# MTH 201 -- Calculus
# Module 12B: The Total Change Theorem

December 2-3, 2020

# Announcements/Agenda

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**Agenda:**

- Review of Fundamental Theorem
- Review of the Total Change Theorem and Daily Prep 12B
- Practice using the Total Change Theorem
- Quick discussion about the next two weeks

$$x^2 + 1\Big|_1^2$$ **equals**

- 3
- 4
- 10/3
- Undefined
- None of the above

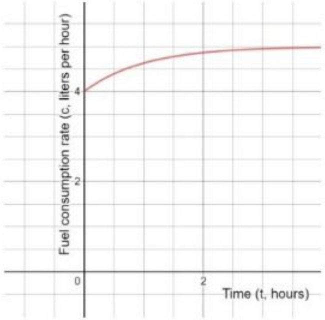
To 0

# The exact value of $\int_0^1 \frac{1}{1+x^2}\, dx$ is

- $\left.\frac{x}{x+(x^2/2)}\right|_0^1 = \text{undefined}$
- $\left.\ln(x^2+1)\right|_0^1 = \ln(2)$
- $\left.\arcsin(x)\right|_0^1 = \pi/2$
- $\left.\arctan(x)\right|_0^1 = \pi/4$
- None of the above

To 0

# The engine on a boat starts at time t = 0 and consumes fuel at a rate of c(t) liters per hour, shown below. To find the AMOUNT of fuel that has been consumed over the first two hours,




- Find the average rate of change in c(t) on [0,2]
- Find the slope of the tangent line to the graph of c(t) at t = 2
- Compute the integral of c(t) from 0 to 2
- Compute the average value of c(t) from 0 to 2 (i.e., integrate, then divide by 2)

**Total Change Theorem.**

If $f$ is a continuously differentiable function on $[a, b]$ with derivative $f'$, then $f(b) - f(a) = \int_a^b f'(x)\,dx$. That is, the definite integral of the rate of change of a function on $[a, b]$ is the total change of the function itself on $[a, b]$.

To find the total amount that a function has changed by, **integrate its derivative**.

# Jamboard: Demo on use of Total Change Theorem, then practice

# What we learned/what's next

- The Total Change Theorem: The integral of a rate of change gives the total amount of change.

NEXT:

- Followup: Working on WeBWorK 12
- LET'S TALK ABOUT THE NEXT TWO WEEKS