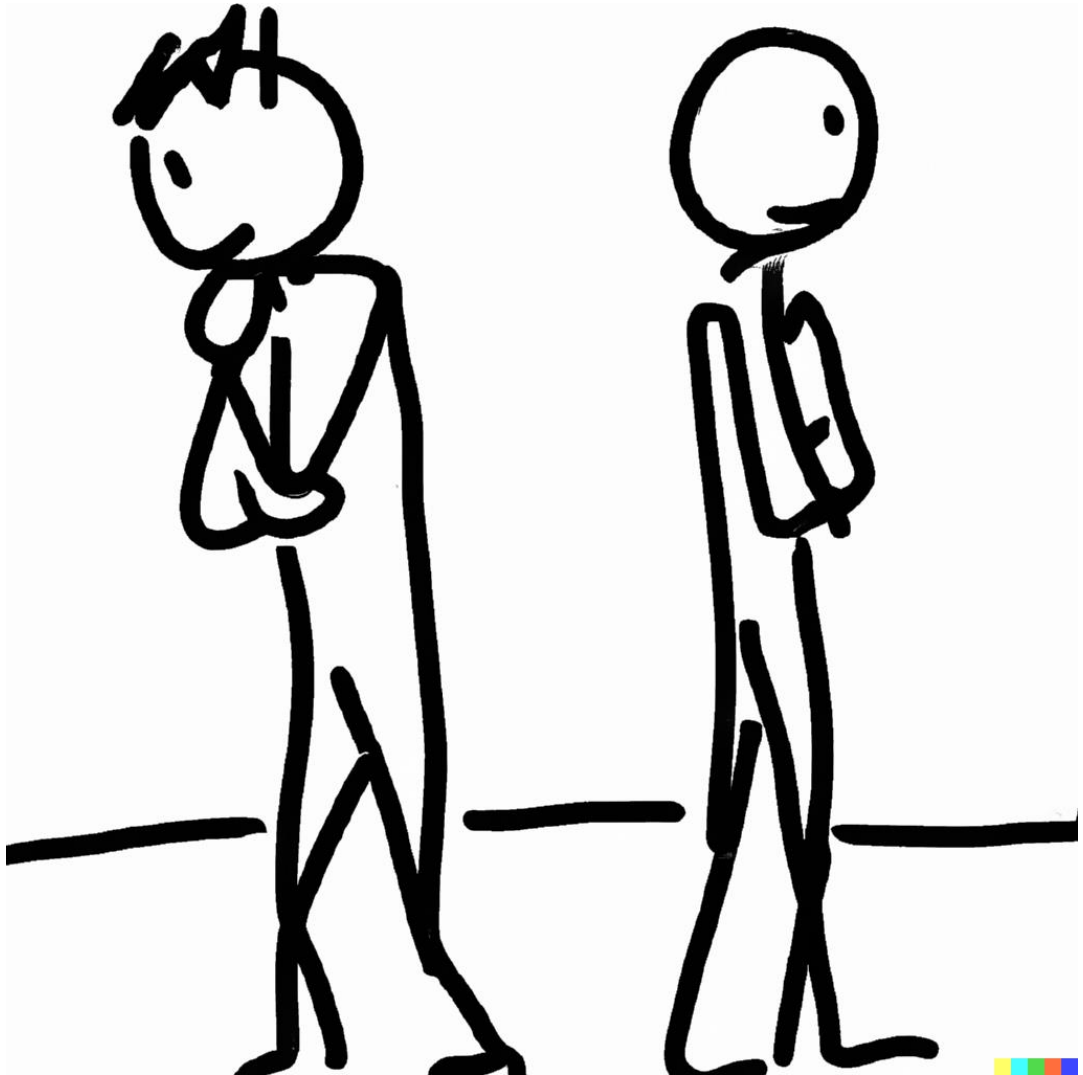
Mathematical background
Differentiation

Notes on Behavioural Economics

Jason Collins



Differentiation

$$\frac{d}{dx}f(x) \qquad \frac{dy}{dx} \qquad f'(x)$$

Differentiation

$$\frac{d}{dx}c = 0$$

Differentiation

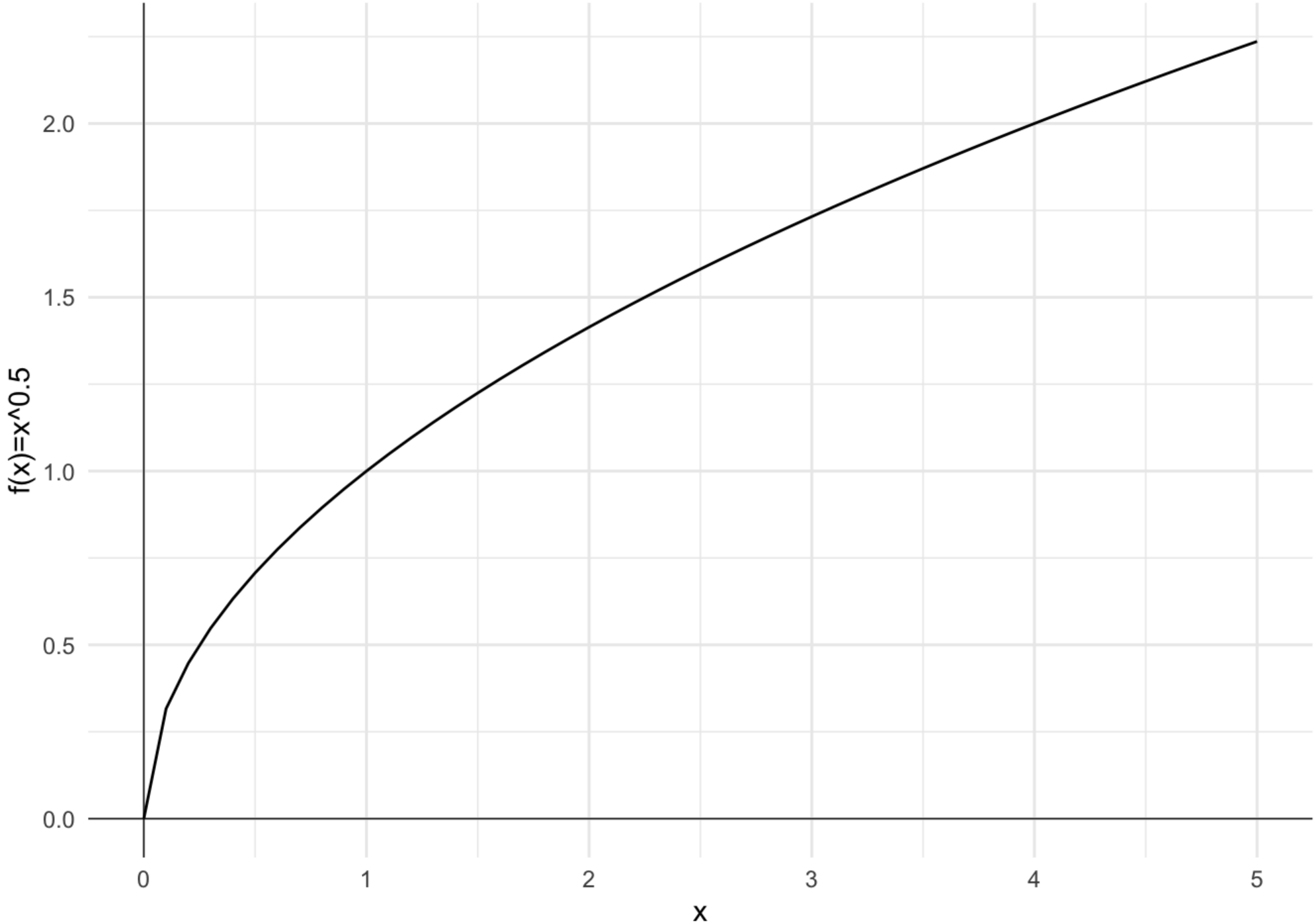
$$\frac{d}{dx} x^a = ax^{a-1}$$

Differentiation

$$\frac{d}{dx}x^2 = 2x$$

