Hello everybody, my name is Nathaniel Takle and I will be the Calculus Master tutor this year. I am here to help you excel in Calculus throughout the semester! My biggest tip for learning calculus is doing practice problems! If you are stumped by a practice problem, refer to videos that work the problem and explain the concept! The following is a link to the Baylor Tutoring YouTube page with videos on EACH concept that is covered during Calculus! (https://www.baylor.edu/case/index.php?id=978621) I would love to help you succeed in any way, please feel free to reach out to me at Nathaniel_Takle1@baylor.edu if you have questions or would like further explanation on a topic.

These resources are a culmination of the main topics learned each week. These are meant to provide you with explanations and more practice to master Calculus this semester!! Remember: The Tutoring Center offers free individual and group tutoring for Calculus.

**Calculus Group Tutoring sessions will be Mondays from 5:15-6:15 PM at the Sid Rich basement, room 74!**

You can reserve a spot at https://baylor.edu/tutoring. I hope to see you there!

**Keywords:** Displacement, Net and Total Change, Integrating Inverse Trigonometry

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**Topic of the Week: Net and Total Change**

In chapter 5.6 we are covering one of the uses that exists for an integral. If you need to calculate the displacement of an object over a period of time, and you know the equation for its rate of change you can find the total displacement from time (1) to time (2) as equal to the integral from time (1) to time (2) of the rate of change, or in in mathematics:

\[
(position \ at \ t = 1) \ - \ (position \ at \ t = 2) = \int_{t_1}^{t_2} v(t) dt
\]

*This tells us the net distance traveled.*

If we want the total distance traveled (rather than just the change in position), we can use the formula

\[
\int_{t_1}^{t_2} |v(t)| dt
\]

*This absolute value makes it so that even any negative distance traveled is included into total distance traveled counts.*
Take this example to help. If I am driving from Waco to Boston, I am now a ton of miles away from where I started. However, if I drive right back to Waco. I am zero miles from where I started. Therefore my **net** distance travelled is zero.

However, my **total** distance travelled is a ton of miles because I travelled all the way from Waco to Boston and back!

- **Video Resource:**
  - [https://www.youtube.com/watch?v=Gim1ScMnGCE](https://www.youtube.com/watch?v=Gim1ScMnGCE)
- **Practice problem 1**
  - What was the total displacement of a person moving at velocity = \( t^2 \) from t=1 to t=3?

### Highlight: Displacement

- To find the **net** displacement of the function shown on the right, you need only take the integral of \( f(x) \) from “a” to “b.” The area under the x-axis will be a negative value (similar to driving back towards Waco on your trip to Boston).
- If you want to find the **total** displacement of \( f(x) \) from “a” to “b,” you will need to take the integral of the first blue area, then the **absolute value** of the yellow area, then the area of the second blue section. You will need to set three different intervals with parameters (or “a” and “b”) from a to the first point where it crosses the x-axis (First star). And another from the first star to the second star. And a third from the second star to “b”.
- **Video Resource:**
  - [https://www.youtube.com/watch?v=ERjAq1b4dNo](https://www.youtube.com/watch?v=ERjAq1b4dNo)
- **Practice Problem 2**
  - What was the displacement of a person moving at velocity = \( 3t^2 - 2t \) from t=1 to t=3?
  - What is the distance?

### Highlight: More Key Integration Functions

As you all progress further into chapter 5, you will come across more integration functions that are essential to integrating trigonometric functions.

Below are the antiderivatives of trig functions. Again, look at the similar patterns of deriving the answer and see what you get. If you memorized the derivatives of arcsin, arctan, and arccos, you should be able to remember the antiderivative well!
As it turns out, due to the equation of inverse cos, cot, and csc, the integrals that would produce these functions are identical to the three inverse trig functions above, except with a negative sign in front of the integral.

- Video Resource
  - https://www.youtube.com/watch?v=ogmCePJg1xE
- Practice problem 3
  - Solve \( \int \frac{dx}{\sqrt{4-9x^2}} \).

**Topics Commonly Struggled with:**

**Things Commonly Struggle With**

- Total Displacement with sections under the x-axis
- Inverse Trigonometry

**Example Problems:**

1) What was the total displacement of a person moving at velocity \( t^2 \) from \( t=1 \) to \( t=3 \)?

2) What was the displacement of a person moving at velocity \( 3t^2 - 2t \) from \( t=1 \) to \( t=3 \)? What is the distance?

3) Solve \( \int \frac{dx}{\sqrt{4-9x^2}} \).
1. Answer: \[ \int_1^3 t^2 \, dt = 9 - 1 = 8 \]

2. Answer: Displacement: \[ \int_1^3 (3t^2 - 2t) \, dt = (27 - 3) - (1 - 1) = 24 \]

3. Answer:
\[
\int \frac{dx}{\sqrt{4 - 9x^2}} = \int \frac{dx}{\sqrt{\frac{4}{9} - x^2}} \quad \text{set } u = \frac{3}{2} x
\]
\[
\frac{1}{2} \int \frac{du}{\sqrt{1 - u^2}} = \frac{1}{2} \sin^{-1} u + c = \frac{1}{2} \sin^{-1} \frac{3}{2} x + c
\]