Objectives:

- Prove the Evaluation Theorem
- Practice using the Evaluation Theorem

Intuition: Remember that the antiderivative of velocity is position. Let $s(t)$ be the position in feet of an object at time t in seconds and $v(t)$ be the velocity of the object at time t in feet per second.

Then $s(5) - s(0)$ represents ______________________________ .

We could estimate $s(5) - s(0)$ using a ______________ .

To get the exact value instead of an estimate, ______________________________

We call this value ______________ .

Proof of the Evaluation Theorem:

Let $F(x)$ be any antiderivative of $f(x)$ (i.e. $F'(x) = f(x)$). Note that this means $F(x)$ is ________ and therefore ________ .

Divide ______________ into ____ intervals, with width ________ .

Now, we try to find a way of writing $F(b) - F(a)$ in terms of these points in $[a, b]$:

Returning to our previous equation for $F(b) - F(a)$:

Using the Evaluation Theorem:
Find $\int_0^{\pi} -2^x + \sin(x)\ dx$.

If $s(x) = x - \sin(x)$ represents the velocity of an object in feet per second, what does the integral above represent?

If $f(x) = x - \sin(x)$ represents the increase or decrease in the quantity of fuel carried by a rocket in units of tons per minute, what does the integral above represent?