Part I (MULTIPLE CHOICE, NO CALCULATORS).

1. Compute $\int \left(2x^2 + \frac{3}{x} - 4\sin x\right) dx$.

   (a) $\frac{1}{2}\left(2x^2 + \frac{3}{x} - 4\sin x\right)^2 + C$ b/c wrong

   (b) $4x - \frac{3}{x^2} - 4\cos x + C$ b/c $2x^2$

   (c) $\frac{2}{3}x^3 + 3\ln|x| - 4\cos x + C$

   (d) $\frac{2}{3}x^3 + 3\ln|x| + 4\cos x + C$

   (e) $\frac{2}{3}x^3 + 3\ln|x| - 2\sin^2 x + C$

2. Compute $\int_{-1}^{1} xe^{x^2} dx$.

   $u = x^2$
   $du = 2x\,dx$
   $\frac{1}{2}\int e^u \, dx = \frac{1}{2}e^u du = \frac{1}{2}e^{x^2}\Big|_{-1}^{1} = \frac{1}{2}(e - e)$

   (a) 2

   (b) $2e$

   (c) e

   (d) $\frac{1}{2}e^{\frac{1}{3}} - \frac{1}{2}e^{-\frac{1}{3}}$

   (e) 0

3. Which of the following definite integrals gives the length of the curve $y = \sin x$ for $0 \leq x \leq \pi$?

   (a) $\int_0^\pi \sqrt{1 + \cos^2 x}dx$

   (b) ~~$\int_0^\pi \cos x dx$~~

   (c) $\int_0^\pi \sqrt{1 + \cos x}dx$

   (d) ~~$\int_0^\pi \sqrt{1 - \cos x}dx$~~

   (e) ~~$\int_0^\pi \sqrt{1 - \cos^2 x}dx$~~

4. Complete the square in the denominator of the integrand of the following indefinite integral and then compute the integral $\int \frac{1}{x^2+2x+2}dx$.

(a) $\frac{1}{2}\tan^{-1}(x+1)+C$

~~(b) $\ln|x^2+2x+2|+C$~~

~~(c) $\tan^{-1}(x^2+2x+2)+C$~~

~~(d) $(\tan^{-1}x)^2+1+C$~~

(e) $\tan^{-1}(x+1)+C$

$(x^2+2x+1)+2-1 = (x+1)^2+1$

$\int \frac{1}{(x+1)^2+1}\,dx$

$= \arctan(x+1)$

5. $\int_0^1 xe^x dx =$

(a) e

(b) $\frac{1}{2}$

(c) $2e$

(d) 1

(e) $\frac{1}{2}e$

$u = x \quad du = 1$
$dv = e^x \quad v = e^x$

$xe^x|_0^1 - \int_0^1 e^x = [1\cdot e^1 - 0\cdot e^0] - e^x|_0^1$
$= e - [e^1 - e^0] = 1$

6. Which of the following statements is correct?

(a) $\sum_{n=1}^{\infty}\frac{\sin n}{n^2}$ converges, and $\sum_{n=1}^{\infty}\frac{2n}{n^4-3}$ converges.

~~(b) $\sum_{n=1}^{\infty}\frac{\sin n}{n^2}$ diverges, and $\sum_{n=1}^{\infty}\frac{2n}{n^4-3}$ diverges.~~

(c) $\sum_{n=1}^{\infty}\frac{\sin n}{n^2}$ converges, and $\sum_{n=1}^{\infty}\frac{2n}{n^4-3}$ diverges.

