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!

P12

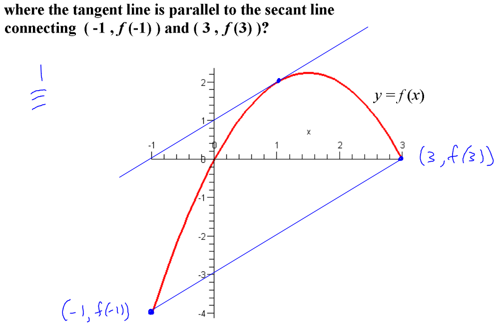
1. Use Newton's method with a guess of 2 to approximate a solution to $x^4 - \sin(x) - 8x = 0$.

2. Use differentials to approximate $\sin(61^{\circ})$. Hint: Convert 61° to radians, and note that this value is close to $\pi/3$.

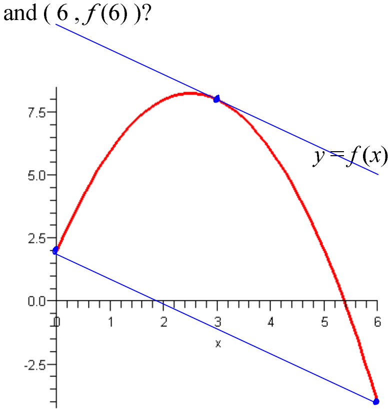
The Mean Value Theorem

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))?**

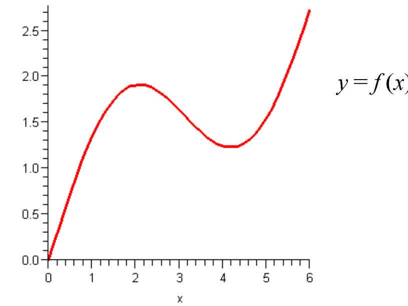


Question: How many values are there between 0 and 6 where the tangent line is parallel to the secant line connecting $(0, f(0))$ and $(6, f(6))$?



P12

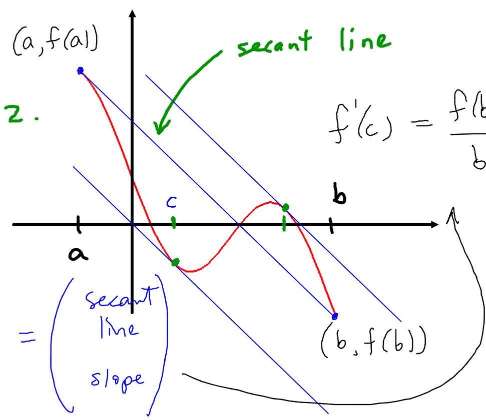
3. How many values are there between 0 and 6 where the tangent line is parallel to the secant line connecting $(0, f(0))$ and $(6, f(6))$?



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.



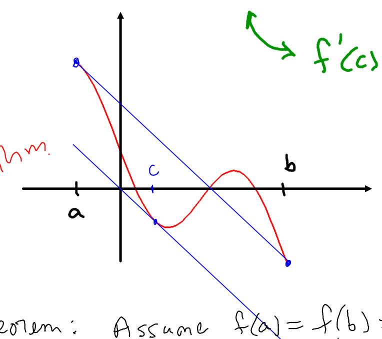
$$f'(c) = \frac{f(b)-f(a)}{b-a}$$

$$\begin{pmatrix}\text{tangent line} \\ \text{slope at} \\ x=c\end{pmatrix} = \begin{pmatrix}\text{secant} \\ \text{line} \\ \text{slope}\end{pmatrix}$$

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

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

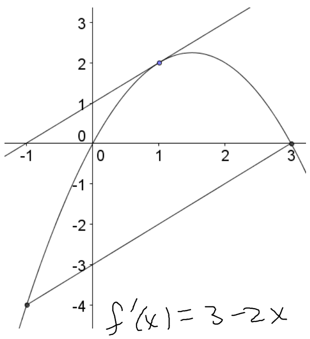
$$f'(c) = \frac{f(b)-f(a)}{b-a}$$



special case of MVThm

Rolle's Theorem: Assume $f(a) = f(b) = 0$. There is at least one value c btwn a and b so that $f'(c) = 0$.

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



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

We need to find $-1 < c < 3$ so that

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

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

$$3 - 2c = 1$$

$$\boxed{c = 1}$$ ✓

Note: $-1 < 1 < 3$.

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4. There is exactly one value that satisfies the conclusion of the mean value theorem for the function $f(x) = x^3 + x - 1$ on the interval $[0,2]$. Give this value.

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

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

MVThm: There is at least one value c btwn -1 and 8 so that

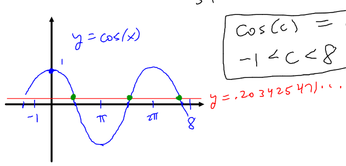
$$f'(c) = \frac{f(8) - f(-1)}{8 - -1}$$

How many c values are there?

$$3 + \cos(c) = \frac{24 + \sin(8) - (-3 + \sin(-1))}{9}$$

$$3 + \cos(c) = 3.20342547\ldots$$

$$\boxed{\begin{array}{l} \cos(c) = .20342547\ldots \\ -1 < c < 8 \end{array}}$$



3 values