

# Calculus I

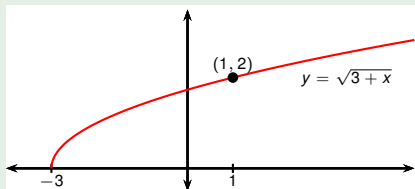
## Linearize a given function, part 1

Todor Milev

2019

## Example

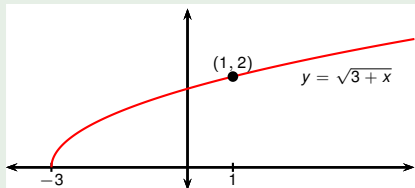
Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?



## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

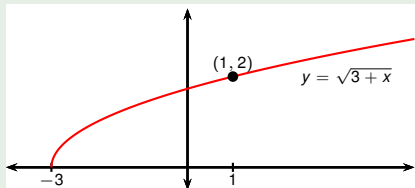
- $f'(x) = ?$
- $f(1) = ?$
- $f'(1) = ?$
- Linearization:



## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

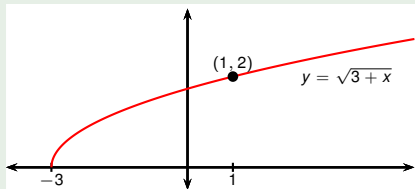
- $f'(x) = ?$
- $f(1) = ?$
- $f'(1) = ?$
- Linearization:



## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

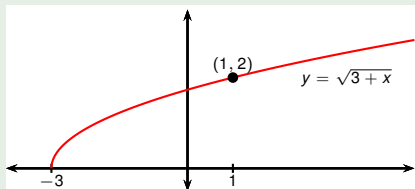
- $f'(x) = \frac{1}{2\sqrt{x+3}}$ .
- $f(1) = ?$
- $f'(1) = ?$
- Linearization:



## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

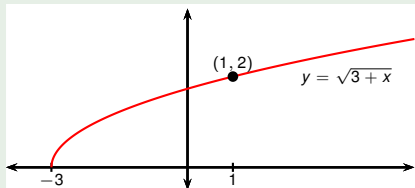
- $f'(x) = \frac{1}{2\sqrt{x+3}}$ .
- $f(1) = ?$
- $f'(1) = ?$
- Linearization:



## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

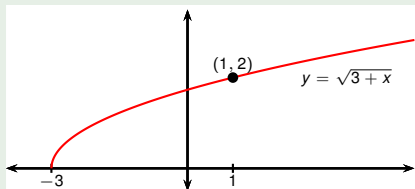
- $f'(x) = \frac{1}{2\sqrt{x+3}}$ .
- $f(1) = \sqrt{1+3} = 2$ .
- $f'(1) = ?$
- Linearization:



## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

- $f'(x) = \frac{1}{2\sqrt{x+3}}$ .
- $f(1) = \sqrt{1+3} = 2$ .
- $f'(1) = ?$
- Linearization:

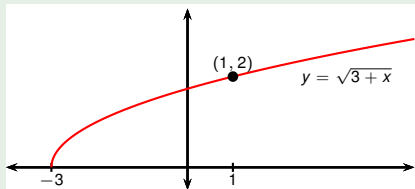




## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

- $f'(x) = \frac{1}{2\sqrt{x+3}}$ .
- $f(1) = \sqrt{1+3} = 2$ .
- $f'(1) = \frac{1}{2\sqrt{1+3}} = \frac{1}{4}$ .
- Linearization:

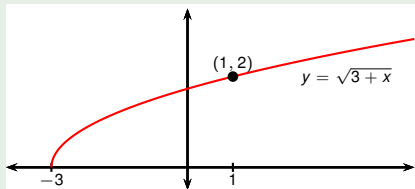


## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

- $f'(x) = \frac{1}{2\sqrt{x+3}}$ .
- $f(1) = \sqrt{1+3} = 2$ .
- $f'(1) = \frac{1}{2\sqrt{1+3}} = \frac{1}{4}$ .
- Linearization:

$$L(x) = ? + ? (x - ?)$$

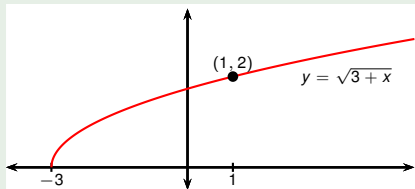


## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

- $f'(x) = \frac{1}{2\sqrt{x+3}}$ .
- $f(1) = \sqrt{1+3} = 2$ .
- $f'(1) = \frac{1}{2\sqrt{1+3}} = \frac{1}{4}$ .
- Linearization:

$$L(x) = ? + ? (x - 1)$$

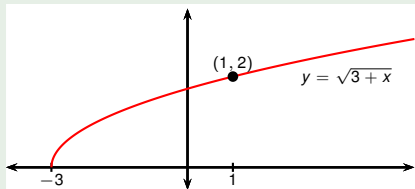


## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

- $f'(x) = \frac{1}{2\sqrt{x+3}}$ .
- $f(1) = \sqrt{1+3} = 2$ .
- $f'(1) = \frac{1}{2\sqrt{1+3}} = \frac{1}{4}$ .
- Linearization:

$$L(x) = \textcolor{red}{?} + \textcolor{red}{?} (x - 1)$$

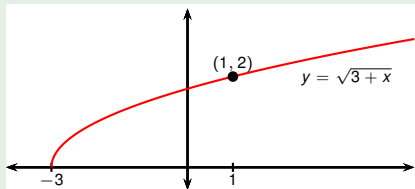


## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

- $f'(x) = \frac{1}{2\sqrt{x+3}}$ .
- $f(1) = \sqrt{1+3} = 2$ .
- $f'(1) = \frac{1}{2\sqrt{1+3}} = \frac{1}{4}$ .
- Linearization:

$$L(x) = 2 + ? (x - 1)$$

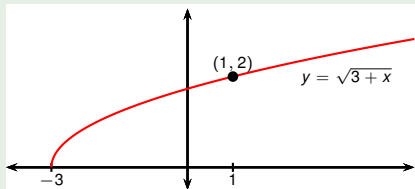


## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

- $f'(x) = \frac{1}{2\sqrt{x+3}}$ .
- $f(1) = \sqrt{1+3} = 2$ .
- $f'(1) = \frac{1}{2\sqrt{1+3}} = \frac{1}{4}$ .
- Linearization:

$$L(x) = 2 + ? (x - 1)$$

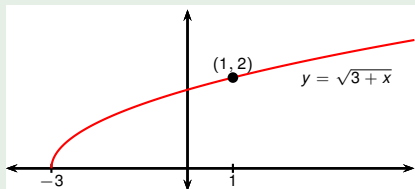


## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

- $f'(x) = \frac{1}{2\sqrt{x+3}}$ .
- $f(1) = \sqrt{1+3} = 2$ .
- $f'(1) = \frac{1}{2\sqrt{1+3}} = \frac{1}{4}$ .
- Linearization:

$$L(x) = 2 + \frac{1}{4}(x - 1)$$

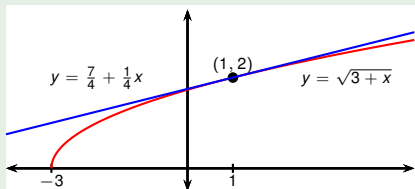


## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

- $f'(x) = \frac{1}{2\sqrt{x+3}}$ .
- $f(1) = \sqrt{1+3} = 2$ .
- $f'(1) = \frac{1}{2\sqrt{1+3}} = \frac{1}{4}$ .
- Linearization:

$$\begin{aligned} L(x) &= 2 + \frac{1}{4}(x - 1) \\ &= \frac{7}{4} + \frac{x}{4} \end{aligned}$$



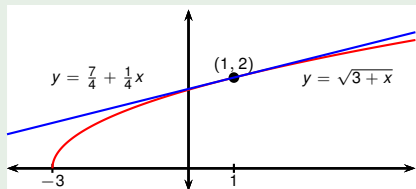


## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

- $f'(x) = \frac{1}{2\sqrt{x+3}}$ .
- $f(1) = \sqrt{1+3} = 2$ .
- $f'(1) = \frac{1}{2\sqrt{1+3}} = \frac{1}{4}$ .
- Linearization:
 
$$L(x) = 2 + \frac{1}{4}(x - 1)$$

$$= \frac{7}{4} + \frac{x}{4}$$



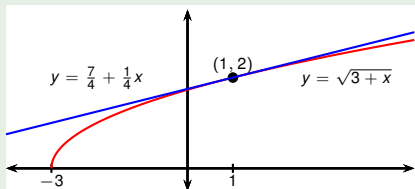
- $\sqrt{3.98} = f(0.98) \approx ?$
- $\sqrt{4.05} = f(1.05) \approx ?$

## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

- $f'(x) = \frac{1}{2\sqrt{x+3}}$ .
- $f(1) = \sqrt{1+3} = 2$ .
- $f'(1) = \frac{1}{2\sqrt{1+3}} = \frac{1}{4}$ .
- Linearization:
 
$$L(x) = 2 + \frac{1}{4}(x - 1)$$

$$= \frac{7}{4} + \frac{x}{4}$$



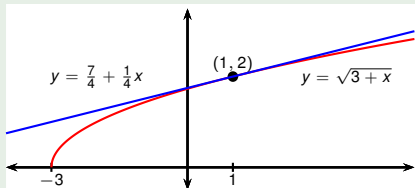
- $\sqrt{3.98} = f(0.98) \approx ?$
- $\sqrt{4.05} = f(1.05) \approx ?$

## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

- $f'(x) = \frac{1}{2\sqrt{x+3}}$ .
- $f(1) = \sqrt{1+3} = 2$ .
- $f'(1) = \frac{1}{2\sqrt{1+3}} = \frac{1}{4}$ .
- Linearization:

$$\begin{aligned} L(x) &= 2 + \frac{1}{4}(x - 1) \\ &= \frac{7}{4} + \frac{x}{4} \end{aligned}$$



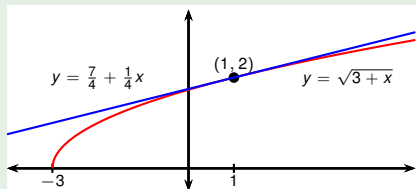
- $\sqrt{3.98} = f(0.98) \approx \frac{7}{4} + \frac{0.98}{4} = 1.995$ .
- $\sqrt{4.05} = f(1.05) \approx ?$

## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

- $f'(x) = \frac{1}{2\sqrt{x+3}}$ .
- $f(1) = \sqrt{1+3} = 2$ .
- $f'(1) = \frac{1}{2\sqrt{1+3}} = \frac{1}{4}$ .
- Linearization:

$$\begin{aligned} L(x) &= 2 + \frac{1}{4}(x - 1) \\ &= \frac{7}{4} + \frac{x}{4} \end{aligned}$$



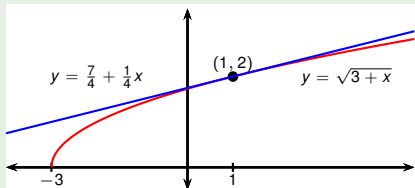
- $\sqrt{3.98} = f(0.98) \approx \frac{7}{4} + \frac{0.98}{4} = 1.995$ .
- $\sqrt{4.05} = f(1.05) \approx ?$

## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

- $f'(x) = \frac{1}{2\sqrt{x+3}}$ .
- $f(1) = \sqrt{1+3} = 2$ .
- $f'(1) = \frac{1}{2\sqrt{1+3}} = \frac{1}{4}$ .
- Linearization:

$$\begin{aligned} L(x) &= 2 + \frac{1}{4}(x - 1) \\ &= \frac{7}{4} + \frac{x}{4} \end{aligned}$$



- $\sqrt{3.98} = f(0.98) \approx \frac{7}{4} + \frac{0.98}{4} = 1.995$ .
- $\sqrt{4.05} = f(1.05) \approx \frac{7}{4} + \frac{1.05}{4} = 2.0125$ .

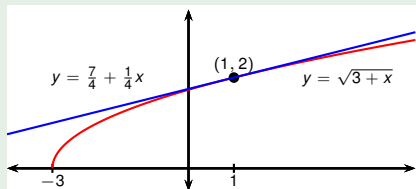
## Example

Find the linearization of the function  $f(x) = \sqrt{x+3}$  at  $a = 1$  and use it to approximate the numbers  $\sqrt{3.98}$  and  $\sqrt{4.05}$ . Are these approximations overestimates or underestimates?

- $f'(x) = \frac{1}{2\sqrt{x+3}}$ .
- $f(1) = \sqrt{1+3} = 2$ .
- $f'(1) = \frac{1}{2\sqrt{1+3}} = \frac{1}{4}$ .
- Linearization:  

$$L(x) = 2 + \frac{1}{4}(x - 1)$$

$$= \frac{7}{4} + \frac{x}{4}$$



The graph of the linearization is above the curve, so these are overestimates.

- $\sqrt{3.98} = f(0.98) \approx \frac{7}{4} + \frac{0.98}{4} = 1.995$ .
- $\sqrt{4.05} = f(1.05) \approx \frac{7}{4} + \frac{1.05}{4} = 2.0125$ .