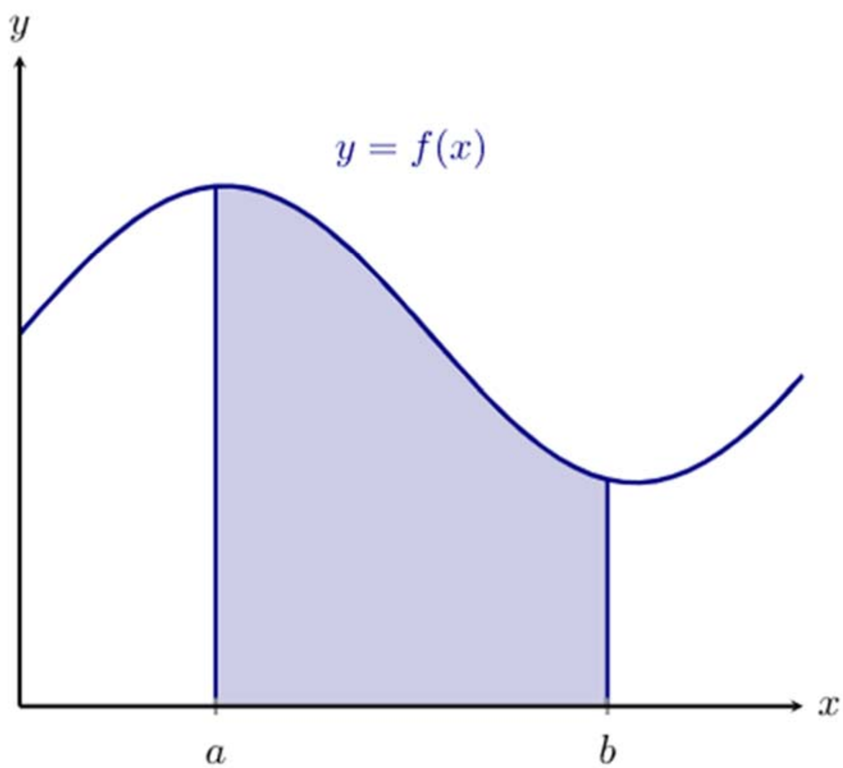
Name: ________________________________ Date: __________

AP Calc: Writing Limits of Riemann Sums as Definite Integrals

Recall:

If a function $f$ is continuous on $[a,b]$ and if $f(x) \geq 0$ for all $x$ in $[a,b]$ then the area under the curve $y = f(x)$ over the interval $[a,b]$ is defined by:

$$Area = \lim_{n \to +\infty} \sum_{k=1}^{n} f(x_k)\Delta x$$




Which can be rewritten as : $Area = \int_a^b f(x)dx$

1. Given $\lim_{n\to\infty}\sum_{k=1}^{n}\left(3\left(3+\frac{2k}{n}\right)+1\right)\cdot\frac{2}{n}$, write as an equivalent definite integral.

2. Given $\lim_{n\to\infty}\sum_{k=1}^{n}\left(\left(\frac{5k}{n}\right)^2+2\right)\cdot\frac{5}{n}$, write as an equivalent definite integral.

3. Given $\lim_{n\to\infty}\sum_{k=1}^{n}\left(3+\frac{4k}{n}\right)^2\cdot\frac{4}{n}$, write as an equivalent definite integral.

Now what if we have to go in the reverse?

4. Given $\int_0^3 e^x\,dx$, write it as an equivalent limit of a Riemann sum

Name: ______________________________

AP Calc – Definite Integrals, Limits of Riemann Sums, and SNACK STEALING?!

A snack stealing scandal has rocked RHS!

The math department is known for their love of food, but this time someone has gone too far! You have been asked to help solve the mystery of the missing snacks!

