AP Calculus AB – Worksheet 53 **Approximating Area Using Riemann Sums**

Approximate areas "under the curve" (between the curve and the x-axis) using four subintervals for left, right and midpoint rectangles and trapezoids. Find the area using the definite integral.

1. $f(x)=x^2$ on $[0,2]$
   a) Left Rectangular Approximation with **graph**
   b) Right Rectangular Approximation with **graph**
   c) Midpoint Rectangular Approximation with **graph**
   d) Trapezoidal Approximation with **graph**
   e) Exact area using definite integrals with **graph**

Approximate areas "under the curve" (between the curve and x-axis) using the indicated Riemann Sum.

2. $f(x)=-x^2$ on $[0,2]$
   a) Find a Trapezoidal Approximation with **graph** using four subintervals.
   b) Is the approximation found in part (a) an overestimate or underestimate? Explain how you know in terms of the concavity (curvature) of the graph.
   c) Find the exact area using a definite integral with **graph**.

3. $f(x)=\sin x$ on $[0,\pi]$
   a) Find a Right Rectangular Approximation with **graph** using four subintervals.
   b) Is the approximation found in part (a) an overestimate or underestimate? Explain how you know in terms of the concavity (curvature) of the graph.
   c) Find the exact area using a definite integral with **graph**.

4. $f(x)=\sqrt{x}$ on $[0,4]$
   a) Find a Left Rectangular Approximation with **graph** using four subintervals.
   b) Is the approximation found in part (a) an overestimate or underestimate? Explain how you know in terms of the concavity (curvature) of the graph.
   c) Find the exact area using a definite integral with **graph**.

5. Consider the continuous function $f(x)$ such that $f(x)>0$ for $[0,1]$. Selected values of $f(x)$ are given in the table below. Use the table of values to approximate the area under $f(x)$ using the Riemann Sum indicated.

x	0	0.25	0.5	0.75	1.0
$f(x)$	1.0	0.8	1.3	1.1	1.6

   a) Trapezoidal Approximation using 4 subintervals
   b) Right Rectangular Approximation using 4 subintervals
   c) Midpoint Rectangular Approximation using 2 subintervals