

2. (7 points) Use a Riemann Sum with 4 equal subdivisions to find a *lower* estimate for

$$\int_0^2 e^x + 1 \, dx.$$

Clearly indicate whether you are using a left-hand sum or a right-hand sum, and show all intermediate calculations. Show your answer to three decimal places (or in exact form).

The function is increasing, therefore the Left Sum is the lower sum.

$x$	0	$\frac{1}{2}$	1	$\frac{3}{2}$	2
$e^x + 1$	2	$e^{1/2} + 1$	$e + 1$	$e^{3/2} + 1$	$e^2 + 1$
$e^x + 1$	2	2.6487	3.7183	5.4817	8.3891

Left Sum

$$LHS_{(4)} = (0.5)(2) + (0.5)(e^{1/2} + 1) + (0.5)(e + 1) + (0.5)(e^{3/2} + 1) = 6.9243$$

3. (7 points) Let  $f(x) = \cos(x) + bx$  and  $g(x) = x^2 - x$ . Find the value of  $b$  such that  $f(x) > g(x)$  on  $[0, 1]$  and the area between the curves from  $x = 0$  to  $x = 1$  is equal to 1.

$$1 = \int_0^1 \cos x + bx - (x^2 - x) \, dx$$

$$1 = \sin(1) - \frac{1}{3} + \frac{b+1}{2}$$

$$b = \frac{5}{3} - 2\sin(1) = -0.0162753$$

[Note that with this value of  $b$ ,  $f(x) > g(x)$  on  $[0, 1]$ —but, with the set-up of the problem as indicated above, we are assuming that  $f(x) > g(x)$  on the interval.]