1) a)Find the 3rd degree Taylor polynomial $T_3(x)$ that approximates the function $f(x) = x^{-2}$ about the point $a = 1$.
b) Us the Taylor inequality to estimate the accuracy of the approximation $f(x) \sim T_3(x)$ when $.8 \leq x \leq 1.1$.
c) Write the Taylor Sereis expansion of $f(x) = x^{-2}$ at $a = 1$. Write the result using summation notation.
d) For what values does the series found in part c) converge?

2) a) Solve for y in terms of x: $\ln(y^2 - 1) - \ln(y - 1) = \ln(\sin x))$.
b) Evaluate the expression $\cos(\arcsin(\frac{2}{\sqrt{x^2+4}}))$.
c) For what values of x does the expression in b) make sense?

3) a) Simplify i^{27}.
b) Write the complex number $8\sqrt{2} - 8\sqrt{2}i$ in polar form.
c) express $e^{3+i\pi/6}$ in the form $a + bi$.
d) Compute the three cube roots of -1.

4) Calculate the following integrals. Show your work.

$$\int xe^{3x}dx \qquad \int \frac{1}{x^2-1}dx$$

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

$$\int \ln(2x)dx \qquad \int \sin^3(2x)\cos^2(2x)dx$$

$$\int \frac{x+4}{x^2+5x-6}dx \qquad \int_4^1 \frac{e^{\sqrt{x}}}{\sqrt{x}}dx$$

5) a) Find the formula for the n-th term of the sequence $-2/5$, $4/25$, $-8/125$, $16/625$,...
b) Compute $\lim_{n\to\infty} \frac{\cos(n\pi)}{2n+1}$ if the limit exists.
c) Compute $\lim_{n\to\infty} \frac{3\ln n}{\ln(n^2)}$ if the limit exists.

6) Determine whether the series is absolutely convergent, conditionally convergent or divergent. If it is a gemoetric series find the limit. Justify your answer.

$$\sum_{n=1}^{\infty}(-1)^n\frac{2^{2n}}{5^n} \qquad \sum_{n=1}^{\infty}\frac{n^2+5n+1}{5-2n^2}$$

$$\sum_{n=1}^{\infty}\frac{2^n+1}{3^n} \qquad \sum_{n=1}^{\infty}e^{\pi}\pi^{-n}e^n$$

$$\sum_{n=1}^{\infty}\frac{3n^3+2n^2+3n^4}{3n+3n^5-3n^2} \qquad \sum_{n=1}^{\infty}\frac{(-1)^{n-1}}{\sqrt{n+1}}$$

7) a) Sketch the curve of the parametric equation $x = t^2 - 2t$, $y = t + 1$, $-1 \le t \le 3$ and indicate with arrows the direction.
b) Find points on the curve where the tangent is horizontal or vertical.
c) Find the tangent to the curve at point $(0, 3)$.
d) Calculate the length of the curve.

8) Sketch the region that lies inside the curve $r = 1 - \cos\theta$ and outside the curve $r = 3/2$. Find the area.

9) If $\dfrac{dy}{dt} = 2yt$ and $y(0) = 50$, find y as a function of t (assume $y > 0$ for all t).

10) Let $f(x) = 2x + \frac{1}{2}\cos(2x)$ for $0 \le x \le 4\pi$.
a) Determine whether f is invertible.
b) Give domain and range for f and f^{-1}.
c) Calculate $\dfrac{df^{-1}}{dx}(x)\Big|_{x=\frac{1}{2}+2\pi}$. (Note that $f(\pi) = \frac{1}{2} + 2\pi$.)

11) Calculate i^i.