

### Helpful Base 10 Exponent Rules

- $(10^x)^y = 10^{xy}$
- $10^{x+y} = 10^x \times 10^y$
- $10^{x-y} = 10^x \div 10^y$
- $10^{-x} = (10^x)^{-1} = 1 \div 10^x$
- $1 \div 10^{-x} = (10^{-x})^{-1} = 10^x$
- If  $y = 10^x$ , then  $\log(y) = \log(10^x) = x$

### Helpful Base 10 Logarithm Rules

- $\log(x^y) = y \times \log(x)$
- $\log(xy) = \log(x) + \log(y)$
- $\log(x/y) = \log(x) - \log(y)$
- $\log(1/x) = \log(x)^{-1} = -\log(x)$
- $-\log(1/x) = \log(1/x)^{-1} = \log(x)$
- If  $y = \log(x)$ , then  $10^y = 10^{\log(x)} = x$

### Helpful Natural Exponent Rules

- $(e^x)^y = e^{xy}$
- $e^{x+y} = e^x \times e^y$
- $e^{x-y} = e^x \div e^y$
- $e^{-x} = (e^x)^{-1} = 1 \div e^x$
- $1 \div e^{-x} = (e^{-x})^{-1} = e^x$
- If  $y = e^x$ , then  $\ln(y) = \ln(e^x) = x$

### Helpful Natural Logarithm Rules

- $\ln(x^y) = y \times \ln(x)$
- $\ln(xy) = \ln(x) + \ln(y)$
- $\ln(x/y) = \ln(x) - \ln(y)$
- $\ln(1/x) = \ln(x)^{-1} = -\ln(x)$
- $-\ln(1/x) = \ln(1/x)^{-1} = \ln(x)$
- If  $y = \ln(x)$ , then  $e^y = e^{\ln(x)} = x$

### Helpful Logarithm Conversion Rules

- $\ln(x) = \ln(10^{\log(x)}) = \log(x) \times \ln(10) = \log(x) \times 2.303$
- $\log(x) = \log(e^{\ln(x)}) = \ln(x) \times \log(e) = \ln(x) \times 0.4343$
- $\ln(10) = \log(10) \div \log(e) = 1 \div \log(e) = 1 \div 0.4343 = 2.303$