EULER'S RULE

This focuses on all of the Eulers Rule Differentiation laws involving e. e^x is the only function whose derivative is itself. There are a few other laws, like $e^{f(x)}$ and $ke^{f(x)}$, which also make differentiation a breeze.

Find the f'(e^{2x+5})

$$f(x) = e^{2x+5}$$
$$.\because f'(x) = 2e^{2x+5}$$

In order to differentiate, we rewrite the function without changing anything. After this, we differentiate the exponent. In this case, the derivative of 2x+5 is 2 as 5 is a constant and hence does not have a derivative (think of the function y=5, it is a horizontal line and as such, there is no change in the input relative to the output). This is how we obtain the derivative.

Find the f'($5e^{2x+5}$)

$$f(x) = 5e^{2x+5}$$
$$.\because f'(x) = 2 * 5e^{2x+5}$$
$$.\because f'(x) = 10e^{2x+5}$$

Now, as you can see above, there is an extension to this rule which involves a co-efficient of e. In this case, the number, generally denoted by k as a constant (unless it has an x or pronumeral in it), will remain out the front and is multiplied by the value derived through the f'(x) phase for the exponent, where the derivative of the exponent and the co-efficient of e make a product in simplification, this is shown by 5 being multiplied by 2 (2 being from the derivative of the exponent). If the derivative of the exponent was 15x or something, then you could still multiply this by the co-efficient to get 30x and have a more elegant solution too.

$$f(x) = 5e^{\frac{1}{5}}$$
$$.\because f'(x) = 5e^{\frac{1}{5}}(\frac{1}{5})$$
$$.\because f'(x) = \frac{1}{5} * \frac{5}{1} e^{\frac{1}{5}}$$
$$.\because f'(x) = e^{\frac{1}{5}}$$

Again, you may need to work with fractions and surds too.