Answer the 6 multiple choice questions posted around the room and you will found out:

WHO: ____________________

WHEN: ____________________

WHAT: ____________________ and ____________________

WITH: ____________________

WHERE: ____________________

# WHO?

Which of the limits is equivalent to the following definite integral?

$$\int_0^{\pi} \cos x \, dx$$

Ⓐ $\lim_{n \to \infty} \sum_{i=1}^{n} \cos\left(\frac{i}{n}\right) \cdot \frac{\pi}{n}$ STACK

Ⓑ $\lim_{n \to \infty} \sum_{i=1}^{n} \cos\left(\frac{\pi i}{n}\right) \cdot \frac{i}{n}$ LEE

Ⓒ $\lim_{n \to \infty} \sum_{i=1}^{n} \cos\left(\frac{\pi i}{n}\right) \cdot \frac{\pi}{n}$ CARMAN

Ⓓ $\lim_{n \to \infty} \sum_{i=1}^{n} \cos\left(\frac{i}{n}\right) \cdot \frac{i}{n}$ LOUGHRAN

# WHEN?

Which of the limits is equivalent to the following definite integral?

$$\int_{-2}^{3} (x+1)\,dx$$

Ⓐ $\lim_{n\to\infty} \sum_{i=1}^{n} \left(\frac{5i}{n} - 1\right) \cdot \frac{5}{n}$ PERIOD 1

Ⓑ $\lim_{n\to\infty} \sum_{i=1}^{n} \left(\frac{5i-1}{n}\right) \cdot \frac{5}{n}$ PERIOD 3

Ⓒ $\lim_{n\to\infty} \sum_{i=1}^{n} \left(\frac{5i+1}{n} + 1\right) \cdot \frac{5}{n}$ PERIOD 5

Ⓓ $\lim_{n\to\infty} \sum_{i=1}^{n} \left(\frac{5i}{n} + 1\right) \cdot \frac{5}{n}$ PERIOD 7

# WHAT? (PART 1)

Which of the definite integrals is equivalent to the following limit?

$$\lim_{n\to\infty}\sum_{i=1}^{n}\ln\left(2+\frac{5i}{n}\right)\cdot\frac{5}{n}$$

Ⓐ $\int_0^7 \ln x\,dx$ ICE CREAM

Ⓑ $\int_2^5 \ln x\,dx$ CUPCAKES

Ⓒ $\int_2^7 \ln x\,dx$ REESES PB CUPS

Ⓓ $\int_0^5 \ln x\,dx$ PEPPERMINT PATTIES

# WHAT? (PART 2)

Which of the definite integrals is equivalent to the following limit?

$$\lim_{n\to\infty}\sum_{i=1}^{n}\cos\left(\frac{\pi}{2}+\frac{\pi i}{2n}\right)\cdot\frac{\pi}{2n}$$

Ⓐ $\int_0^{\pi} \cos x \, dx$ GREEN TEA

Ⓑ $\int_{\pi/2}^{3\pi/4} \cos x \, dx$ ICED CARAMEL LATTE

Ⓒ $\int_0^{\pi/2} \cos x \, dx$ PEACH SELTZER

Ⓓ $\int_{\pi/2}^{\pi} \cos x \, dx$ HOT CHOCOLATE

# WITH?

Which of the definite integrals is equivalent to the following limit?

$$\lim_{n\to\infty} \sum_{i=1}^{n} 4 \cdot \frac{5}{n}$$

Ⓐ $\int_0^4 5x\,dx$ PAPER CLIP

Ⓑ $\int_0^5 4x\,dx$ SCREWDRIVER

Ⓒ $\int_0^4 5\,dx$ HAMMER

Ⓓ $\int_0^5 4\,dx$ COMPASS

# WHERE?

Which of the definite integrals is equivalent to the following limit?

$$\lim_{n\to\infty} \sum_{i=1}^{n} \sqrt{4+\frac{5i}{n}} \cdot \frac{5}{n}$$

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Ⓐ $\int_0^4 \sqrt{4+x}\,dx$ LIBRARY

Ⓑ $\int_0^5 \sqrt{x}\,dx$ MAIN OFFICE

Ⓒ $\int_4^9 \sqrt{x}\,dx$ TESTING CENTER

Ⓓ $\int_4^9 \sqrt{4+x}\,dx$ SCIENCE STUDY CENTER