**1)( 8 points)** What is the area of the triangle with vertices $(1,2,1)$, $(1,3,1)$ and $(2,1,2)$?

A) 2

B) $\sqrt{2}$

C) $\sqrt{2}/2$

D) $\sqrt{3}$

E) $\sqrt{3}/2$

**2)(8 points)** Find the volume of the parallelepiped determined by the vectors

$$\vec{u} = \langle 1,1,0\rangle, \quad \vec{v} = \langle 1,3,1\rangle \text{ and } \vec{w} = \langle 1,1,2\rangle.$$

A) 3

B) $\sqrt{3}$

C) 4

D) $\sqrt{5}$

E) 6

**3)( 8 points)** The area of the region in the $xy$-plane bounded by the curves $x = 4 - y^2$ and $x = y^2 + 2$ is equal to

A) 4/3

B) 8/3

C) 5/3

D) 3

E) 5

**4)( 8 points)** If $R$ is the region of the $xy$-plane bounded by the curves $x = 2$, $y = 0$ and $y = \ln x$, then the volume of the solid generated by rotating $R$ about the $x$-axis is given by the integral

A) $\pi \int_1^2 \ln x \; dx$

B) $\pi \int_1^2 (\ln x)^2 \; dx$

C) $\pi \int_1^2 (x \ln x)^2 \; dx$

D) $\pi \int_0^1 (\ln x)^2 \; dx$

E) $\pi \int_1^2 x(\ln x)^2 \; dx$

**5)(8 points)** Find the area of the surface of the solid obtained by rotating the curve $y = \frac{x^3}{3}$, with $0 \leq x \leq 1$, about the $x$-axis

A) $\frac{\pi}{17}(\sqrt{3} - 1)$

B) $\frac{\pi}{9}(2\sqrt{2} - 1)$

C) $2\pi$

D) $\frac{\pi}{27}(5\sqrt{2} - 1)$

E) $\frac{\pi}{54}(37\sqrt{37} - 1)$

**6)( 8 points)** If one uses the method of cylindrical shells to find the volume of the solid obtained by rotating the region bounded by the curves $y = x^3$, $y = 0$ and $x = 1$ about the line $x = 1$ one obtains the following integral

A) $2\pi \int_0^1 (1 - x)x^3 \, dx$

B) $2\pi \int_1^2 (1 - x)x^3 \, dx$

C) $2\pi \int_0^1 (1 - x)^2 x^3 \, dx$

D) $2\pi \int_1^2 (1 - x)^2 x^3 \, dx$

E) none of the above

**7)(8 points)** A spring is stretched 3 feet beyond its natural length, and a force of 15 lbs is required to hold it in that position. If one wants to stretch it by two more feet, how much work would be necessary to do that?

A) 15/8 ft-lb

B) 15/6 ft-lb

C) 5/3 ft-lb

D) 40 ft-lb

E) 30 ft-lb

**8)( 8 points)** The partial fraction decomposition of

$$\frac{x}{(x+1)(x^2+1)^2} \text{ has the form}$$

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

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

C) $\frac{A}{x+1} + \frac{Bx+C}{x^2+1}$

D) $\frac{A}{x+1} + \frac{Bx+C}{(x^2+1)^2} + \frac{Dx+E}{x^2+1}$

E) $\frac{A}{(x+1)} + \frac{B}{(x^2+1)^2}$

**9)( 8 points)** The integral

$$\int_0^{\frac{\pi}{2}} \cos^3 x \sin^3 x \, dx \quad \text{is equal to}$$

A) 4/53

B) 3/17

C) 2

D) 1/12

E) 4/15

**10)( 8 points)** The improper integral

$$\int_0^1 \frac{x^2}{(1-x^3)^{\frac{3}{2}}} \, dx$$

A) is equal to $3\pi/4$

B) is equal to $5/2$

C) is equal to $2\pi/3$

D) is equal to $3\pi/7$

E) diverges

**11)(8 points)** Compute the integral

$$\int_0^\infty \frac{1}{(x^2+1)^2}\,dx$$

A) 1

B) $\pi/4$

C) $\sqrt{3}/2$

D) $2\pi$

E) $3\pi/4$

**12)(8 points)** Compute the integral

$$\int_0^{\sqrt{2}/2} \frac{1}{(1-x^2)^{3/2}}\,dx$$

A) $\sqrt{3}/2$

B) $\pi/3$

C) 1

D) $\sqrt{2}$

E) $\pi/4$

**13)(8 points)** Compute the improper integral

$$\int_0^\infty xe^{-x}\,dx$$

A) $e$

B) $e^2$

C) $2\ln 3$

D) 1

E) $\ln 2$

**14)(8 points)** Masses of 2 and 4 kg are placed at the points $(-1, 1)$ and $(1, 2)$ respectively. Where should a mass of 3 kg be placed so that the system have center of mass at $(1, 1)$?

