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The O−Notation

Definition: Let f,g: ℕ -> ℕ.

1. f = O(g) ⇔ ∃c>0 $\exists n_0 \in \mathbb{N}\ \forall\ n \geq n_0 : f(n) \leq c \cdot g(n)$
   (asymptotically, f does not grow faster than g)
2. f = Ω(g) ⇔ g = O(f)
   (asymptotically, f grows at least as fast as g)
3. f = Θ(g) ⇔ f = O(g) and g = O(f)

Order the following functions concerning their asymptotic growths such that $g_1 = \Omega(g_2),\ g_2 = \Omega(g_3)$ ...

a) 1
b) 1.5^n
c) $n^2 + 14\,n - 200$
d) n+145
e) $2^{\ln n}$
f) 20 log(n) + 57
g) $\frac{1}{2}n^2 - 20\,n$
h) 3^n

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Curve sketching: Let f(x) = $\frac{x}{\sqrt{x^4+2}}$ be a function in the real variable x.

Hints: plot, simplify, solve, diff, evalf, subs, asympt

a) Plot the curve

b) Explore the symmetrie. Is f(−x) = f(x) or f(−x) = −f(x)?

c) Where are the zeroes?

d) What are the lokal extrema?

f) How does f behave going to infinity?

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