~~(d) $\sum_{n=1}^{\infty}\frac{\sin n}{n^2}$ diverges, and $\sum_{n=1}^{\infty}\frac{2n}{n^4-3}$ converges.~~

~~(e) $\sum_{n=1}^{\infty}\frac{\sin n}{n^2}$ converges, and $\sum_{n=1}^{\infty}\frac{2n^4}{n^4-3}$ converges.~~

$-\infty < \sum \frac{-1}{n^2} \le \sum_{n=1}^{\infty} \frac{\sin n}{n^2} \le \sum \frac{1}{n^2} < \infty$

$\sum_{n=1}^{\infty} \frac{2n^4}{n^4-3}$ but $\frac{2n^4}{n^4-3} \to 2 \neq 0$

7. $\int x^2 \cos(2x^3)\, dx =$

$u = 2x^3$
$du = 6x^2\, dx$

$\frac{1}{6} \int \cos u \, du = \frac{1}{6} \sin u$

~~(a) $\sin(2x^3) + x$~~

(b) $\frac{1}{6} \sin(2x^3) + C$

~~(c) $\frac{1}{2} \sin(2x^3) + C$~~

~~(d) $\sin\left(\frac{1}{2}x^4\right) + C$~~

~~(e) $\frac{1}{3}x^3 \sin(2x^3) + C$~~

8. $\int \frac{\ln x}{x} dx =$

$u = \ln x$
$du = \frac{1}{x} dx$

$\int u \, du = \frac{1}{2}u^2 = \frac{1}{2}(\ln x)^2$

(a) $\ln|x| + C$

(b) $\ln|\ln x| + C$

(c) $\frac{1}{2}\ln(x^2) + C$

(d) $\frac{1}{2}(\ln x)^2 + C$

(e) $\ln\left(\frac{1}{2}x^2\right) + C$

9. $\int \frac{1}{2x+1} dx =$

$u = 2x+1$
$du = 2\, dx$

$\frac{1}{2} \int \frac{1}{u} = \frac{1}{2} \ln u$

(a) $\frac{1}{x^2 + x} + C$

(b) $\ln|2x+1| + C$

(c) $\frac{1}{2}\ln|2x+1| + C$

(d) $\frac{1}{(2x+1)^2} + C$

(e) $\ln|x^2 + x| + C$

10. $\int \cos(x)\, e^{\sin(x)} dx =$

$u = \sin x$
$du = \cos x\, dx$
$\int e^u\, du = e^u$

(a) $e^{\sin(x)} + C$

(b) $-e^{\sin(x)} + C$

(c) $-\sin e^{\cos x} + C$

(d) $-\sin x e^{\sin x} + C$

(e) $e^{\cos x} + C$

11. Use $\int \frac{u^2}{\sqrt{a^2-u^2}} du = -\frac{u}{2}\sqrt{a^2-u^2} + \frac{a^2}{2}\sin^{-1}\left(\frac{u}{a}\right) + C$ and substitution to compute $\int \frac{x^2}{\sqrt{5-4x^2}} dx.$

$\frac{u^2}{4} = x^2 \leftarrow u^2 = 4x^2 \quad a^2 = 5$
$u = 2x$
$du = 2dx$

$\int \frac{(u^2/4)}{\sqrt{a^2-u^2}} \frac{1}{2} du = \frac{1}{8}\int \frac{u^2}{a^2-u^2} du$
$= -\frac{u}{16}\sqrt{a^2-u^2} + \frac{a^2}{16}\sin^{-1}\left(\frac{u}{a}\right)$
$= -\frac{2x}{16}\sqrt{5-4x^2} + \frac{5}{16}\sin^{-1}\left(\frac{2x}{\sqrt{5}}\right)$

~~(a) $-x\sqrt{5-4x^2} + \frac{5}{2}\sin^{-1}\left(\frac{x}{5}\right) + C$~~

(b) $-\frac{x}{8}\sqrt{5-4x^2} + \frac{\sqrt{5}}{2}\sin^{-1}\left(\frac{x}{\sqrt{5}}\right) + C$

(c) $-\frac{x}{8}\sqrt{5-4x^2} + \frac{5}{16}\sin^{-1}\left(\frac{2x}{\sqrt{5}}\right) + C$

(d) $-\frac{x}{8}\sqrt{5-4x^2} + \frac{5}{8}\sin^{-1}\left(\frac{2x}{\sqrt{5}}\right) + C$

