

$$1a) \frac{3^2}{9} - \left(\frac{1}{3}\right)^2 = \frac{9}{9} - \frac{1}{9} = \frac{8}{9}$$

$$b) (3-12)^2 = (-9)^2 = 81$$

$$c) -2^3 - 3^2 = -8 - 9 = -17$$

$$d) \frac{(16-20)^7}{(-8)^3} = \frac{(-4)^7}{(-4 \cdot 2)^3} = \frac{\cancel{(-4)^3} \cdot (-4)^4}{\cancel{(-4)^3} \cdot 2^3} = 32$$

$$② a) 2^{2000} \cdot 0,5^{2000} = (2 \cdot 0,5)^{2000} = 1^{2000} = 1$$

$$b) \frac{10^{15} \cdot 10^{-3}}{10^{10}} = \frac{10^{12}}{10^{10}} = 10^2 = 100$$

$$c) 3 \cdot (3^{-2} + 3^{-2}) = 3 \cdot \left(\frac{1}{3^2} + \frac{1}{3^2}\right) = 3 \cdot \frac{2}{9} = \frac{6}{9} = \frac{2}{3}$$

$$d) \frac{7,1 \cdot 10^{-9} + 2,9 \cdot 10^{-8}}{6^4 - 4,906 \cdot 10^3} = -1 \cdot 10^{-11} \quad (= -10 \cdot 10^{-12}) \\ = -10^{-11}$$

$$③ a) 4x - (3x + 8) - 4 = 4x - 3x - 8 - 4 = x - 12$$

$$b) 5(2x - 3) - 4(x + 5) = 10x - 15 - 4x - 20 = 6x - 35$$

$$c) -x^2(-3x + 1) - (-x^3 + x^2) = 3x^3 - x^2 + x^3 - x^2 = 4x^3 - 2x^2$$

$$d) \frac{3}{4}a^2 - \frac{1}{2}a + 1 - \frac{5}{6}a - a^2 = \frac{3}{4}a^2 - \frac{3}{6}a + 1 - \frac{5}{6}a - \frac{4}{4}a^2$$

$$= -\frac{1}{4}a^2 - \frac{8}{6}a + 1$$

$$= -\frac{1}{4}a^2 - \frac{4}{3}a + 1$$

$$4) \left(\frac{1}{2}x^2 - 7x\right) - \left(-\frac{1}{2}x^2 - 8x\right) = \frac{1}{2}x^2 - 7x + \frac{1}{2}x^2 + 8x$$

$$= x^2 - x$$

$$b) \left(\frac{1}{2}x^2 - 7x\right)\left(-\frac{1}{2}x^2 - 8x\right)$$

$$= -\frac{1}{4}x^4 - 4x^3 + \frac{7}{2}x^3 + 56x^2$$

$$= -\frac{1}{4}x^4 - \frac{1}{2}x^3 + 56x^2$$

$$c) \left(\frac{1}{2}x^2 - 7x\right) + \left(-\frac{1}{2}x^2 - 8x\right) = \frac{1}{2}x^2 - 7x - \frac{1}{2}x^2 - 8x = -15x$$

$$d) \frac{\frac{1}{2}x^2 - 7x}{-\frac{1}{2}x^2 - 8x} = \frac{x\left(\frac{1}{2}x - 7\right)}{x\left(-\frac{1}{2}x - 8\right)} = \frac{\frac{1}{2}x - 7}{-\frac{1}{2}x - 8} = \frac{-x + 14}{x + 16}$$

$$⑤ (6n-1)(4n+2) - (n-2)(n+10)$$

$$= 24n^2 + 12n - 4n - 2 - (n^2 + 10n - 2n - 20)$$

$$= 24n^2 + \cancel{12n} - \cancel{4n} - 2 - n^2 - 10n + \cancel{2n} + 20$$

$$= \underbrace{23n^2 + 18}_{20 \quad 70}$$

SIS LAUSEKE SAA POSITIIVISEN
ARVON MIN ARVOSTA RIIPPUMATTA

⑥ a, b, c ovat suorakulmaisen Δ n mittalukukuja
jos ne toteuttavat Pythagoraan lauseen.

$$a^2 + b^2 = c^2$$

$$(2xy)^2 + (x^2 - y^2)^2 = (x^2 + y^2)^2$$

$$4x^2y^2 + (x^2 - y^2)(x^2 - y^2) = (x^2 + y^2)(x^2 + y^2)$$

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

$$x^4 + 2x^2y^2 + y^4 = x^4 + 2x^2y^2 + y^4 \quad \text{TOSI}$$

→ PYTHAGORAAN
LAUSEETOTEUTTU
JOTEN
a, b, c VOIVAT
OLLA SUORAKULM.
KOLMION
MITTALUKUJA.

