

## Kotitehtävät

5.3 Ratkaise yhtälö.

a)  $4x^2 + 5x + 1 = 0$

b)  $-6x^2 + x + 2 = 0$

5.5 Ratkaise yhtälö.

a)  $x^2 + 1 = 2x$

b)  $x - 3 = x^2$

Toisen asteen polynomiyhtälö:

$$ax^2 + bx + c = 0, a \neq 0$$

Toisen asteen yhtälön ratkaisukaava:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, a \neq 0$$

a)  $4x^2 + 5x + 1 = 0$

$$a=4 \quad b=5 \quad c=1$$

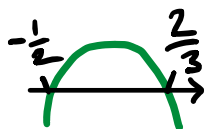
$$x = \frac{-5 \pm \sqrt{5^2 - 4 \cdot 4 \cdot 1}}{2 \cdot 4} = \frac{-5 \pm \sqrt{25 - 16}}{8} = \frac{-5 \pm \sqrt{9}}{8} = \frac{-5 \pm 3}{8}$$


$$x = \frac{-5+3}{8} = \frac{-2}{8} = -\frac{1}{4} \quad \text{tai} \quad x = \frac{-5-3}{8} = \frac{-8}{8} = -1$$

b)  $-6x^2 + x + 2 = 0$

$$a=-6 \quad b=1 \quad c=2$$

$$x = \frac{-1 \pm \sqrt{1^2 - 4 \cdot (-6) \cdot 2}}{2 \cdot (-6)} = \frac{-1 \pm \sqrt{1 + 48}}{-12} = \frac{-1 \pm \sqrt{49}}{-12} = \frac{-1 \pm 7}{-12}$$


$$x = \frac{-1-7}{-12} = \frac{-8}{-12} = \frac{2}{3} \quad \text{tai} \quad x = \frac{-1+7}{-12} = \frac{6}{-12} = -\frac{1}{2}$$

5.5 b)  $x - 3 = x^2$

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

$$a=-1 \quad b=1 \quad c=-3$$

$$x = \frac{-1 \pm \sqrt{1^2 - 4 \cdot (-1) \cdot (-3)}}{2 \cdot (-1)} = \frac{-1 \pm \sqrt{1 - 12}}{-2} = \frac{-1 \pm \sqrt{-11}}{-2}$$


$$\rightarrow x \quad \text{ei ratkaisua.}$$

$$ax^2 + bx + c = 0, a \neq 0$$

Toisen asteen yhtälön ratkaisukaava:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, a \neq 0$$

ei voi laskea

⑥ 2. asteen vaillinainen yhtälö  
 $ax^2 + bx + c = 0$   $a \neq 0$

⑥  $b=0$   $ax^2 + c = 0$

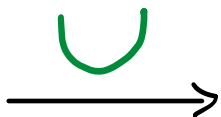
⑥.1 a)  $x^2 = 25$   $\parallel \sqrt{\quad}$   
 $x = \pm \sqrt{25}$   
 $x = \pm 5$   
 $x = 5$  tai  $x = -5$

TAI

$x^2 = 25$   
 $x^2 - 25 = 0$   
 $a=1$   $b=0$   $c=-25$   
 $x = \frac{-0 \pm \sqrt{0^2 - 4 \cdot 1 \cdot (-25)}}{2 \cdot 1}$   
 $= \frac{\pm \sqrt{100}}{2} = \frac{\pm 10}{2} = \pm 5$

b)  $x^2 - 10 = 0$   
 $x^2 = 10$   
 $x = \pm \sqrt{10}$

c)  $x^2 + 1 = 0$   
 $x^2 = -1$   
 $x = \pm \sqrt{-1}$



ei ratkaisua

⑥.7 a)  $4x^2 + 8x = 0$   $c=0$   $ax^2 + bx = 0$

$x(4x + 8) = 0$  *tulon nollasääntö*  
 $x=0$  tai  $4x+8=0$   
 $4x = -8$   $\parallel :4$   
 $x = -2$

TAI

$a=4$   $b=8$   $c=0$   
 $x = \frac{-8 \pm \sqrt{8^2 - 4 \cdot 4 \cdot 0}}{2 \cdot 4}$   
 $= \frac{-8 \pm 8}{8}$   $x = \frac{-8+8}{8} = \frac{0}{8} = 0$   
 tai  $x = \frac{-8-8}{8} = \frac{-16}{8} = -2$

b)  $6x^2 - x = 0$

$x(6x - 1) = 0$   $\parallel$  TMS  
 $x=0$   $6x-1=0$

$$6x = 1 \quad \parallel :6$$

$$x = \frac{1}{6}$$

6.5 Ratkaise yhtälö.

a)  $120x^2 = x^2$

b)  $-5x^2 + 15 = 0$

c)  $7x^2 - 3 + x = 4 + x$

a)  $120x^2 = x^2$

$$120x^2 - x^2 = 0$$

$$119x^2 = 0 \quad \parallel :119$$

$$x^2 = 0$$

$$x = \pm \sqrt{0}$$

$$x = 0$$

b)  $-5x^2 + 15 = 0 \quad \parallel (-5)$

$$x^2 - 3 = 0$$

$$x^2 = 3$$

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

c)  $7x^2 - 3 + x = 4 + x$

$$7x^2 - 3 + \cancel{x} - 4 - \cancel{x} = 0$$

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

$$7x^2 = 7 \quad \parallel :7$$

$$x^2 = 1$$

$$x = \pm \sqrt{1}$$

$$x = \pm 1$$

6.11 Olkoot  $f(x) = x^2 - 5$  ja  $g(x) = -x^2 + 7x - 5$ . Millä muuttujan  $x$  arvoilla

a) funktio  $f$  saa arvon 0

b) funktiot  $f$  ja  $g$  saavat saman arvon?

a)  $f(x) = 0 \Leftrightarrow x^2 - 5 = 0$

$$x^2 = 5$$

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

b)  $f(x) = g(x) \Leftrightarrow x^2 - 5 = -x^2 + 7x - 5$

$$\underline{x^2} - \underline{5} + \underline{x^2} - \underline{7x} + \underline{5} = 0$$

$$\underline{2x^2} - \underline{7x} = 0$$

$$x(2x - 7) = 0$$

$$x = 0 \quad \text{tai} \quad 2x - 7 = 0$$

$$2x = 7 \quad |:2$$

$$x = \frac{7}{2}$$