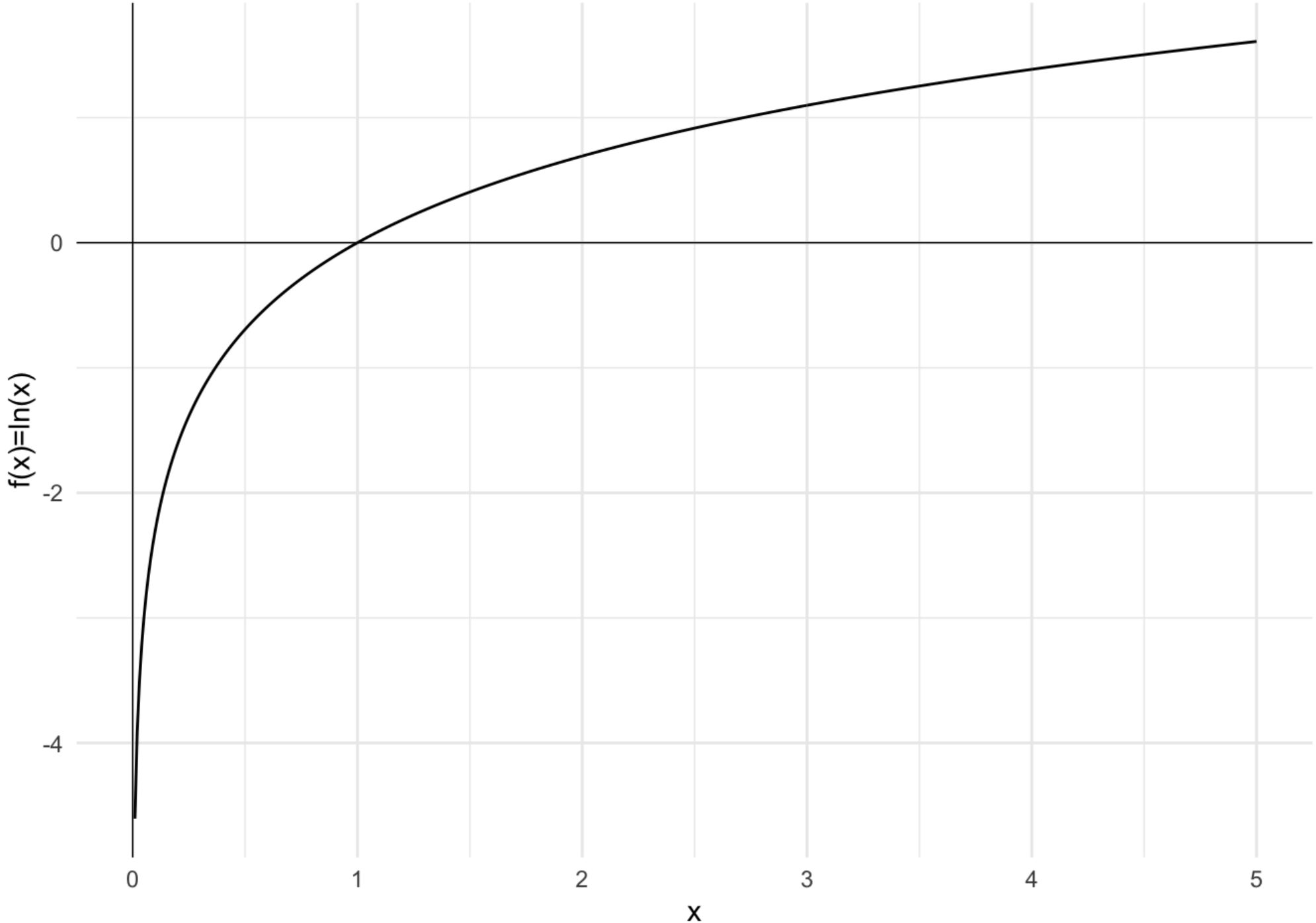
Differentiation

$$\frac{d}{dx} x^{0.5} = 0.5x^{-0.5}$$


f(x)=x^0.5
2.0
1.5
1.0
0.5
0.0
0
1
2
3
4
5
x

Differentiation

$$\frac{d}{dx}\ln(x) = \frac{1}{x}$$


0
-2
-4
f(x)=ln(x)
0
1
2
3
4
5
x

Differentiation

$$\frac{d}{dx}\frac{1}{f(x)} = -\frac{f'(x)}{f(x)^2}$$

Differentiation

$$\frac{d}{dx}\frac{1}{x} = -\frac{1}{x^2}$$

Differentiation

$$\frac{d}{dx}\frac{1}{x} = \frac{d}{dx}x^{-1} = -1x^{-2} = -\frac{1}{x^2}$$

The second derivative

$$\frac{d^2}{dx^2} f(x) = \frac{d}{dx}\left(\frac{d}{dx} f(x)\right)$$

The second derivative

$$\frac{d^2}{dx^2} f(x) \qquad \frac{d^2y}{dx^2} \qquad f''(x)$$

The second derivative

$$\frac{d^2}{dx^2} f(x) > 0 \text{ for all } x \Rightarrow f(x) \text{ is convex}$$

