Data Science Math Skills
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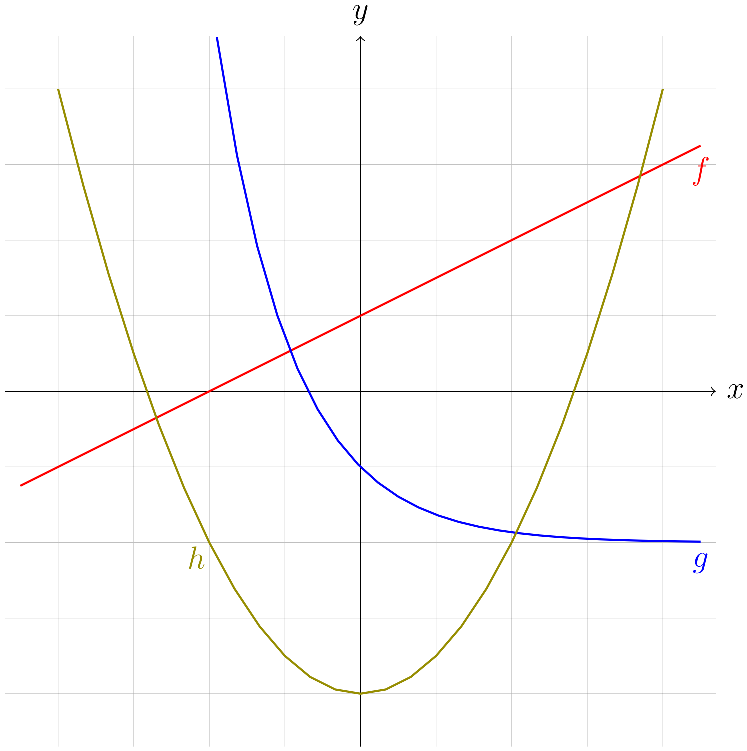
Functions: Increasing and Decreasing Functions

Video companion

1 Introduction



- f is *strictly increasing*
- g is *strictly decreasing*
- h is neither

Let $f : \mathbb{R} \to \mathbb{R}$,
f is strictly increasing if whenever $a < b$, we have $f(a) < f(b)$.
f is strictly decreasing if whenever $a < b$, we have $f(a) > f(b)$.

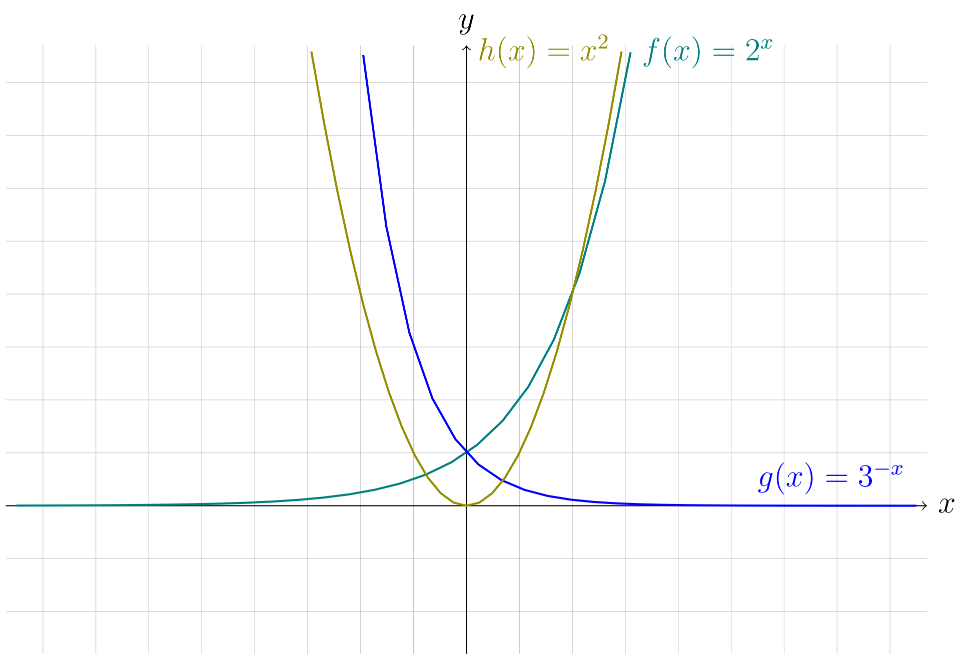
2 Examples

$f(x) = 2^x$ (exponential function)
$g(x) = 3^{-x}$
$h(x) = x^2$

x	$f(x)$
0	$2^0 = 1$
1	$2^1 = 2$
2	$2^2 = 4$
3	$2^3 = 8$
-1	$2^{-1} = \frac{1}{2}$

