Natural Exponential Function

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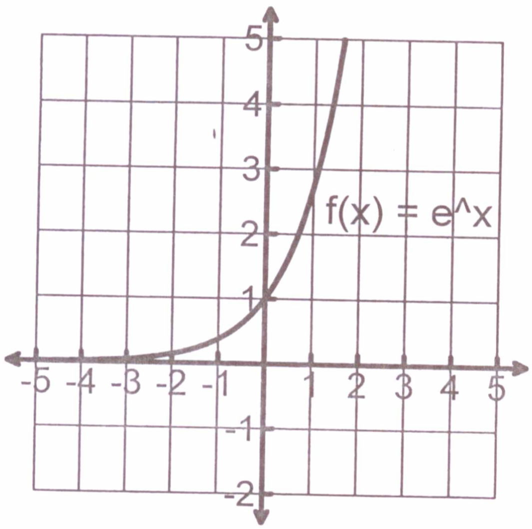

1. The inverse of $f(x) = e^x$ is $f^{(-1)}(x) = \ln(x)$.
2. Continuous, increasing everywhere (monotonic), and above the x-axis
3. $\lim_{x \to -\infty} e^x = 0$ and $\lim_{x \to \infty} e^x = \infty$
4. Exponential functions grow faster than polynomial or logarithmic functions.

$$\frac{d}{dx}(e^x) = e^x \qquad \frac{d}{dx} = \text{du}(e^u)$$

Find the derivatives:

1. $y = e^{(2x-1)}$

$y' = 2e^{2x-1}$

**2. If $f(x) = \frac{e^{2x}}{2x}$, then find $f'(x)$.

$y' = \frac{(2x)(2e^{2x}) - (e^{2x})(2)}{(2x)^2} = \frac{4xe^{2x} - 2e^{2x}}{4x^2} = \frac{2e^{2x}(2x-1)}{4x^2} = \frac{e^{2x}(2x-1)}{2x^2}$

**3. If $f(x) = e^x$, which of the following is equal to $f'(e)$?

A. $\lim_{h \to 0} \frac{e^{(x+h)} - e^e}{h}$ B. $\lim_{h \to 0} \frac{e^{(e+h)} - e}{h}$ C. $\lim_{h \to 0} \frac{e^{(e+h)} - e^e}{h}$

$\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ or $\lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$

$a = e$
$f(a) = e^x$

**(calc.) 4. Let f be a function given by $f(x) = 3e^{2x}$ and let g be a function given by $g(x) = 6x^3$. At what value(s) of x do the graphs of f and g have parallel tangent lines?

$f'(x) = 6e^{2x}$
$g'(x) = 18x^2$

$6e^{2x} = 18x^2$
$e^{2x} = 3x^2$
$e^{2x} - 3x^2 = 0$

$x = -.3906$