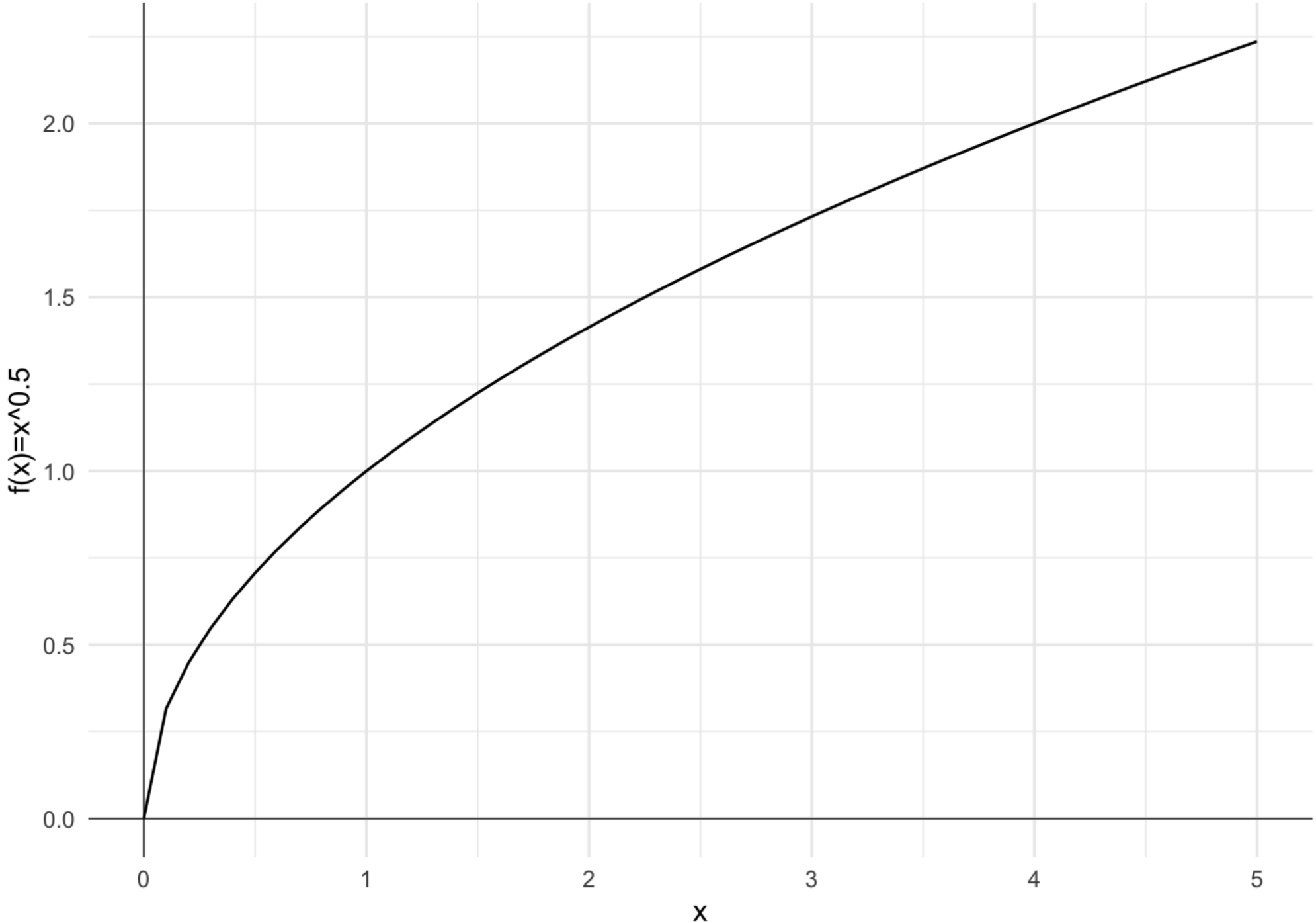
$$\frac{d^2}{dx^2} f(x) < 0 \text{ for all } x \Rightarrow f(x) \text{ is concave}$$