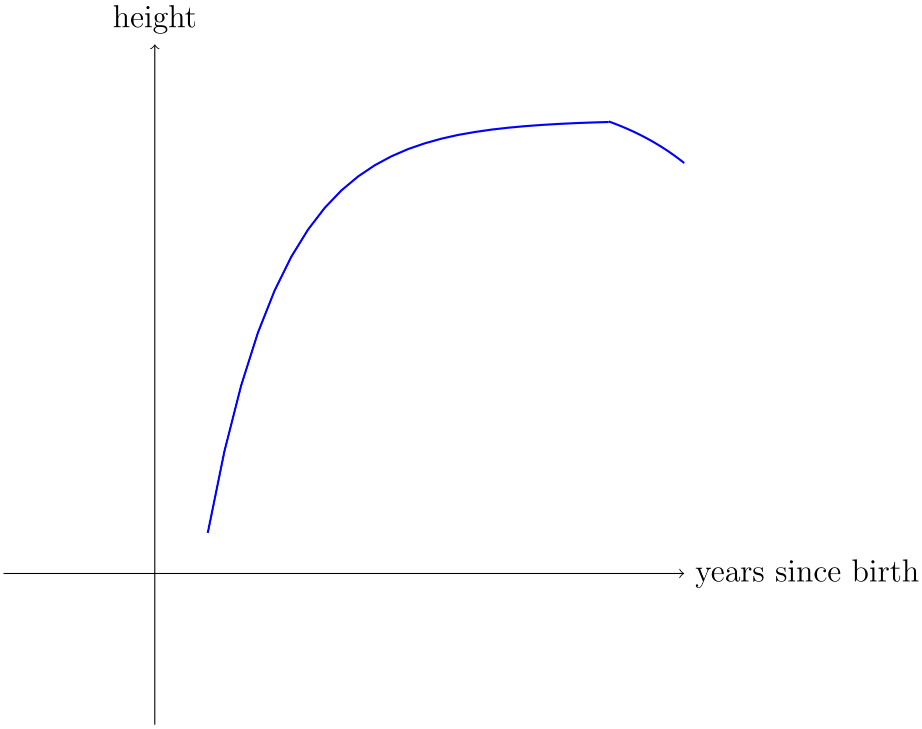
x	$g(x)$
0	$3^0 = 1$
1	$3^{-1} = \frac{1}{3}$
2	$3^{-2} = \frac{1}{9}$
3	$3^{-3} = \frac{1}{27}$
-1	$3^1 = 3$

