1. Consider the power series,

$$f(x)=\sum_{n=2}^{\infty}(-1)^n\frac{x^n}{n^2-n}\,, \tag{1}$$

where x is a real variable.

(a) Compute the radius of convergence of the power series $f(x)$.

(b) Determine whether the power series given in eq. (1) is absolutely convergent, conditionally convergent, or divergent at the point $x = 1$.

HINT: The method of partial fractions is your friend (after factoring the denominator).

(c) If $f(1)$ is convergent, determine its value.

2. Consider the real valued function:

$$g(x)=\left(\frac{3}{x^3}-\frac{1}{x}\right)\sin x-\frac{3}{x^2}\cos x\,.$$

(a) Compute $\lim\limits_{x\to 0} g(x)$.

(b) Find the *behavior* of $g(x)$ as $x \to 0$.

3. Evaluate the following quantities:

(a) $(-1)^i$

(b) $\mathrm{Im}\,[ix+\sqrt{1-x^2}]^{-1}$, where x is a real number and $|x|<1$

(c) $\mathrm{Arg}(\sin i)$

Be sure to indicate all possible values if the quantity in question is multivalued. Simplify your expressions as much as possible.

4. Find all complex number solutions z to the equation, $z^3 = i$.

5. Consider the system of equations:

$$x_1 + 3x_2 - x_3 = 4\,,$$
$$x_1 + 2x_2 + x_3 = 2\,,$$
$$3x_1 + 7x_2 + x_3 = c\,,$$

where c is some unspecified real number. There exists one value of c for which there are solutions to the above system of equations. Find that value of c and determine the allowed solutions.