~~(e) $-\frac{x}{2}\sqrt{5-4x^2} + \frac{5}{2}\sin^{-1}\left(\frac{x}{\sqrt{5}}\right) + C$~~

12. Choose the definite integral that is equal to the following limit. $\lim_{n\to\infty} \sum_{i=1}^{n} \underbrace{\left(1+\frac{i}{n}\right)}_{1 \text{ to } 2}^3 \underbrace{\frac{1}{n}}_{=\Delta x}.$ The Riemann Sum uses right-hand endpoints.

at $i=0$, $1+\frac{0}{n}=1$
at $i=n$, $1+\frac{n}{n}=2$
$1^3 \to 2^3$

~~(a)~~ $\int_1^2 (1+x)^3\, dx$ $\quad 2^3 \to 3^3$

(b) $\int_0^1 x^3 dx \quad \to \quad 0^3 \to 1^3$

(c) $\int_1^2 x^3 dx \quad \to \quad 1^3 \to 2^3$

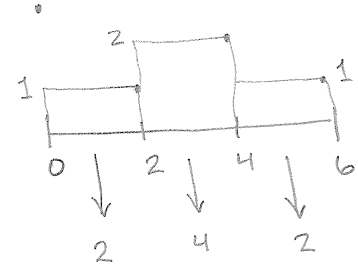
~~(d)~~ $\int_0^2 (1+x)^3\, dx$ $\quad 1^3 \to 3^3$

(e) $\int_0^2 x^3 dx$ $\quad 0^3 \to 2^3$

Part II (MULTIPLE CHOICE, CALCULATORS ALLOWED).

1. A table of values of a function f is shown. We wish to estimate $\int_0^6 f(x)\,dx$. Do this by finding the Riemann sum for f on $[0, 6]$, using three equal subintervals and taking the sample points to be the right endpoints.

f	0	2	4	6
$f(x)$	5	1	2	1



(a) 0
(b) 2
(c) 4
(d) 6
(e) 8

2. Compute $f''(x)$ where $f(x) = \int_0^x e^{t^2}\,dt$.

(a) e^{x^2}
(b) $2xe^{x^2}$
(c) xe^{x^2}
(d) e^{2x}
(e) $\frac{1}{2}e^{x^2}$

$f'(x) = e^{x^2}$

$f''(x) = 2xe^{x^2}$

3. Compute the average value of $\sin x$ on the interval $0 \leq x \leq \pi$.

(a) 2
(b) $\frac{1}{2}\sin x$
(c) $\frac{\pi}{2}$
(d) 0
(e) $\frac{2}{\pi}$

$\frac{1}{\pi - 0}\int_0^{\pi} \sin x\,dx$

$\frac{1}{\pi}\left[-\cos x\right]_0^{\pi}$

$-\frac{1}{\pi}(-1-1) = 2/\pi$

4. What is the area of the region bounded by the curves $y = e^x, y = 0$ and the lines $x = 0$ and $x = \ln 2$?

(a) 1

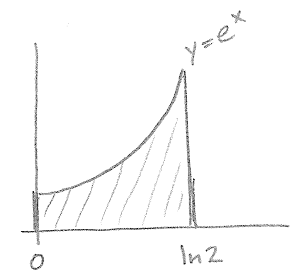
(b) 2

(c) $\ln 2$

(d) e

(e) 1.718

$$\int_0^{\ln 2} e^x \, dx$$
$$= e^x \Big|_0^{\ln 2}$$
$$= e^{\ln 2} - e^0$$
$$= 2 - 1$$



5. Find $\lim_{n\to\infty} \dfrac{\ln n}{n}$

$$\lim_{n\to\infty} \frac{\ln n}{n} = \lim_{n\to\infty} \frac{(1/n)}{1} = \lim_{n\to\infty} \frac{1}{n} = 0$$

(a) $-\infty$

(b) 0

(c) 1

(d) $+\infty$

(c) c

6. Find the exact value (if the series converges) of the geometric series $\sum_{n=1}^{\infty} \left(\frac{1}{3}\right)^n$. Be carcful!

$$\sum_{n=1}^{\infty} \frac{1}{3}\left(\frac{1}{3}\right)^{n-1} = \frac{(1/3)}{1-1/3} = \frac{1/3}{2/3} = 1/2$$

(a) $\frac{3}{2}$

(b) $\frac{1}{3}$

(c) $\frac{1}{2}$

(d) 1

(e) $\frac{2}{3}$

X 7. What is the best estimate of the error (to six decimal places) in using the first five terms of the alternating series $\sum_{n=1}^{\infty} \dfrac{(-1)^n}{n \cdot 5^n}$ to approximate the value of the series.