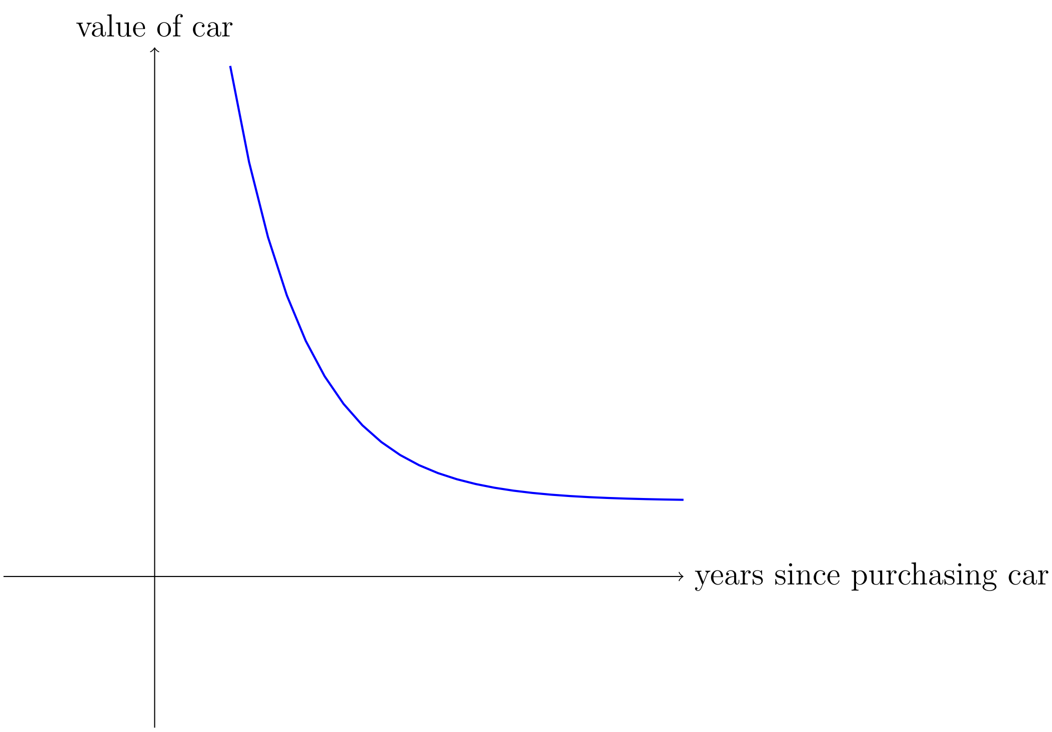
x	$h(x)$
0	$0^2 = 0$
1	$1^2 = 1$
2	$2^2 = 4$
3	$3^2 = 9$
-1	$(-1)^2 = 1$



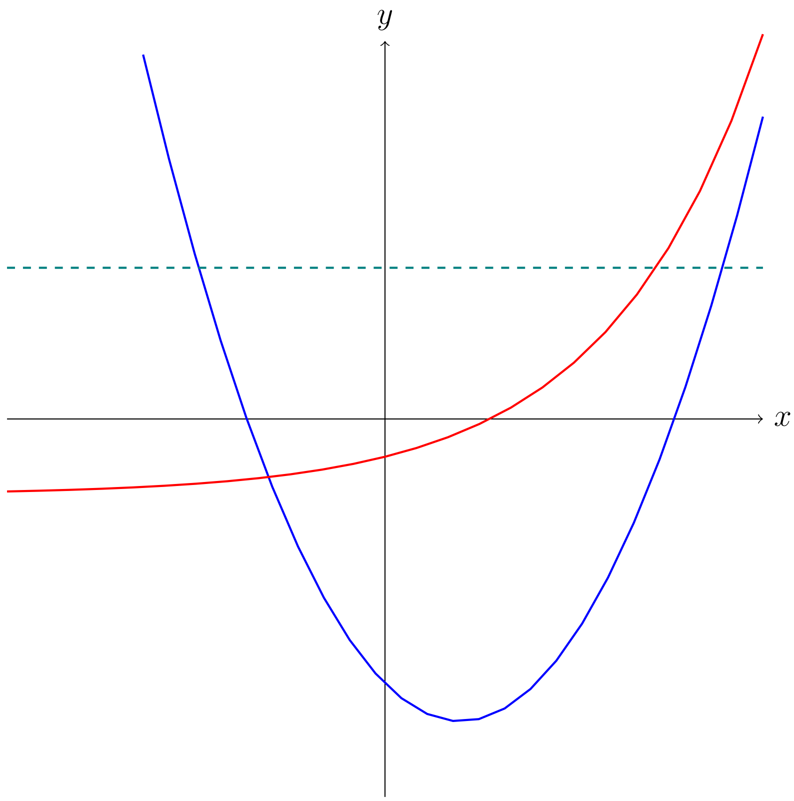
- f is strictly increasing
- g is strictly decreasing
- h is neither
  - h is strictly increasing on $[0, \infty)$
  - h is strictly decreasing on $(-\infty, 0]$

3 "Real-world" examples





4 Horizontal line test



A function is strictly increasing or strictly decreasing if a horizontal line crosses it only once.