Name: ____

- You have fifty minutes to complete this mock exam.

1. True or false, $\sum_{n=2}^{\infty} \frac{n^{0.001}}{\ln n}$ converges.

   A. True B. False

2. Where is the integral

$$\int_0^{\pi} \tan\theta \; d\theta$$

   improper?

   A. Nowhere
   B. $\frac{\pi}{4}$
   C. $\frac{\pi}{2}$
   D. $\frac{3\pi}{4}$
   E. π

3. True or false, the integral test can be applied to the series

$$\sum_{n=1}^{\infty} \frac{\sin\left(\frac{n\pi}{2}\right)}{n^2}?$$

A. True B. False

4. True or false, the series

$$\sum_{n=1}^{\infty} \frac{n+1}{n^3}$$

converges?

A. True B. False

5. Which of the following integrals represents the area of the surface obtained by rotating the curve $y = \sin x$ for $0 \leq x \leq \pi$ about the x-axis?

   A. $\displaystyle\int_0^{\pi} \sin x\sqrt{1+\cos^2 x}\; dx$

   B. $\displaystyle 2\pi\int_0^{\pi} \sin x\sqrt{1+\sin^2 x}\; dx$

   C. $\displaystyle 2\pi\int_0^{\pi} \cos x\sqrt{1+\sin^2 x}\; dx$

   D. $\displaystyle 2\pi\int_0^{\pi} \sin x\sqrt{1+\cos^2 x}\; dx$

   E. $\displaystyle\int_0^{\pi} \sqrt{1+\cos^2 x}\; dx$

6. Show that

$$\sum_{n=2}^{\infty} \frac{1}{n^2 - 1} = \frac{3}{4}.$$

7. A triangular lamina that is 4 m tall and 5 m wide is partially submerged, base-first, in water. It reaches a maximum depth of 3 m. Carefully sketch a diagram of this situation with clearly drawn and labeled axes. Compute the hydrostatic force on one side of the lamina.

8. Determine if the following series converge or diverge. If a series converges, find its sum.

(a) $\dfrac{1}{\pi} + \dfrac{1}{\pi^2} + \dfrac{1}{\pi^3} + \dfrac{1}{\pi^4} + \cdots$

(b) $\displaystyle\sum_{n=0}^{\infty} \frac{2^{2n+1}}{3^n}$

9. Compute the centroid of the region bounded by the curve $\sqrt{x} + \sqrt{y} = 1$, the x-axis, and the y-axis.

10. Consider the series $\sum_{n=1}^{\infty} ne^{-n^2}$.

(a) Use the integral test to show that this series converges.

(b) How many terms are required to approximate the value of this series to within ten decimal places of accuracy?