The second derivative

$$\frac{d^2}{dx^2}x^2 = \frac{d}{dx}2x = 2$$

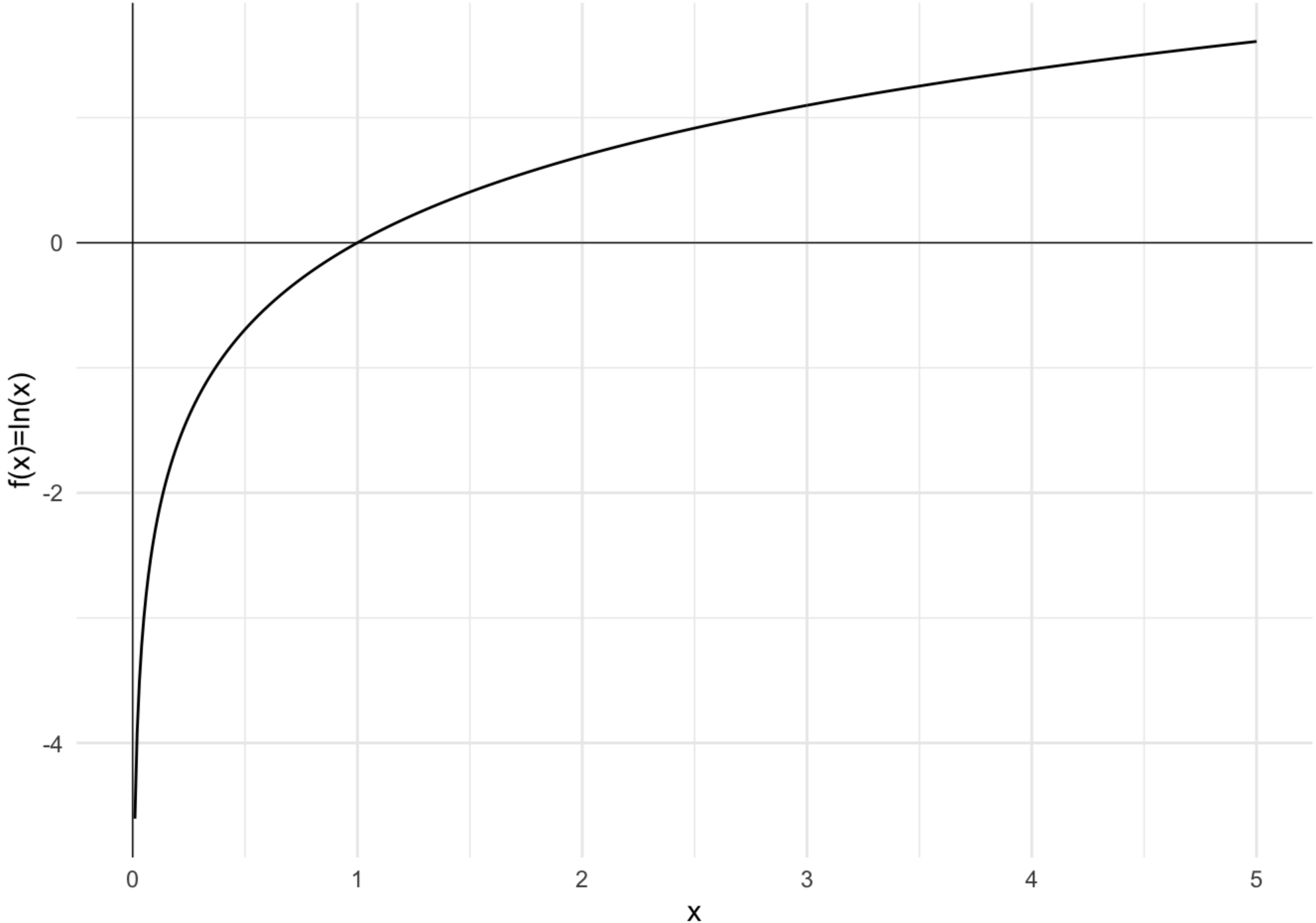
The second derivative

$$\frac{d^2}{dx^2} x^{0.5} = \frac{d}{dx} 0.5x^{-0.5} = -0.25x^{-1.5}$$


f(x)=x^0.5
2.0
1.5
1.0
0.5
0.0
0
1
2
3
4
5
x

The second derivative

$$\frac{d^2}{dx^2}\ln(x) = \frac{d}{dx}\frac{1}{x} = -\frac{1}{x^2}$$


0
-2
-4
f(x)=ln(x)
0
1
2
3
4
5
x