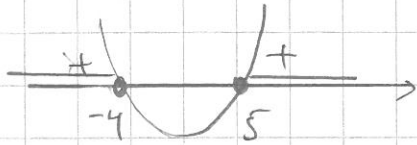


$$\Leftrightarrow x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4 \cdot 1 \cdot (-20)}}{2 \cdot 1} = \frac{1 \pm \sqrt{1+80}}{2} = \frac{1 \pm \sqrt{81}}{2} = \frac{1 \pm 9}{2} = \begin{cases} 5 \\ -4 \end{cases}$$



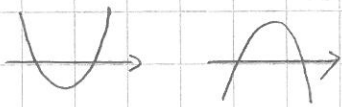
x ollaero positiivinen  $\Rightarrow$  Var.  $x \geq 5$

### 13. Diskriminantti

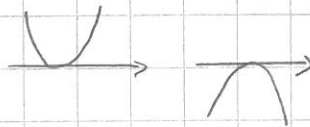
$$ax^2 + bx + c = 0 \quad (a \neq 0) \quad \Leftrightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\boxed{D = b^2 - 4ac} \quad \text{DISKRIMINANTTI}$$

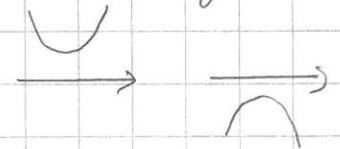
1<sup>o</sup>  $D > 0$  : 2 juurta



2<sup>o</sup>  $D = 0$  : 1 juuri



3<sup>o</sup>  $D < 0$  : ei juuria



Esim. Montoko juurta on yhtälöllä a)  $5x^2 + 2x - 3 = 0$ , b)  $x - 3 = x^2$ ?

Ratk. a)  $D = b^2 - 4ac = 2^2 - 4 \cdot 5 \cdot (-3) = 4 + 60 = 64 > 0 \Rightarrow$  2 juurta

b)  $x - 3 = x^2 \quad \Leftrightarrow -x^2 + x - 3 = 0$

$$D = 1^2 - 4 \cdot (-1) \cdot (-3) = 1 - 12 = -11 < 0 \Rightarrow$$
 0 juurta (ei juuria)

13. 5, 6, 12

13.5  $4x^2 - 8x + q = 0$

a)  $D = (-8)^2 - 4 \cdot 4 \cdot q = 64 - 16q > 0$

$$\Leftrightarrow -16q > -64 \quad | : (-16) < 0$$

$$\Leftrightarrow q < \frac{-64}{-16} \quad \Leftrightarrow \underline{q < 4}$$

b)  $D = 64 - 16q = 0 \quad \Leftrightarrow 64 = 16q \quad | : 16 \quad \Leftrightarrow \underline{q = 4}$

c)  $D = 64 - 16q \leq 0 \quad \Leftrightarrow -16q \leq -64 \quad | : (-16) < 0$

$$\Leftrightarrow q \geq \frac{-64}{-16} \quad \Leftrightarrow \underline{q \geq 4}$$

13.6  $f(x) = -4x^2 + 2x - 1 = 0$

$$D = 2^2 - 4 \cdot (-4) \cdot (-1) = 2^2 - 16 < 0$$

Varsteavo yhtälö:  $2^2 - 16 = 0 \quad \Leftrightarrow 2^2 = 16 \quad | \sqrt{\quad} \quad \Leftrightarrow 2 = \pm \sqrt{16} = \pm 4$