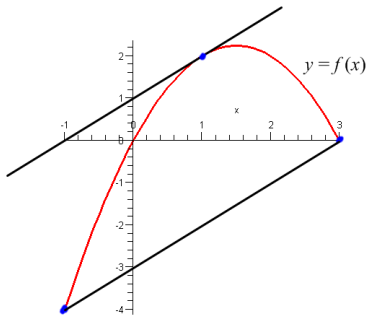
Info

- There is no Homework due next Monday.
- There are EMCFs due every MWF.
- There is an Online Quiz due Monday.
- Take care of Practice Test 2!!
- Schedule and take Test 2!

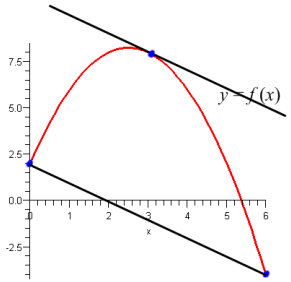
The Mean Value Theorem

Section 4.1

Question: **How many values are there between -1 and 3 where the tangent line is parallel to the secant line connecting (-1 , $f(-1)$) and (3 , $f(3)$)?**



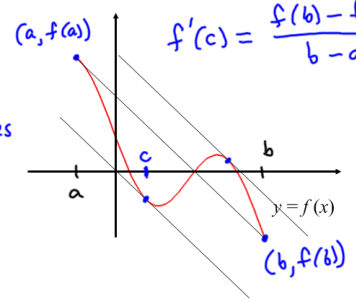
Question: How many values are there between 0 and 6 where the tangent line is parallel to the secant line connecting (0 , $f(0)$) and (6 , $f(6)$)?



General Question: Are there values between a and b where the tangent line is parallel to the secant line connecting $(a, f(a))$ and $(b, f(b))$?

yes.

we see 2 values

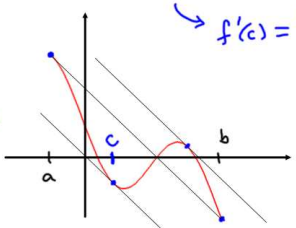


$$f'(c) = \frac{f(b) - f(a)}{b - a}$$

Mean Value Theorem: If f is continuous on $[a,b]$ and differentiable on (a,b), then there is at least one value c between a and b so that

$$f(b) - f(a) = f'(c)(b - a)$$

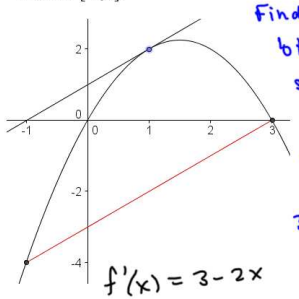
$$f'(c) = \frac{f(b) - f(a)}{b - a}$$



special case

Rolle's Theorem: Same conditions on f. If $f(a) = f(b) = 0$ then there is at least one value c between a and b where $f'(c) = 0$.

Example: Verify the mean value theorem for $f(x) = 3x - x^2$ on the interval $[-1,3]$.



Find a value c btwn -1 and 3 so that

$$f'(c) = \frac{f(3) - f(-1)}{3 - -1}$$

$$3 - 2c = \frac{0 - -4}{4}$$

$f'(x) = 3 - 2x$

$3 - 2c = 1$

$2c = 2$

$c = 1$ ✓

Note: $-1 < 1 < 3$.

Example: How many values of x satisfy the conclusion of the Mean Value Theorem for $f(x) = 3x + \sin(x)$ on the interval $[-1,8]$.

1. Algebraically. Find all values c btwen -1 and 8 so that

$$f'(c) = \frac{f(8) - f(-1)}{8 - -1}$$

$f'(x) = 3 + \cos(x)$

$3 + \cos(c) = 3.203425470 2\ldots$

$\cos(c) = .203425470 2\ldots$

$-1 < c < 8$

3 values