Midterm Exam No. 01 (2020 Spring)

PHYS 301: THEORETICAL METHODS IN PHYSICS

Department of Physics, Southern Illinois University–Carbondale

Date: 2020 Feb 5

Note: Standard identities will be provided to a student when requested.

1. (**20 points.**) Find the real and imaginary part of the function

$$f = \frac{e^{iz}}{z}. \tag{1}$$

   Here z represents a complex number.

2. (**20 points.**) Find the magnitude and direction, (or phase, or argument,) of

$$z^{11}, \tag{2}$$

   where $z = 1 + i$. Mark z and z^{11} on the complex plane.

3. (**20 points.**) Find the four roots of the equation

$$z^4 = \frac{1+i}{\sqrt{2}}. \tag{3}$$

   Mark the the points corresponding to the four roots on the complex plane.

4. (**20 points.**) Check if the function

$$f(z) = e^{z+iz} \tag{4}$$

   satisfies the Cauchy-Riemann conditions.

5. (**20 points.**) Evaluate the contour integral

$$I = \frac{1}{2\pi i} \oint_c \frac{dz}{(2z^2 + 3z - 2)}, \tag{5}$$

   where the contour c is along the unit circle going counterclockwise.