⑦ $\sqrt{5}-2 > 0$, JOTEN $\sqrt{5}-2$ ON JONKIN POSIT. LUVUN NELIJOUKSI

$$(\sqrt{5}-2)^2 = (\sqrt{5}-2)(\sqrt{5}-2)$$

$$= 5 - 2\sqrt{5} - 2\sqrt{5} + 4$$

$$= \underline{\underline{9 - 4\sqrt{5}}} \approx \underline{\underline{0,0557}}$$

⑧ $f(x) = (x^2 - 3x + 2)(x - 4) - (x^2 - 5x + 4)(x - 2)$

$$= x^3 - 4x^2 - 3x^2 + 12x + 2x - 8 - (x^3 - 2x^2 - 5x^2 + 10x + 4x - 8)$$

$$= \cancel{x^3} - \cancel{4x^2} - \cancel{3x^2} + \cancel{12x} + \cancel{2x} - \cancel{8} - \cancel{x^3} + \cancel{2x^2} + \cancel{5x^2} - \cancel{10x} - \cancel{4x} + \cancel{8}$$

$$= 0$$

JOTEN $f(0) = 0$

$$f(2) = 0$$

$$f(4) = 0$$

⑨ $p = \frac{mgh}{t} \parallel \cdot t$

$$pt = mgh \parallel : (gh)$$

$$\frac{pt}{gh} = m$$

$$m = \frac{900 \cdot 45}{9,81 \cdot 4,5} \approx 917$$

⑩ $3x + 1 = 0$
 $3x = -1$
 $x = -\frac{1}{3}$

TÄLLÖIN

$$x^2 - 6x + 5$$

$$= \left(-\frac{1}{3}\right)^2 - 6 \cdot \left(-\frac{1}{3}\right) + 5$$

$$= \frac{1}{9} + 2 + 5 = 7\frac{1}{9}$$

$$\textcircled{11} \text{ a) } 5 - (6x - 8) = x - 1$$

$$5 - 6x + 8 = x - 1$$

$$-6x - x = -1 - 5 - 8$$

$$-7x = -14 \quad || : (-7)$$

$$x = 2$$

$$\text{b) } \frac{x+8}{2} = \frac{3x-2}{4}$$

$$4(x+8) = 2(3x-2)$$

$$4x+32 = 6x-4$$

$$4x-6x = -4-32$$

$$-2x = -36 \quad || : (-2)$$

$$x = 18$$

$$\text{c) } \frac{3}{5} - \frac{x+1}{10} = \frac{5-x}{10}$$

$$\frac{6}{10} - \frac{x+1}{10} = \frac{5-x}{10} \quad || \cdot 10$$

$$6 - (x+1) = 5-x$$

$$6 - x - 1 = 5 - x$$

$$-x + x = 5 - 6 + 1$$

$$0 = 0 \text{ TOSI}$$

JOTEN YHTÄLÖ TOTEUTUU KAIKILLA X:N ARVOILLA

$$\textcircled{12.} \text{ a) } 10x^2 - x = 0$$

$$x(10x-1) = 0$$

$$x=0 \text{ TAI } 10x-1=0$$

$$x=0 \text{ TAI } 10x=1$$

$$x=0 \text{ TAI } x = \frac{1}{10}$$

$$\text{b) } 5x^2 - 20 = 0$$

$$5x^2 = 20 \quad || : 5$$

$$x^2 = 4$$

$$x = \pm \sqrt{4}$$

$$x = 2 \text{ TAI } x = -2$$

$$\text{c) } 5x^2 - 4x - 1 = 0$$

$$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4 \cdot 5 \cdot (-1)}}{2 \cdot 5}$$

$$\text{ELI } x = \frac{4 \pm \sqrt{16+20}}{10}$$

$$x = \frac{4 \pm 6}{10}$$

SIIIS

$$x = \frac{10}{10} \text{ TAI } x = \frac{-2}{10}$$

$$\text{VAST } x = 1$$

$$\text{TAI } x = -\frac{1}{5}$$