(a) 0.000064

(b) 0

(c) 0.000008

(d) 0.000011

(e) 0.000400

8. Find the radius of convergence of the power series $\sum_{n=1}^{\infty} \frac{x^n}{n \cdot 2^n}$.

   (a) 1
   (b) 2
   (c) $\frac{1}{2}$
   (d) 4
   (e) The series diverges.

$\left| \frac{x^{n+1}}{(n+1)2^{n+1}} \cdot \frac{n2^n}{x^n} \right| = \left| \frac{xn}{2(n+1)} \right| = |x| \cdot \frac{n}{2n+2} \xrightarrow[n\to\infty]{} \frac{|x|}{2} < 1$

$|x| < 2$

9. Compute the power series representation centered at $a = 0$ for the function $\frac{1}{(1-x)^2}$.

   Note that $\frac{1}{(1-x)^2} = \frac{d}{dx}\left[\frac{1}{1-x}\right]$.

   (a) $\sum_{n\ 0}^{\infty} \frac{x^{n+1}}{n+1}$
   (b) $\sum_{n\ 0}^{\infty} x^{2n}$
   (c) $\sum_{n=1}^{\infty} 2x^n$
   (d) $\sum_{n=1}^{\infty} nx^{n-1}$
   (e) $\sum_{n=1}^{\infty} \frac{x^{n+1}}{n+1}$

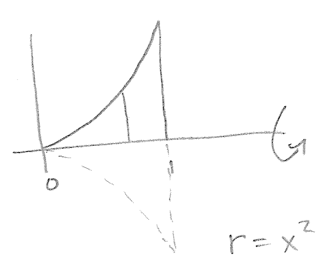
$\frac{1}{1-x} = \sum_{n=0} x^n = 1 + x + x^2 + x^3 + x^4 + \cdots$

$\frac{d}{dx}\left(\frac{1}{1-x}\right) = \sum \frac{d}{dx}(x^n) = 1 + 2x + 3x^2 + 4x^3 + \cdots$

$= \sum n x^{n-1}$

10. Find the volume generated when the area bounded by $y = x^2, y = 0$ and the lines $x = 0$ and $x = 1$ is rotated about the x-axis.

   (a) $\frac{\pi}{5}$
   (b) $\frac{\pi}{3}$
   (c) $\frac{\pi}{2}$
   (d) $\frac{1}{5}$
   (e) $\frac{1}{3}$



$r = x^2$

$A(x) = x^4 \pi$

$\pi \int_0^1 x^4\, dx = \pi \frac{x^5}{5} \Big|_0^1 = \pi/5$

11. The series $\sum_{n=0}^{\infty} (-1)^n \frac{x^{4n}}{n!}$ represents which of the following functions.

(a) e^{-4x}

(b) $\sin 4x$

(c) $\cos 4x$

(d) e^{-x^4}

(e) $\frac{1}{1+x^4}$

$e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!}$

$e^{-x^4} = \sum_{n=0}^{\infty} \frac{(-x^4)^n}{n!} = \sum_{n=0}^{\infty} (-1)^n \frac{x^{4n}}{n!}$