A) $(7/3, -1/3)$

B) $(2, -1/3)$

C) $(11/3, 7/4)$

D) $(1.12/7)$

E) $(2, -3/7)$

**15)(8 points)** The sum of the series

$$\sum_{n=1}^{\infty} \frac{2^n + 3^{n+1}}{5^n} =$$

A) 12/7

B) 8

C) 18/5

D) 31/6

E) 27/18

**16)(8 points)** The series

$$\sum_{n=1}^{\infty} \frac{1}{2n^2 - n}$$

A) diverges by the comparison test

B) converges by the limit comparison test

C) diverges by the integral test

D) converges by the ratio test

E) diverges by the ratio test

**17)(8 points)** The series

$$\sum_{n=1}^{\infty}(-1)^n\frac{1}{\sqrt{n}}$$

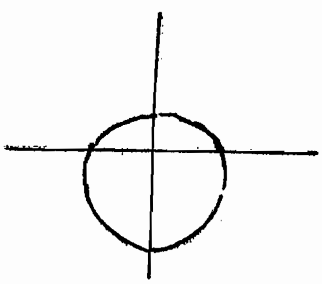
A) converges absolutely

B) converges conditionally

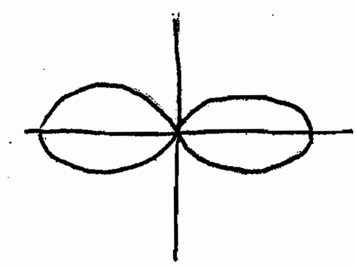
C) diverges

**18)(8 points)** The graph of the function given by polar equation $r = 2 - \sin\theta$ looks mostly like

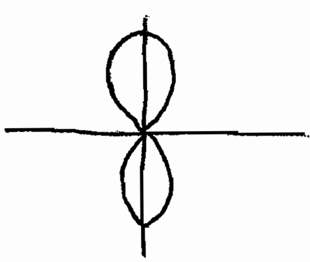
A)



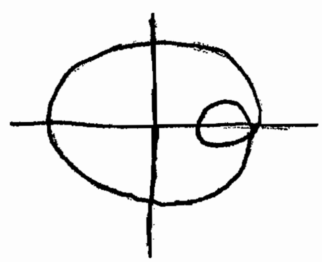
B)



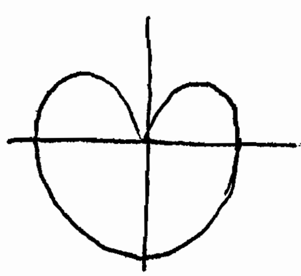
C)



D)



E)



**19)(8 points)** The radius of convergence of the series $\sum_{n=1}^{\infty} \frac{2n^2}{n!} x^n$ is

A) 0

B) 1

C) 2

D) $\infty$

E) 1/4

**20)(8 points)** The integral

$$\int_0^1 \frac{e^x}{\sqrt{x}}\, dx$$

is equal to

A) $\sum_{n=0}^{\infty} \frac{2}{n!(2n+1)}$

B) $\sum_{n=0}^{\infty} \frac{1}{n!\sqrt{n+1}}$

C) $\sum_{n=0}^{\infty} (-1)^n \frac{1}{(n+1)\sqrt{n}}$

D) $\sum_{n=0}^{\infty} \frac{1}{(n+1)!}$

E) $\sum_{n=0}^{\infty} \frac{e^n}{\sqrt{n+1}}$

**21)(8 points)** The first three terms of the Taylor series of $\ln x$, centered at $a = e$, are

A) $(x-e) - \frac{(x-e)^2}{2} + \frac{(x-e)^3}{3}$

B) $1 + \frac{(x-e)}{e} - \frac{(x-e)^2}{2e^2}$

C) $x - \frac{x^2}{3e} + \frac{x^3}{3}$

D) $ex - \frac{x^2}{e} + \frac{x^3}{2e}$

E) none of the above

**22)(8 points)** If $f(x) = (1-x^2)^{-1}$ then $f^{(4)}(0) =$

A) 1

B) 2

C) -4

D) 12

E) 24

**23)(8 points)** The length of the curve given by $x = \sin 2t$, $y = 1 + \cos 2t$, $0 \le t \le \frac{\pi}{4}$ is

A) 1

B) 2

C) $\sqrt{2}$

D) $\pi/2$

E) $\pi$

**24)(8 points)** If polar coordinates of a point are $(r, \theta) = (1, \pi)$, its Cartesian coordinates are

A) $(1, \pi)$

B) $(1, 1)$

C) $(1, 0)$

D) $(-1, 0)$

E) $(-1, 1)$

**25)(8 points)** The two curves sketched below have polar equations

$$r = 2 \quad \text{and} \quad r = \frac{1}{1+\sin\theta}.$$

Which of the integrals represents the area of the shaded region?

A) $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} (r^2 - r^2 \frac{(1+\sin\theta)^2}{2})\, d\theta$

B) $\int_{-\frac{\pi}{6}}^{\frac{7\pi}{6}} (2 - \frac{1}{2(1+\sin\theta)^2})\, d\theta$

C) $\int_{0}^{2\pi} \frac{1}{2}(2 - \frac{1}{1+\sin\theta})^2\, d\theta$

D) $\int_{-\frac{\pi}{3}}^{\frac{5\pi}{3}} \frac{1}{2}(2 - \frac{1}{1+\sin\theta})^2\, d\theta$

E) $\int_{-\frac{\pi}{4}}^{\frac{5\pi}{4}} \frac{1}{2}(1 + \frac{1}{1+\sin\theta})^2\, d\theta$