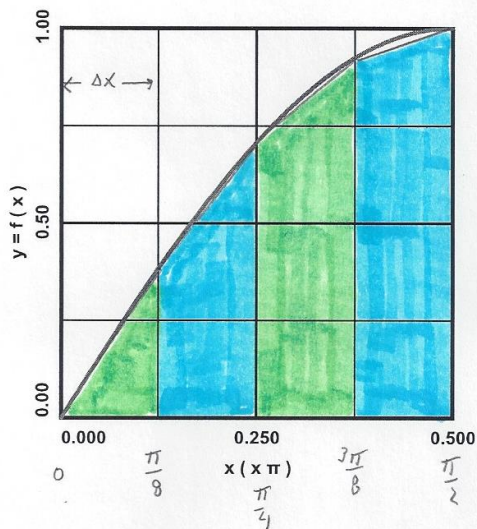


# AP CALCULUS AB

# TRAPEZOIDAL RULE

For  $f(x) = \sin x$  on  $x \in [0, \pi/2]$ , estimate the area under the curve using four equal subdivisions with four trapezoids. Draw the trapezoids used on the graph. Also, what is the exact value of the area?



$$\Delta x = \frac{\pi}{8} \equiv \text{subdivision size}$$

$$\text{The exact area is } \int_0^{\pi/2} \sin x \, dx = \left[ -\cos x \right]_0^{\pi/2} = -\cos \frac{\pi}{2} + \cos 0 = 0 + 1 = 1$$

area  $\approx$

$$\begin{aligned} & \frac{1}{2} \left[ f(0) + f\left(\frac{\pi}{8}\right) \right] \Delta x \\ & + \frac{1}{2} \left[ f\left(\frac{\pi}{8}\right) + f\left(\frac{\pi}{4}\right) \right] \Delta x \\ & + \frac{1}{2} \left[ f\left(\frac{\pi}{4}\right) + f\left(\frac{3\pi}{8}\right) \right] \Delta x \\ & + \frac{1}{2} \left[ f\left(\frac{3\pi}{8}\right) + f\left(\frac{\pi}{2}\right) \right] \Delta x = \\ & = \frac{1}{2} \left[ f(0) + 2f\left(\frac{\pi}{8}\right) + 2f\left(\frac{\pi}{4}\right) + 2f\left(\frac{3\pi}{8}\right) + f\left(\frac{\pi}{2}\right) \right] \Delta x = \\ & = 0.987115801 \end{aligned}$$