

Sample Test (MS/PhD Mathematics)

1. **(Complex Variables)** The point $z = 0$ is a _____ of the function $f(z) = |z|^2$
(a) regular point (b) singular point (c) pole (d) Essential Singular point (e) None
2. **(Differential Equations)** Find the particular solution of the differential equation

$$\frac{x^2}{y^2 - 6} \frac{dy}{dx} = \frac{1}{2y}$$

satisfying the initial condition $y(1) = \sqrt{7}$.

- a). $\sqrt{e^{1-1/x} + 6}$
b). $\sqrt{e^{1-1/x}} + 6$
c). $\sin \sqrt{1 - 1/x} + 6$
d). $\cos \sqrt{1 - 1/x} + 6$
e). None
3. **(Calculus)** Evaluate

$$\int_0^{\frac{3\pi}{2}} |\sin(x)| dx$$

- a. 3
b. 0
c. 1
d. π
e. None
4. **(Linear Algebra)** Determine all values of k for which the system

$$2x - 7y = 4$$

$$5x - ky = 2$$

has no solution.

- a) k is any non-zero real number.
b) $k = -2, 5$.
c) $k = -5$
d) $k \neq 0, -5$.
e) None
5. **(Algebra)** How many elements of order 2 are in the symmetric group S_5 ?
(a) 60 (b) 75 (c) 100 (d) 45 (e) None
6. **Analysis** Let $\{a_n\}$ be a sequence such that $a_n \rightarrow 0$ and let $\{b_n\}$ be a bounded sequence. Then the sequence $\{a_n b_n\}$

- (a) is divergent
 - (b) converges to zero
 - (c) converges to a non-zero real number
 - (d) is monotone
 - (e) None
7. (**Topology**) Let X be a nonempty set, and let τ_1 and τ_2 be two topologies on X . Assume that the identity map $I: (X, \tau_1) \rightarrow (X, \tau_2)$ is continuous, then
- (a) $\tau_1 \subset \tau_2$
 - (b) $\tau_2 \subset \tau_1$
 - (c) $\tau_1 = \tau_2$
 - (d) $\tau_1 \subsetneq \tau_2$
 - (e) None