My Office Hours: M & W 2:30–4:00, Tu 2:00–3:30, & F 1:30–2:30 or by appointment. **Math Intern:** Sun: 2:00–5:00, 7:00–10pm; Mon thru Thu: 3:00–5:30 and 7:00–10:30pm in Lansing 310. Website: `http://math.hws.edu/~mitchell/Math131F15/index.html`.

Practice

1. Read Section 5.2 which finishes our introduction to the Riemann Integral.
   (*a*) Understand the definition of a **Riemann Sum** (p. 351).
   (*b*) Memorize the definition of a **Definite Integral** (p. 351).
   (*c*) Understand Theorem 5.2 (p. 352).
   (*d*) Remember, geometrically, a definite integral $\int_a^b f(x)\,dx$ is the net area 'under' f on $[a,b]$. We have 'solved' the area problem.
   (*e*) Next time we will discuss the properties of the integral in the last few pages of the section. So with that in mind: Review the properties of Definite Integrals on pages 354–357. These are summarized on page 356.

2. Review section 5.2 as needed trying page 358ff #1, 3, 5, 9 (what shape is the area under the curve), 11 (left and right only), 21, 23, 25, and 27.

Extra Credit

1. We only have a few summation formulas. But there are lots of functions. Use the `xFunctions` software utility that is online (there is a red link to it and instructions on the course homepage listed above) to estimate the following by using Lower(500) and Upper(500), inscribed and circumscribed rectangle sums. To receive credit, print out the first page of the results showing the graph.

(*a*) $\int_0^2 e^{\sin x}\,dx$ (*b*) $\int_1^3 \ln(x) + \cos(x)\,dx$

Note: $e^{\sin x}$ is entered as `exp(sin(x))`.

Math 131: Homework Due Next Class:

1. **Complete pages 3 and 4 of this handout.** These are (almost) the same as the WeBWorK Day 04 assignment. Do them both at the same time to check your answers!

2. (*a*) WeBWorK assignment Day04 Due Wednesday night.
   (*b*) WeBWorK Day03 Due Tuesday night.

3. (*a*) Optional: Try the Extra Credit above.
   (*b*) Not to hand in: Try the Self-Review problems that follow on this sheet. Ask questions about them in next time or in office hours.

Self-Review From Class—This is for you. Not to be handed in.

1. **Definition**: Suppose f is defined on the interval $[a,b]$ with partition $a = x_0 < x_1 < x_2 < \cdots < x_{n-1} < x_n = b$. Let $\Delta x_k = x_k - x_{i-1}$ and let c_k be any point chosen so that $x_{k-1} \le c_k \le x_k$. Then

$$\sum_{k=1}^{n} f(c_k)\Delta x_k$$

is called a **Riemann sum** for f on $[a,b]$.

2. We will often use **regular partitions** where

$$\Delta x = \frac{b-a}{n} \qquad \text{and the formulafor } x_k = \_\_\_\_\_\_\_\_\_\_.$$

3. Generally we will look at **upper sums** and **lower sums**

$$\text{Upper}(n) = \sum_{k=1}^{n} f(M_k)\Delta x$$

where $f(M_k)$ is the maximum value of f on the kth subinterval and

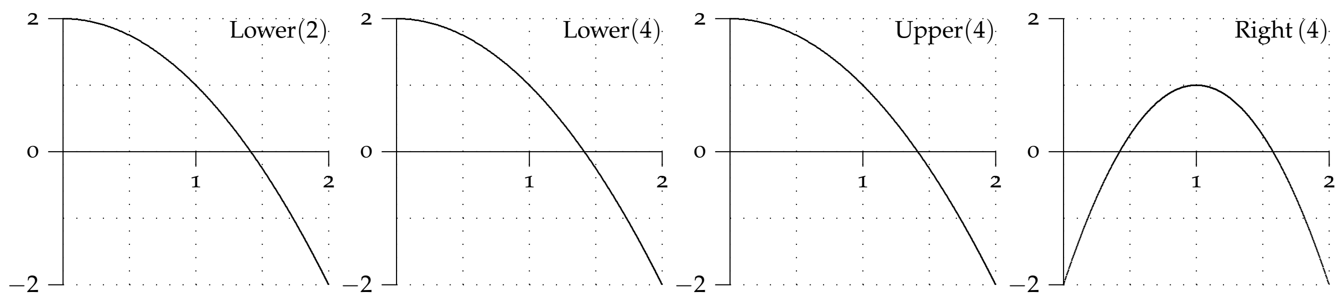
$$\text{Lower}(n) = \sum_{k=1}^{n} \_\_\_\_\_\_\_\_\_\_ \Delta x$$

where ____ of f on the kth subinterval.

