**Find** $\frac{d}{dx}\left[5^x\right]$.

This is just a basic application of the derivative rule for exponentials with a = 5:

$$\frac{d}{dx}\left[5^x\right] = \ln(5)\cdot 5^x$$

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**Find the derivative of** $h(x) = x^2 e^x$.

Since this is a product

$$h(x) = \underset{u}{x^2}\,\underset{v}{e^x}$$

We'll use the product rule to find the derivative:

$$h'(x) = \underset{v}{e^x}\cdot\underset{u'}{2x} + \underset{u}{x^2}\cdot\underset{v'}{e^x}$$

This can be simplified by factoring $e^x$ from each term:

$$h'(x) = e^x\left(2x + x^2\right)$$

---

**Find the derivative of** $y = \frac{2x^3 + x}{e^x}$.

Write this as a quotient

$$y = \frac{\overset{u}{2x^3 + x}}{\underset{v}{e^x}}$$

Now write out the quotient rule with the appropriate derivatives:

$$y' = \frac{\overset{v}{e^x}\overset{u'}{\left(6x^2+1\right)} - \overset{u}{\left(2x^3+x\right)}\overset{v'}{e^x}}{\underset{v^2}{\left(e^x\right)^2}}$$

If we factor out the $e^x$ on top, we can simplify this considerably:

$$y' = \frac{e^x\left(6x^2+1-2x^3-x\right)}{\left(e^x\right)^2}$$
$$= \frac{6x^2+1-2x^3-x}{e^x}$$

---

**Find** $\frac{d}{dx}\left[e^{5x^3+3x^2+x}\right]$

Start by writing this as a composition:

$$g(x) = 5x^3+3x^2+x \quad \rightarrow \quad g'(x) = 15x^2+6x+1$$
$$f(x) = e^x \quad \rightarrow \quad f'(x) = e^x$$

Applying the chain rule leaves us with

$$\frac{d}{dx}\left[e^{5x^3+3x^2+x}\right] = \underbrace{e^{5x^3+3x^2+x}}_{f'(g(x))} \cdot \underbrace{\left(15x^2+6x+1\right)}_{g'(x)}$$