1. Calculate the following integrals.

[8] a) $\int \frac{\ln x}{\sqrt{x}}\, dx =$

[8] b) $\int \frac{2x+3}{x^2+2x+1}\, dx$

[8] c) $\int \tan^3 x \sec^4 x\, dx$

[8] d) $\int \frac{\sqrt{x^2-36}}{x}\,dx$

[8] e) Use the trapezoidal rule to express the integral below as a numerical sum. Use step $\Delta x = 0.5$

(No need to evaluate the sum.) $\int_0^2 \frac{x}{9x^3+1}$

2. Calculate the following definite integrals.

[10] a) $\int_0^\infty x^2 e^{-x^3}\,dx$

[10] b) $\int_1^2 \frac{dx}{\sqrt{x-1}}$

3. Find the following limits.

[10] a) $\lim_{x \to 0^+} (e^{3x} - e^{x}) \cot x$

[10] b) $\lim_{x \to 0^+} (2x+1)^{1/x}$

[8] 4. Evaluate the series or, if it is divergent, explain why.

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

5. Determine if the series is absolutely convergent, conditionally convergent or divergent. Include your arguments and reasoning to receive credit for your answer.

[8] a) $\sum_{n=0}^{\infty} \left(\frac{3n+2}{5n+3} \right)^n$

[8] b) $\sum_{n=0}^{\infty} \frac{(-7)^n}{3n-1}$

[8] c) $\sum_{n=0}^{\infty} \frac{(-2)^n n^3}{n!}$

6. Find the interval of convergence of the series. Include the analysis of the endpoints.

[8] a) $\sum_{n=1}^{\infty} \frac{(-1)^n x^n}{3^n (n+1)}$

[8] b) If you use the first 4 terms to approximate the value of this series for x = ½, estimate how large the error could be. Explain your answer.

[8] 7. Find MacLaurin expansion of the function

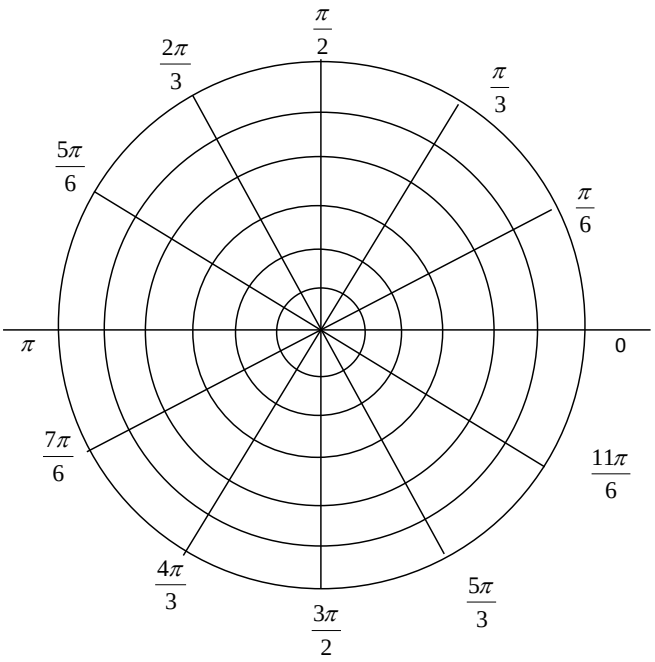
$$f(x) = \frac{x^2}{1+\pi x}$$

8. [8] a) Represent the function f(x) = arctan(x) (the same as f(x) = $\tan^{-1}(x)$) as a power series.

[8] b) Use your result to find the exact value of $\sum_{n=0}^{\infty}(-1)^n \frac{3^{(2n+1)/2}}{2n+1}$

[8] 9. Write the first 4 non-zero terms of the Taylor expansion of the function f(x) = cos(x) around point a = π/4.

[8] 10. Find the area enclosed by the smaller loop made by the polar curve $r = 1 + 2\cos\theta$.



11. [8] a) Find the arc length of the part of the curve given below for $0 \le t \le \ln 2$.

$$\begin{cases} x = \frac{2}{3} e^{3t/2} \\ y = e^{t} \end{cases}$$

[8] b) Find the equation of the line tangent to the above curve at t = 0.

12. [8] a) Determine the eccentricity and identify the conic as one of four types: circle, parabola, hyperbola, or ellipse.

(i) $r = \dfrac{5}{6-3\sin\theta}$ (ii) $r = \dfrac{6}{1+2\cos\theta}$

(eccentricity) e = e =

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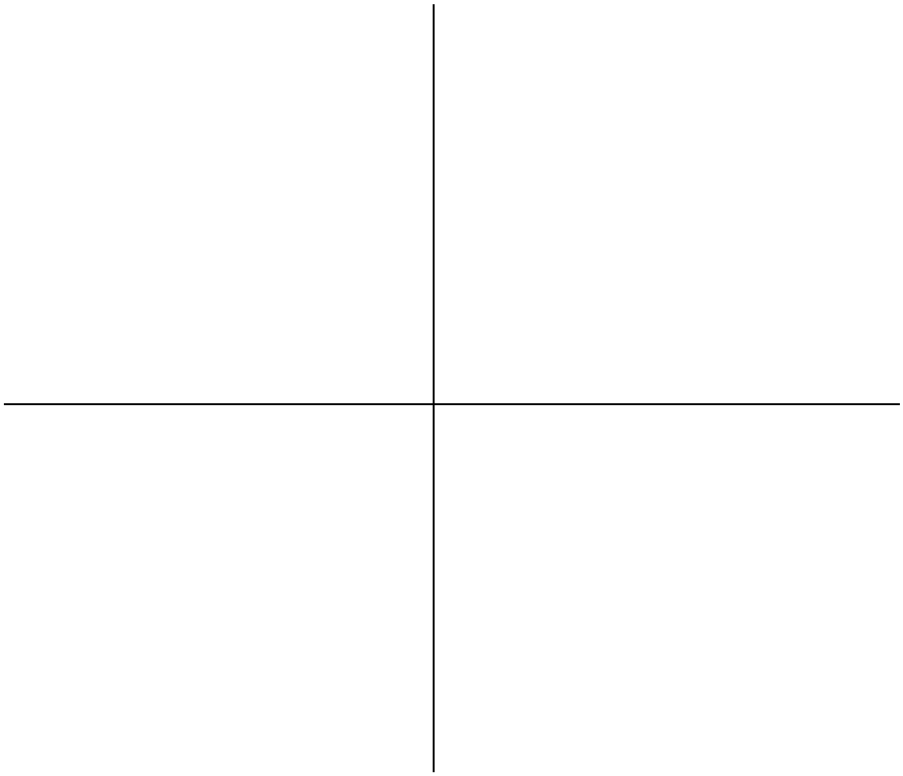
[8] b) Sketch the second curve (**ii**) to all that apply, label by coordinates **intercepts** (**intersections with** ***x*** and ***y*** axes), the **center** and the **foci**. Draw one directrix. Then fill in the blanks at the bottom of the page:



Work:

Answers to all that apply
Vertices:
Center:
Foci:
Equation of directrix:
The main axes: a = b =