Math 2413- Calculus I

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- Check CASA calendar for due dates.
- Bring "blank notes" to class. Completed notes will be posted after class.
- Do your best to attend every lecture and lab.
- Study after every lecture; work on the quiz covering the topic we cover on the lecture immediately afterwards. Retake your quizzes for more practice.
- Get help when you need help; bring your questions to the labs, or my office hours. We also have tutoring options on campus.
- Respect your friends in class; stay away from distractive behavior. Do your best to concentrate on the lecture.
- If you email me, mention the course code in the subject line. Email is the best way to communicate with me outside of class. Teams chat messages are not monitored or replied to.

Section 5.2 - Differentials



Definition: For $h \neq 0$, the difference f(x+h) - f(x) is called the *increment of* f *from* x *to* x+h and this increment is denoted by Δf :

$$\Delta f = f(x+h) - f(x).$$

The product f'(x)h is called the *differential* f at x with increment h and is denoted by df:

$$df = f'(x)h.$$

For small h, $\Delta f \approx df$. Notice that

$$f(x+h)-f(x) \approx df \implies f(x+h) \approx f(x)+df$$
.

To approximate f(x+h), we first calculate the differential df = f'(x)h and then add this to the function value:

$$f(x+h) \approx f(x) + df$$

Example 1: Find the differential of $f(x) = \sqrt{x+5}$ at x = 4 with increment h = 0.1.

Example 2: Use differentials to approximate $\sqrt{5}$.





Example 3: Use differentials to approximate $\sqrt[3]{25}$.



Example 4: Use differentials to approximate $31^{2/5}$.



Example 5: Given that $\ln(2) \approx 0.69$, use differentials to approximate $\ln(2.1)$.



Example 5: Use differentials to approximate $\sin(29^0)$.

In some problems, you're simply asked for the differential $df = f'(a) \cdot h$.

Example 6: The total cost incurred in operating a certain type of truck on a 500mile trip, traveling at an average speed of *x* mph, is estimated to be $C(x) = 125 + x + \frac{4500}{x}$ dollars. Find the approximate change in total operating cost when the average speed is increased from 55mph to 58 mph.

Attendance Popper

Q# Use differentials to approximate $\sqrt{6}$.

- a) 7/4
- b) 5/2
- c) 3
- d) 21/8
- e) None

Q# Find the differential of $f(x) = \sqrt{x}$ at x=9 with increment h = 0.3.

- a) 1/10
- b) 1/5
- c) 1/20
- d) 2/15
- e) None
- **Q#** Use differentials to approximate $(33)^{1/5}$.
 - a) 163/80 b) 161/80 c) 81/40 d) 83/40 e) None