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Practical 15

Question: Locate the zero and poles of $g(z) = \frac{\pi \cot(\pi t)}{z^2}$ and determine their order. Also justify that $\text{Res}(g, 0) = -\frac{\pi^2}{3}$.

In[•]:=
```
f[z_] := Pi Cot[Pi z] / z^2;
Solve[Cot[Pi z] == 0, z]
```

Out[•]=

$$\left\{\left\{z \to \frac{\frac{\pi}{2} + \pi\, C_1}{\pi} \text{ if } C_1 \in \mathbb{Z}\right\}\right\}$$

```
Text["Conclusion: The function f has zero at z=(Pi/2 + Pi n)/Pi (n∈Z) for order 1."]
```

Out[•]=

Conclusion: The function g has zero at $z=\frac{\frac{\pi}{2}+\pi n}{\pi}$ $(n \in Z)$ for order 1.

In[•]:=
```
Solve[1 / f[z] == 0, z]
```

Solve: Inverse functions are being used by Solve, so some solutions may not be found; use Reduce for complete solution information.

Out[•]=

$\{\{z \to 0\}\}$

In[•]:=
```
Text["Conclusion: The function f1 has pole at z=0 of order 2."]
```

Out[•]=

Conclusion: The function f1 has pole at z=0 of order 2.

In[•]:=
```
Residue[f[z], {z, 0}]
```

Out[•]=

$$-\frac{\pi^2}{3}$$

In[•]:=
```
SeriesCoefficient[f[z], {z, 0, -1}]
```

Out[•]=

$$-\frac{\pi^2}{3}$$