1 \times 2 = 2$$
$$1 + 2 = 3$$

$$-1, -2 = 2$$
$$-1 + (-2) = -3$$

$$(x - 1)(x - 2) = 0$$

$$(x - 1) = 0, (x - 2) = 0$$

$$\Rightarrow \underline{x_1 = 1, x_2 = 2}$$

$$b) 6x^2 - 17x = -12 \quad \rightarrow \quad \underbrace{6}_a x^2 - \underbrace{17}_b x + \underbrace{12}_c = 0 \quad \begin{matrix} x_1 = \frac{3}{2} \\ x_2 = \frac{4}{3} \end{matrix}$$

$$x = \frac{-(-17) \pm \sqrt{(-17)^2 - 4(6)(12)}}{2(6)}$$

$$x = \frac{17 \pm \sqrt{289 - 288}}{12} = \frac{17 \pm 1}{12}$$

$$x_1 = \frac{18}{12} = \frac{3}{2} \quad x_2 = \frac{16}{12} = \frac{4}{3}$$

القانون العام

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

$$\sqrt{1} = 1$$

Logarithmic Function:

$$\log_b x = y \longleftrightarrow b^y = x$$

Logarithmic properties, If x&y are positive.

$$1. \log_b (xy) = \log_b x + \log_b y$$

$$2. \log_b \left(\frac{x}{y} \right) = \log_b x - \log_b y$$

$$3. \log_b (x^r) = r \log_b x$$

Solve:

$$a) \log_2 16 = y$$

$$\log_b x = y \longleftrightarrow b^y = x$$

$$2^y = 16$$

$$\sqrt[2]{16} = 4$$

$$y = 4$$

$$2^4 = 16 \longleftrightarrow 2^4 = 2^4$$

$$b) \log_{\cancel{2}} 8 = y$$

$$\rightarrow \log_2 x = y \longleftrightarrow b^y = x$$

$$2^y = 8$$

$$y = 3 \Rightarrow 2^3 = 8$$

Natural Logarithm:

The logarithm with base $e \Rightarrow \ln$

$$\log_b x = y$$

$$\log_{\underbrace{e}} x = \underline{\ln x}$$

$$\underline{e \approx 2.718 \dots}$$

$$\pi \approx 3.14$$

$$f(x) = e^x$$

$$\log_e x = \ln x$$

$$\cancel{e}^{\cancel{\ln}(2)} = 2$$

$$\underline{e}^{\ln x} = x, \quad e^{\log_e x} = x$$

Find the value of x :

$$a) e^{\underline{3-4x}} = \ln 12$$

$$\cancel{\ln} e^{\cancel{3-4x}} = \ln(12)$$

$$\xrightarrow{\hspace{1cm}} 3-4x = \ln(12)$$

$$(-4x = \ln(12) - 3) \div (-4)$$

$$x = \frac{\ln(12) - 3}{-4} \Rightarrow x = \frac{-\ln(12) + 3}{4}$$

$$b) \cancel{\ln} e^{2x} = \ln 3$$

$$\cancel{\ln} e^{2x} = \ln(\ln(3))$$

$$[2x = \ln(\ln(3))] \div 2$$

$$x = \frac{\ln(\ln(3))}{2}$$

$$\cancel{e}^{\ln(3x)} = e^5$$

$$3x = e^5$$

$$x = \frac{e^5}{3}$$