Calculus

Chapter 7: Differential Equations and More Riemann Sums

Lesson 4: Numerical Approximation Methods with Integrals

Question #1

Reference Q.704

For the following function, use n=4 sub-intervals to approximate the value of the integral by

$$\int_1^5 3x^2 + 1 \, dx$$1st Note: Express the answers to 4 decimal places.2nd Note: You should do a few by hand to make sure you can solve them and so you can show the correct work on the written portion of a test, but then should feel free to use a program on your graphing calculator to calculate the rest.

a. using the midpoint approximation

b. using the trapezoidal approximation

c. using Simpson's rule.

Question #2

Reference Q.705

For the following function, use n=4 sub-intervals to approximate the value of the integral by

$$\int_3^7 \frac{1}{x-1} \, dx$$

a. using the midpoint approximation

b. using the trapezoidal approximation

c. using Simpson's rule.

1st Note: Express the answers to 4 decimal places.
2nd Note: You should do a few by hand to make sure you can solve them and so you can show the correct work on the written portion of a test, but then should feel free to use a program on your graphing calculator to calculate the rest.

Question #3

Reference Q.706

For the following function, use n=4 sub-intervals to approximate the value of the integral by

$$\int_{-\pi/2}^{\pi/2} \cos x \, dx$$

a. a) using the midpoint approximation

b. b) using the trapezoidal approximation

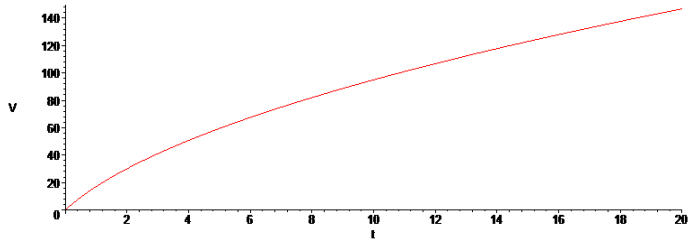
c. c) using Simpson's rule.

1st Note: Express the answers to 4 decimal places.
2nd Note: You should do a few by hand to make sure you can solve them and so you can show the correct work on the written portion of a test, but then should feel free to use a program on your graphing calculator to calculate the rest.

Question #4

Reference Q.708

(Try this!) For the following velocity time graph, use the Trapezoidal Rule to approximate the distance (in feet) the object travels in the first 10 seconds. HOWEVER, use the 4 subintervals separated by divisions at t=0, t=2, t=5, t=7, t=10.



Question #5

Reference Q.9280

Let $M(t)$ be the mass of a magical object, which changes continuously with respect to time, and let $M(0) = 34,\ M(3) = 27,\ M(5) = 22,\ M(9) = 13,\ M(10) = 7$. Use the trapezoidal rule to estimate the average mass between $t = 0$ and $t = 10$.

Question #6

Reference Q.9281

Use Simpson's Rule with 4 subintervals to approximate the area under $y = \sin x + 3$ between $x = 0$ and $x = \pi$.

Question #7

Reference Q.9279

Let $f(0) = 3,\ f(2) = 5,\ f(5) = 12,\ f(8) = 17$, find a trapezoidal approximation of $\int_0^8 f(x) \, dx$ using the subintervals $[0,\ 2]$, $[2,\ 5]$, and $[5,\ 8]$.

Question #8

Reference Q.9278

If $f(0) = 2,\ f(1) = 3,\ f(2) = 5,\ f(4) = k,\ f(5) = 15$ and is continuous on the interval $[0,\ 5]$, given that the trapezoidal approximation (with 4 subintervals) for $\int_0^5 f(x) \, dx$ yields 30, what is the value of k?