# Critical Numbers

Math 2413
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Pg 32

**Def.** Let $f$ be a function defined at $c$. Then $c$ is a critical number of $f$ if one of the following is true:

1) $f'(c) = 0$
1) $f'(c)$ DNE

* We need to factor derivatives to more easily see where they equal zero.

**Ex.** $f(x) = \frac{6}{5}x^5 + 3x^4 - 30x^3$

$f'(x) = 6x^4 + 12x^3 - 90x^2$ → defined on all real #

$= 6x^2(x^2 + 2x - 15)$

$= 6x^2(x-3)(x+5) = 0$ for $x = \underbrace{-5, 0, 3}_{\text{crit \# of } f}$

**Ex.** $g(t) = t\sqrt{4-t}$, $0 < t < 4$

$g'(t) = \sqrt{4-t} + t\left(\frac{-1}{2\sqrt{4-t}}\right)$

$= \frac{2(4-t) - t}{2\sqrt{4-t}} = \frac{8-3t}{2\sqrt{4-t}}$

$g'$ not defined at $t=4$, but $g$ not defined there, so $t=4$ is not a crit # of $g$.

$g'(t) = 0 \longrightarrow 8 - 3t = 0$

$8 = 3t$

$\frac{8}{3} = t$ ← the only other crit #.

**Ex.** $h(x) = 6x + \cos(x)$

$h' = 6 - \sin(x) \neq 0$

Sin defined on $\mathbb{R}$, so no crit #