Author 1 _____

Author 2 _____

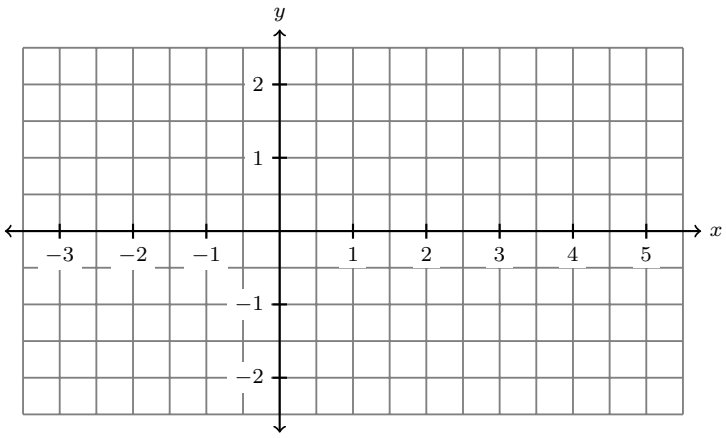
Author 3 _____

21 – Mean Value Theorem

1. For each part, draw (if possible) the graph of a function f that has the given properties:

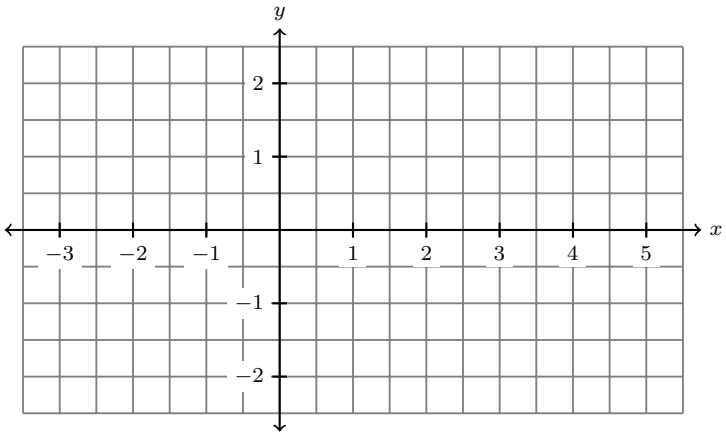
(a)

- f is continuous on $[-2, 4]$
- f is differentiable on $(-2, 4)$
- f has **NO** horizontal tangent lines



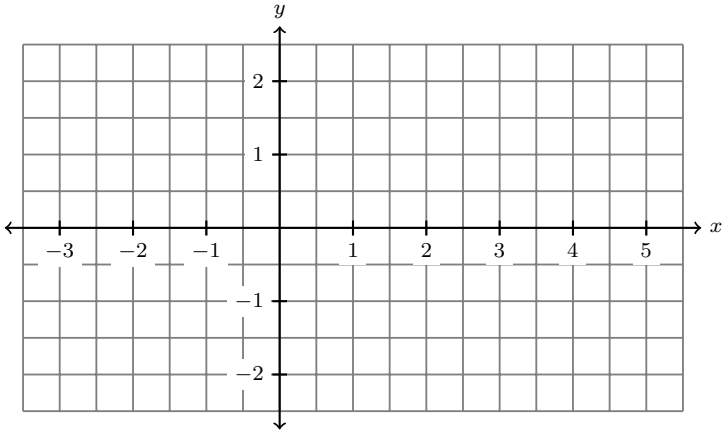
(b)

- f is continuous on $[-2, 4]$
- $f(-2) = f(4)$
- f has **NO** horizontal tangent lines



(c)

- f is continuous on $[-2, 4]$
- f is differentiable on $(-2, 4)$
- $f(-2) = f(4)$
- f has **NO** horizontal tangent lines



Theorem: Mean Value Theorem

Suppose that f is continuous on $[a, b]$ and f is differentiable on (a, b). Then there is at least one number c in the interval (a, b) such that

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

Theorem: Functions with the Same Derivative

If $f'(x) = g'(x)$, then $f(x) = g(x) + C$ for some constant C.

2. Let $h(x) = \sin(x) + 1$

(a) Find a function whose derivative is $h(x)$. That is, find a formula for $f(x)$ such that $f'(x) = h(x)$.

(b) Find a different function whose derivative is $h(x)$.

(c) How many different functions do you think there are whose derivative is $h(x)$?

(d) Use the theorem above to write an expression that represents *all* functions whose derivative is $h(x)$.