<u>Finding Extrema Using Critical Numbers</u>

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<u>Critical Numbers</u>: Let f be defined at c. If $f'(c) = 0$ or if f' is undefined at c, then c is a critical number. To find the critical point, find the y-value of the function at c or $f(c)$.

To find extrema of f for [a,b]:

1. Find the critical numbers of f in (a,b)
2. Evaluate f at each critical number in (a,b)
3. Evaluate f at each endpoint of [a,b]
4. The least value = minimum and the greatest value = maximum

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**(calc.) 1. For $f'(x) = \dfrac{\cos^2 x}{x} - \dfrac{1}{5}$ how many critical values does f have on the interval (0, 10)? 3

2. Find the extrema values on $f(x) = \dfrac{9(x^2 - 3)}{x^3}$ for [-4, -1].

$9x^2 - 27$

easier to use $f = \dfrac{9x^2}{x^3} - \dfrac{27}{x^3}$

$f'(x) = \dfrac{(x^3)(18x) - (9x^2-27)(3x^2)}{(x^3)^2} = \dfrac{3x^2(6x^2 - 9x^2 + 27)}{x^6}$

$\dfrac{3x^2(-3x^2 + 27)}{x^6} = \dfrac{9(-x^2+9)}{x^4} = 0$ $x = \pm 3$ ~~$x = 3$~~ ~~$x = 0$~~

$= 0$

$f(-4) = -\dfrac{117}{64}$

$\boxed{f(-1) = 18 \text{ max value}}$

$\boxed{f(-3) = -2 \text{ min value}}$

**3. The absolute maximum value of $f(x) = x^3 - 3x^2 + 12$ on the interval [-2, 4] is <u>28</u>.

$64 - 48 + 12$

$f'(x) = 3x^2 - 6x = 0$

$3x(x-2) = 0$

$x = 0$ $x = 2$

$f(-2) = -8$ ← global min

$f(0) = 12$

$f(2) = 8$

$f(4) = 28$ ← global max