Fast Growth, Slow Growth: The Change of Base Formula

Video companion

1 Introduction

Generally use base 10, base 2, and natural log (base e) in data science.

$$\log_2(12) = 3.585 \qquad \log_2(7) = 2.807$$
$$\log_{10}(12) = 1.079 \qquad \log_{10}(7) = 0.8451$$

$$2^{3.585} = 12 \qquad 2^{2.807} = 7$$
$$10^{1.079} = 12 \qquad 10^{0.8451} = 7$$

The change of base formula: "Old" base is x, "new" base is a,

$$\log_a(b) = \frac{\log_x(b)}{\log_x(a)}$$ conversion factor

Examples
Want to convert $\log_{10}(12)$ to base $a = 2$:

$$\log_2(12) = \frac{\log_{10}(12)}{\log_{10}(2)} = \frac{1.079}{0.30103} = 3.585$$

Want to convert $\log_2(7)$ to base $a = 10$:

$$\log_{10}(7) = \frac{\log_2(7)}{\log_2(10)} = \frac{2.8073}{3.3219} = 0.8540$$