Problem 2.1

Problem 2.1

1 point possible (ungraded)

Find the principal part of the Laurent series of

$$\frac{1+2z^2}{z^3+z^5}$$

at point $z=0$.

$$\frac{\square}{z^3}+\frac{\square}{z^2}+\frac{\square}{z}$$

	-2	-1	0	1	2	

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Problem 2.2

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Problem 2.2

2 points possible (ungraded)

Find the order of the pole and coefficient in front of $\frac{1}{z}$ of Laurent series at point $z = 0$ for the function

$$f(z) = \frac{1}{z(e^z - 1)}.$$

Order of the pole

Coefficient in front of $\frac{1}{z}$

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Problem 2.3

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Homework due Oct 31, 2020 20:00 EDT *Completed*

Problem 2.3

1/2 points (graded)

Build the Laurent expansion around $z = 0$ for the function

$$\frac{1}{z(z-1)}$$

for the region: (i) $|z| \in (0,1)$ and ii) $|z| \in (1,\infty)$.

$$\text{(i)} \quad \frac{1}{z(z-1)} = \frac{-1}{z} - \sum_{n=0}^{\infty} z^n$$

	-2	-1	0	1	2	z^n	

✔

$$\text{(ii)} \quad \frac{1}{z(z-1)} = \frac{1}{z} + \sum_{n=2}^{\infty} z^{-n-1}$$

	-2	-1	0	1	2	z^n	

✖

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Previous Next

Problem 2.4

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Homework due Oct 31, 2020 20:00 EDT

Problem 2.4

1 point possible (graded)

Build the Laurent expansion for the function

$$\frac{z}{z^2+1}$$

around point $z = i$. What is the convergence region of the obtained result?

$$\boxed{}\,\frac{1}{z-i} - \frac{i}{4}\sum_{n=0}^{\infty}\left(\boxed{}\right)^n (z-i)^n, \quad |z-i| < \boxed{}$$

2	1	$-\frac{1}{2}$	$\frac{1}{2}$	$\frac{i}{2}$	$\frac{2}{i}$	

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Problem 2.5

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Problem 2.5

1/1 point (ungraded)
Consider the functions

$$\frac{1}{\sin z} + \frac{2z}{z^2 - \pi^2}.$$

Find the singularity type at points $z = \pm\pi$

- (x) Removable simgularities.
- ( ) Poles.
- ( ) Essential singularities.

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Correct (1/1 point)

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Problem 2.6

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Problem 2.6

3 points possible (ungraded)

Compute the following integrals along contour C -- unit circle centered at $z=0$. Use pi for π and i for imaginary unity

(1)

$\int_C \frac{ze^z}{\tan z^2}dz$

(2)

$\int_C e^{-1/z}\sin\left(\frac{1}{z}\right)dz$

(3)

$$\int_C \frac{e^z}{z^n}dz \quad \text{(for natural} \quad n) = \frac{\boxed{}}{\left(\boxed{}\right)!}$$

2	$2\pi i$	πi	n	$n-1$	

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Problem 2.7

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Problem 2.7

2 points possible (ungraded)
Find all the isolated singularities of the functions and define their type (assuming n is an integer).
1)$f\left(z\right)=\frac{\sin z}{1-\tan z}$

- simple poles at $z=\frac{\pi}{4}+2\pi n$
- simple poles at $z=\frac{\pi}{4}+\pi n$
- simple poles at $z=\frac{\pi}{4}+2\pi n$ and higher order poles at $z=\frac{3\pi}{4}+2\pi n$

2)$f\left(z\right)=\frac{e^{c/(z-a)}}{e^{z/a}-1}$

- simple poles at $z=2\pi ina$ and removable singularity at $z=a$
- simple poles at $z=2\pi ina$ and essential non-isolated singularity at $z=a$
- simple poles at $z=2\pi ina$ and essential isolated singularity at $z=a$
- simple poles at $z=\pi ina$ and essential isolated singularity at $z=a$

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Problem 2.8

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Homework due Oct 31, 2020 20:00 EDT

Problem 2.8

2 points possible (graded)

Find coefficient in front of $\frac{1}{z}$ of Laurent series of the functions

$$1)\ f(z) = \frac{\sin\frac{1}{z}}{1-z}, \quad 2)\ g(z) = \exp\left(-\exp\left(\frac{1}{z}\right)\right)$$

at $z = 0$.

Coefficient in front of $\frac{1}{z}$ for Laurent series of $f(z)$

Coefficient in front of $\frac{1}{z}$ for Laurent series of $g(z)$

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Problem 2.9

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Problem 2.9

1 point possible (ungraded)

Determine the singularity type of the function $ze^{\frac{1}{z}}e^{-\frac{1}{z^2}}$ at point $z = 0$:

- Non-isolated singularity.
- Essential isolated singularity.
- Simple pole
- Higher-order pole

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Problem 2.10

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Problem 2.10

2 points possible (ungraded)
Function

$$\frac{e^{iz}}{\cos z - 1}$$

can be expanded into Laurent series $\sum_{n=-\infty}^{\infty} c_n z^n$ in the region $|z| \in (2\pi k, 2\pi(k+1))$ for any integer non negative k. Find coefficient c_{-3} for such a series for $k=0$ and $k=1$. Use i for imaginary unit and pi for π.

c_{-3} for $k=0$

c_{-3} for $k=1$

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