

DIFFERENTIATING SINE, COSINE & 'e'



$e \approx 2.718$

$$\frac{d}{dx} e^{f(x)} = f'(x)e^{f(x)}$$

$$\frac{d}{dx} \sin(f(x)) = f'(x) \cos(f(x))$$

$$\frac{d}{dx} \cos(f(x)) = -f'(x) \sin(f(x))$$

$$\frac{d}{dx} e^{f(x)} = f'(x)e^{f(x)}$$

Example 1: Find $\frac{d}{dx} e^{4x}$

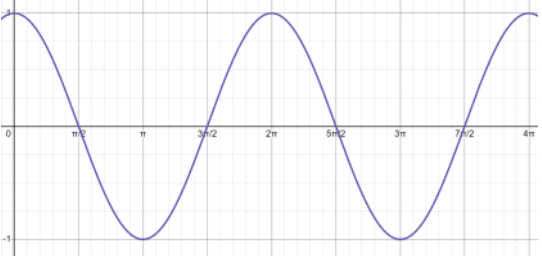
In this case, $f(x) = 4x$ and therefore $f'(x) = 4 \rightarrow \frac{d}{dx} e^{4x} = 4 \cdot e^{4x}$

Differentiating $\sin(x)$

Consider the graph of $\sin(x)$ below



The derivative of this function can be constructed graphically below...



Recognise this graph... $\cos(x)$

$$\text{So... } \frac{d}{dx} \sin(x) = \cos(x) \text{ and } \frac{d}{dx} \cos(x) = -\sin(x)$$

$$\text{More specifically... } \frac{d}{dx} \sin(f(x)) = f'(x) \cos(f(x)) \text{ and } \frac{d}{dx} \cos(f(x)) = -f'(x) \sin(f(x))$$

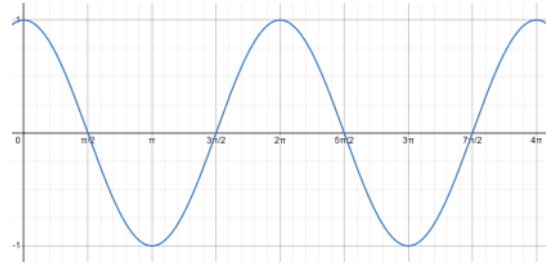
Example 2: Find $\frac{d}{dx} \sin(3x^2)$

In this situation... $f(x) = 3x^2$ and so $f'(x) = 6x$

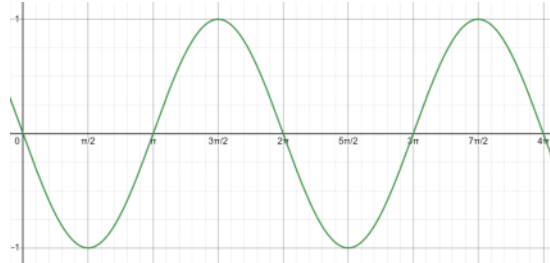
Therefore... $\frac{d}{dx} \sin(3x^2) = 6x \cdot \cos(3x^2)$

Differentiating $\cos(x)$

Consider the graph of $\cos(x)$ below



The derivative of this function can be constructed graphically below...



Recognise this graph... $-\sin(x)$



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