12. Find A and B in the partial fraction $\frac{x+2}{(x+3)(x-2)} = \frac{A}{x+3} + \frac{B}{x-2}$.

(a) $A = -3, B = 2$

(b) $A = -\frac{1}{5}, B = -\frac{4}{5}$

(c) $A = \frac{1}{2}, B = -\frac{1}{2}$

(d) $A = \frac{4}{5}, B = \frac{1}{5}$

(e) $A = \frac{1}{5}, B = \frac{4}{5}$

$X+2 = A(X-2) + B(X+3)$

$X=2 \quad 4 = 5B, \quad B = 4/5$

$X=-3 \quad -1 = -5A, \quad A = 1/5$

13. If the improper integral $\int_0^\infty xe^{-x^2}dx$ converges, its value is

(a) 0

(b) $\frac{1}{2}$

(c) 1

(d) e

(e) The integral diverges

$u = -x^2$

$du = -2x\,dx$

$-\frac{1}{2}\int_0^{\infty} e^u\,du = -\frac{1}{2}e^u = -\frac{1}{2}e^{-x^2}\Big|_0^{\infty}$

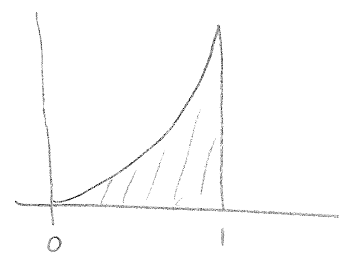
$= -\frac{1}{2}e^{-\infty} + \frac{1}{2}e^0$

$= 0 + 1/2$

Part III (FREE RESPONSE, CALCULATORS ALLOWED).

1. (a) [4 points] Compute the area of the region in the first quadrant, bounded by the graphs of $y = x^2$, $y = 0$, and $x = 1$.

$$\int_0^1 x^2\,dx = \frac{x^3}{3}\Big|_0^1 = \frac{1}{3}$$



(b) [6 points] Find the coordinates $(\bar{x}, \bar{y})$ of the centroid of the area in the first quadrant bounded by the graphs of $y = x^2$, $y = 0$, and $x = 1$.

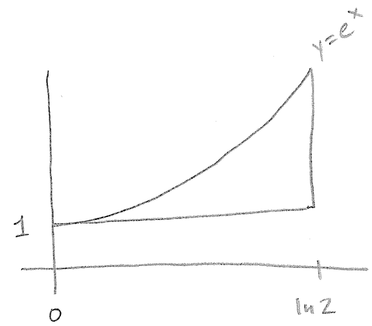
$$\bar{X} = \frac{1}{A}\int_a^b x f(x)\,dx$$
$$= 3\int_0^1 x \cdot x^2\,dx$$
$$= 3\int_0^1 x^3\,dx$$
$$= \frac{3}{4}x^4\Big|_0^1$$
$$= 3/4$$

$$\bar{Y} = \frac{1}{A}\int_a^b \frac{1}{2}[f(x)]^2\,dx$$
$$= 3\int_0^1 \frac{1}{2}x^4\,dx$$
$$= 3/2 \cdot \frac{x^5}{5}\Big|_0^1$$
$$= 3/2 \cdot 1/5$$
$$= 3/10$$

centroid $= (3/4, 3/10) = (.75, .3)$

2. Each part of this problem refers to the region R bounded by $y = e^x, y = 1$ and the lines $x = 0$ and $x = \ln 2$.

In each part, give the appropriate definite integral, but DO NOT evaluate the integrals.



(a) [2.5 points] Give the definite integral needed to compute the volume generated when the region R is rotated about the x-axis.

$$V = \pi \int_0^{\ln 2} e^{2x} - 1 \, dx$$

$R = e^x$

$r = 1$

$A(x) = R^2\pi - r^2\pi$

$= (e^{2x} - 1)\pi$

(b) [2.5 points] Give the definite integral needed to compute the volume generated when the region R is rotated about the y-axis. You must use washers for this part.

