30. The functions given by

$$f(x) = \begin{cases} ax + 1, & x \leq \pi/2 \\ \sin x + b, & x > \pi/2 \end{cases}$$

is continuous if

(A) $a = \sin b$

(B) $a = \dfrac{\pi b}{2}$

(C) $b = \dfrac{\pi a}{2}$

(D) $b = \sin a$

31. Consider the differential equation $y' = y \cot(x) + \sin(x)$. The corresponding homogeneous linear equation has a general solution

(A) $y = \cos(Cx)$

(B) $y = \sin(Cx)$

(C) $y = C \cos(x)$

(D) $y = C \sin(x)$

where C is integration constant.

32. The method of substitution for a first order linear differential equation $y' = P(x)y + Q(x)$ constitutes in writing the general solution as product of two functions, i.e., $y(x) = u(x)v(x, C)$, where C is the integration constant. For the equation $\frac{dx}{dy} = \frac{2x}{y} + \frac{3}{y^2}$, the solutions for u and v can be written as

(A) $u = y^2, v = C - \frac{1}{y^2}$

(B) $u = y^2, v = C - \frac{1}{y^3}$

(C) $u = -\frac{1}{y^3}, v = y^2 + y + C$

(D) $u = -\frac{1}{y^3 + C}, v = y^2 + y$

33. The vectors $(\xi, 1, 0), (1, \xi, 1)$ and $(0, 1, \xi)$ in $\mathbf{R}^3$ are linearly dependent when the scalar ξ is

(A) 0

(B) ± 1

(C) $\pm\sqrt{2}$

(D) $\pm\sqrt{3}$

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