2023 AP Daily: Practice Sessions

AP Calculus BC

Session 1 – MCQ

1. Which of the following is a logistic differential equation whose solution has carrying capacity of 50?

   A. $\frac{dy}{dt} = 50y$

   B. $\frac{dy}{dt} = \frac{y}{50}(1 - y)$

   C. $\frac{dy}{dt} = 50y(1 - y)$

   D. $\frac{dy}{dt} = y(1 - \frac{y}{50})$

2. Which of the following series is conditionally convergent?

   A. $\sum_{n=1}^{\infty} \frac{(-1)^{2n+3}}{5n+1}$

   B. $\sum_{n=1}^{\infty} (-1)^n \frac{2n+3}{5n+1}$

   C. $\sum_{n=1}^{\infty} (-1)^n \frac{2n+3}{5n^2+1}$

   D. $\sum_{n=1}^{\infty} (-1)^n \frac{2n^2+3}{5n^4+1}$

3. The power series $\sum_{n=0}^{\infty} a_n (x-5)^n$ converges conditionally at $x = 9$. For which of the following pairs of x values must $\sum_{n=0}^{\infty} a_n (x-5)^n$ also converge?

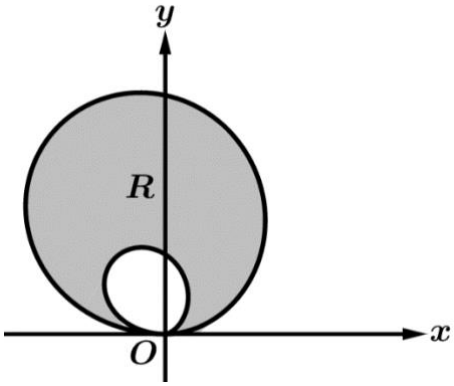
   A. $x = 1$ and $x = 7$

   B. $x = 2$ and $x = 10$

   C. $x = 2$ and $x = 8$

   D. $x = 0$ and $x = 6$

All problems written by Bryan Passwater



4. The graph of the polar function $r(\theta) = \frac{\theta}{2}\sin(\theta)$ is shown in the figure above for $0 \le \theta \le 2\pi$. Let R be the shaded region between the inner and outer loops, as shown above. Which of the following expressions gives the area of the region R?

   A. $\frac{1}{2}\int_0^{\pi}(r(\theta))^2\,d\theta$

   B. $\frac{1}{2}\int_0^{2\pi}(r(\theta))^2\,d\theta$

   C. $\frac{1}{2}\int_{\pi}^{2\pi}(r(\theta))^2\,d\theta - \frac{1}{2}\int_0^{\pi}(r(\theta))^2\,d\theta$

   D. $\frac{1}{2}\int_0^{2\pi}(r(\theta))^2\,d\theta - \frac{1}{2}\int_{\pi}^{2\pi}(r(\theta))^2\,d\theta$

5. If $x(t) = 3t^2 - 5$ and $y(t) = t^3 - 4t + 2$ for $t = 0$, then $\frac{d^2y}{dx^2} =$

   A. $\frac{3t^2+4}{6t^2}$

   B. $\frac{-18t^2-24}{(3t^2-4)^2}$

   C. $\frac{3t^2+4}{6t^2(3t^2-4)}$

   D. $\frac{3t^2+4}{36t^2}$