4. Whenever possible we will use **right-hand Riemann sums** where the right-hand endpoint x_k of each interval is the evaluation point. This makes the calculations easy.

$$\text{Right}(n) = \sum_{k=1}^{n} f(x_k)\Delta x.$$

5. Draw the following:



Practice

1. (*a*) Fill in the following table for the Riemann sums using regular partitions and right-hand endpoints.

$f(x)$	$[a,b]$	Δx	$x_k = a + i\Delta x$	$f(x_k)$	$\text{Right}(n) = \sum_{k=1}^{n} f(x_k)\Delta x$ (Do not simplify yet)
$x^2 - 1$	$[0, 2]$				
$2(x-1)^2$	$[1, 4]$				
$\sin(x)$	$[0, \pi]$				

(*b*) For $x^2 - 1$, simplify $\text{Right}(n) = \sum_{k=1}^{n} f(x_k)\Delta x$.

(*c*) Then calculate $\int_0^2 x^2 - 1\, dx$ by evaluating $\lim_{n\to\infty} \text{Right}(n)$.

Hand in next class. These are (almost) the same as the WeBWorK Day 04 assignment. Do them together; check your answers!

1. (*a*) Fill in the following table for the Riemann sum using regular partitions and right-hand endpoints.

$f(x)$	$[a,b]$	Δx	$x_k = a + k\Delta x$	$f(x_k)$	Write out $\text{Right}(n) = \sum_{k=1}^{n} f(x_k)\Delta x$ (Do not simplify yet)
$(x-1)^2$	$[0,2]$				

(*b*) Simplify $\text{Right}(n) = \sum_{k=1}^{n} f(x_k)\Delta x$. No sum should appear.

(*c*) $\lim_{n\to\infty} \text{Right}(n) =$

(*d*) When $f(x)$ is continuous, this limit is denoted by $\int_a^b f(x)\,dx$. Here we would write $\int_0^2 (x-1)^2\,dx = \lim_{n\to\infty} \text{Right}(n) =$

2. (*a*) Fill in the following table for the Riemann sum using regular partitions and right-hand endpoints.

$f(x)$	$[a,b]$	Δx	$x_k = a + k\Delta x$	$f(x_k)$	Write out $\text{Right}(n) = \sum_{k=1}^{n} f(x_k)\Delta x$ (Do not simplify yet)
$4(x-2)^3$	$[2,4]$				

(*b*) Simplify $\text{Right}(n) = \sum_{k=1}^{n} f(x_k)\Delta x$. No sum should appear. This simplifies a lot!

(*c*) [Hint: See Problem 1(c,d).] Here $f(x)$ is continuous, so $\int_2^4 4(x-2)^3\,dx =$

3. (*a*) Fill in the following table for the Riemann sum using regular partitions and right-hand endpoints.

$f(x)$	$[a,b]$	Δx	$x_k = a + k\Delta x$	$f(x_k)$	Write out Right$(n) = \sum_{k=1}^{n} f(x_k)\Delta x$ (Do not simplify yet)
$-4x^2$	$[0,2]$				

(*b*) Simplify Right$(n) = \sum_{k=1}^{n} f(x_k)\Delta x$. No sum should appear.

(*c*) [Hint: See Problem 1(c,d).] Here $f(x)$ is continuous, so $\int_0^2 -4x^2\,dx =$

4. (*a*) Fill in the following table for the Riemann sum using regular partitions and right-hand endpoints.

$f(x)$	$[a,b]$	Δx	$x_k = a + k\Delta x$	$f(x_k)$	Write out Right$(n) = \sum_{k=1}^{n} f(x_k)\Delta x$ (Do not simplify yet)
$2(x-1)^2$	$[1,4]$				

(*b*) Simplify Right$(n) = \sum_{k=1}^{n} f(x_k)\Delta x$. No sum should appear. This simplifies a lot!

(*c*) [Hint: See Problem 1(c,d).] Here $f(x)$ is continuous, so $\int_{\_}^{\_}$ ____________ $dx =$