$$V = \pi \int_1^2 (\ln 2)^2 - (\ln y) \, dy$$

$R = \ln 2$

$r : y = e^x$

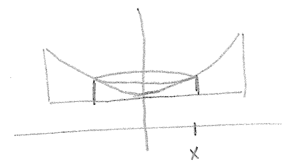
$x = \ln y$

$A(y) = R^2\pi - r^2\pi$

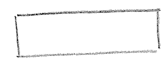
$= ((\ln 2)^2 - (\ln y)^2)\pi$

$y = e^{\ln 2} = 2$

(c) [2.5 points] Give the definite integral needed to compute the volume generated when the region R is rotated about the y-axis. You <u>must</u> use <u>shells</u> for this part.



$$V = 2\pi \int_0^{\ln 2} x(e^x - 1)\, dx$$



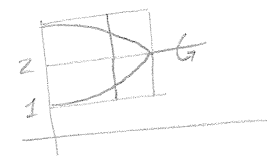
$\} h = e^x - 1$

$2\pi r = 2\pi x$

Cylindar :

$2\pi x(e^x - 1)\, \Delta x$

(d) [2.5 points] Give the definite integral needed to compute the volume generated when the region R is rotated about the line $y = 2$.



$$V = \pi \int_0^{\ln 2} 1 - (2 - e^x)^2\, dx$$

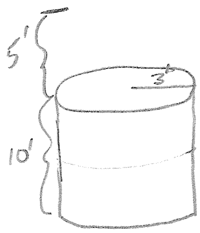
$R = 1$

$r = 2 - e^x$

$A(x) = R^2\pi - r^2\pi$

$= (1 - (2 - e^x)^2)\pi$

$1000\,kg/m^3 \cdot \left(\frac{m}{100cm}\right)^3 \cdot \left(\frac{2.54cm}{1in}\right)^3 \cdot \left(\frac{12in}{1ft}\right)^3$



3. In this problem, we will compute the work done in pumping water out of a right circular cylindrical tank. The height of the tank is 10 feet and its radius is 3 feet. The tank is sitting on its circular base and is full of water (density 62.5 lbs/cu.ft.). ← $g \times$ density $= \boxed{\text{weight}}$
The water is to be pumped to a level 5 feet above the top of the tank.

(a) [8 points] Set up the definite integral needed to compute the work done. [the value of the integral will be computed in part (b).]

$V_i = r^2\pi\Delta = 3^2\pi\Delta x = 9\pi\,\Delta x \quad ft^3$

$F_i = V_i \cdot \text{weight} = 9\pi(62.5)\,\Delta x \quad \text{lbs.}$

Force in lbs

$W_i = 9\pi(62.5)\,\Delta x \cdot x_i$

$x_i = \text{distance} \longrightarrow 5 \text{ to } 15$

$$\int_5^{15} 9\pi(62.5)x\,dx$$

(b) [2 points] Evaluate the definite integral in part (a) to get the numercial answer to the work done.

$$562.5\pi \int_5^{15} x\,dx = 562.5\pi \cdot \frac{x^2}{2}\Big|_5^{15}$$

$$= 281.25\pi\,(225-25)$$

$$= 56250\pi$$

$$= 176714.5868$$

4. (a) [3 points] The partial sums of the series $\sum_{n=1}^{\infty} \frac{1}{n^2}$ are given by $S_n = \sum_{i=1}^{n} \frac{1}{i^2}$. Compute

S_1, S_2, S_3, S_4 and S_5.

$S_1 = \frac{1}{1^2} = 1$

$S_2 = \frac{1}{1^2} + \frac{1}{2^2} = 1 + 1/4 = 5/4$

$S_3 = 1/1 + 1/4 + 1/9 = 5/4 + 1/9 = \frac{45+4}{36} = \frac{49}{36}$

$S_4 = 1/1 + 1/4 + 1/9 + 1/16 = 49/36 + \frac{1}{16} = \frac{205}{144}$

$S_5 = 1/1 + 1/4 + 1/9 + 1/16 + 1/25 = \frac{205}{144} + \frac{1}{25} = \frac{5269}{3600}$

(b) [3 points] In terms of limits, what is the relation between the series $\sum_{n=1}^{\infty} a_n$ and the sequence of partial sums $S_n = \sum_{i=1}^{n} a_i$?

