Sketch of Lecture 1

Tue, 8/18/2015

Review of our zoo of functions

- polynomials

  x^2, x^3, $7x^4 - x + 2$, ...
- rational functions

  $\frac{1}{x+1}$, $\frac{x^2-2x-3}{x^3+7}$, ...
- power functions

  x^2, $x^{1/2} = \sqrt{x}$, $x^{-1/2} = \frac{1}{\sqrt{x}}$, ...
- exponentials

  2^x, e^x, ...
- logarithms

  $\ln(x) = \log_e(x)$, $\log_2(x)$, ...
- trigonometric functions

  $\sin(x)$, $\cos(x)$, $\tan(x) = \frac{\sin(x)}{\cos(x)}$, ...
- inverse trig functions

  $\arcsin(x)$, $\arccos(x)$, $\arctan(x)$, ...

Review of derivatives

If $y(x)$ is a function, then its derivative is denoted $y'(x)$ or $\frac{\mathrm{d}}{\mathrm{d}x} y(x)$ (or, in physics, $\dot{y}(x)$).

Recall the interpretation of $y'(a)$ as the slope of the line best approximating the function $y(x)$ at the value $x = a$.

Example 1. State the product rule, the quotient rule and the chain rule.

Example 2.

(a) $\frac{\mathrm{d}}{\mathrm{d}x} x^3 =$

(b) $\frac{\mathrm{d}}{\mathrm{d}x} x^a =$ (a is just some number.)

(c) $\frac{\mathrm{d}}{\mathrm{d}x} \frac{1}{\sqrt{x}} =$

(d) $\frac{\mathrm{d}}{\mathrm{d}x} \sin(x) =$

(e) $\frac{\mathrm{d}}{\mathrm{d}x} \cos(x) =$

(f) $\frac{\mathrm{d}}{\mathrm{d}x} \sin(x^2+1) =$

(g) $\frac{\mathrm{d}}{\mathrm{d}t} e^{-t}(t^2 - 2t + 2) =$

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