**Derivatives of exponential functions**

$$\frac{d}{dx}(b^u) = b^u(\ln b)\,\frac{du}{dx}\,,$$
$$\frac{d}{dx}(e^u) = e^u\,\frac{du}{dx}\,.$$

In particular, $(e^x)' = e^x$ and $(b^x)' = b^x\,\ln b$.

**Example 1.** Differentiate $y = 2^{x^2}$ with respect to $x$ .

**Example 2.** Differentiate $y = e^{\sin x}$ with respect to $x$.

**Example 3.** Differentiate $y = \dfrac{e^x}{e^{\sin x}}$ with respect to $x$.

**Example 4.** Differentiate $y = x\,e^x$.

**Example 5**. Differentiate $y = \dfrac{e^{\cos x} \cdot e^{\arcsin x}}{e^{\arctan x}}$ .

**Example 6**. Differentiate implicitly to find $dy/dx$ if $e^y = x$.