$\sum_{n=1}^{\infty} a_n = \lim_{n \to \infty} S_n$

(c) [4 points] Given a simple example of a series $\sum_{n=1}^{\infty} a_n$ that diverges but $\lim_{n \to \infty} a_n = 0$.

$\sum_{n=1}^{\infty} \frac{1}{n}$ diverges

but $\lim_{n \to \infty} \frac{1}{n} = 0$

5. This problem is concerned with the power series $\sum_{n=1}^{\infty} (-1)^n \frac{(x+2)^n}{n \cdot 2^n}$.

(a) [5 points] Find the interval of convergence for this series. Don't forget to check the endpoints of the interval.

$$\lim_{n\to\infty} \left| \frac{\frac{(-1)^{n+1}(x+2)^{n+1}}{(n+1)2^{n+1}}}{\frac{(-1)^n(x+2)^n}{n2^n}} \right| = \lim_{n\to\infty} \left| \frac{(x+2)^{n+1}}{(n+1)2^{n+1}} \cdot \frac{n\cdot 2^n}{(x+2)^n} \right|$$

$$= \lim_{n\to\infty} \left| \frac{(x+2)\,n}{(n+1)\cdot 2} \right| = |x+2| \lim_{n\to\infty} \frac{n}{2(n+1)} = \frac{|x+2|}{2} < 1$$

$$|x+2| < 2$$

$$-2 < x+2 < 2$$

$$-4 < x < 0$$

$x=0$, $\sum (-1)^n \frac{(0+2)^n}{n2^n} = \sum \frac{(-1)^n}{n}$ C

$x=-4$, $\sum (-1)^n \frac{(-2)^n}{n2^n} = \sum \frac{1}{n}$ D

Interval = $(-4, 0]$

(b) [3 points] Approximate the value of the series when $x = -1.9$ using the first five terms.

$$(-1)\frac{(-1.9+2)}{2} + \frac{(-1.9+2)^2}{2\cdot 4} - \frac{(2-1.9)^3}{3\cdot 8} + \frac{(2-1.9)^4}{4\cdot 16} - \frac{(2-1.6)^5}{5\cdot 32}$$

$$= -.05 + .00125 - \quad + \quad - $$

$$= -.0487901667$$

X

(c) [3 points] Estimate the error in the approximation in part (b). Note that the series is an alternating series when $x = -1.9$.

6. (a) [3 points] Use the integral test to show that the series $\sum_{n=1}^{\infty} \frac{1}{n^3}$ converges. I.e., show

that the improper integral $\int_1^\infty \frac{1}{x^3} dx$ converges.

$\int_1^\infty x^{-3}\,dx = \frac{x^{-2}}{-2} = -\frac{1}{2x^2}\Big|_1^\infty = -\frac{1}{2} + \frac{1}{\infty} = -1/2$

(b) [4 points] Let $S = \sum_{n=1}^{\infty} \frac{1}{n^3}$, $S_n = \sum_{k=1}^{n} \frac{1}{k^3}$ and $f(x) = \frac{1}{x^3}$. Given that $S_n + \int_{n+1}^\infty f(x)\,dx \le S \le S_n + \int_n^\infty f(x)\,dx$, compute A and B (to six decimal places) so that $A \le S \le B$ for $n = 10$.

$A = S_{10} + \int_{11}^\infty \frac{1}{x^3}dx = \sum_{k=1}^{10} 1/k^3 + \int_{11}^\infty 1/x^3\,dx = 1.19753198567$
$+ .004132231405$

$= 1.20166421708$

$B = S_{10} + \int_{10}^\infty 1/x^3\,dx = \sum_{k=1}^{10} 1/k^3 + \int_{10}^\infty 1/x^3\,dx = 1.19753198567$
$+ .005$

$= 1.20253198567$

(c) [3 points] Let $R_n = S - S_n$ (remainder after n terms). Given that $R_n \leq \int_n^{\infty} f(x)\,dx$, find the minimum number of terms ($n =$?) so that $R_n \leq 0.0005$.