

72. Let (a, b, c, d) be a randomly selected ordered quadruple of positive integers such that $1 \leq a, b, c, d \leq 10$. (“Randomly selected” means all quadruples are equally likely.) What is the probability that $ad - bc$ is odd?
- (A) $\frac{3}{16}$ (B) $\frac{1}{4}$ (C) $\frac{3}{8}$ (D) $\frac{1}{2}$ (E) $\frac{3}{4}$
73. If $\sin^2 \alpha + \cos^2 \beta = \frac{7}{9}$, $\sin^2 \beta + \cos^2 \gamma = \frac{2}{3}$, and $\sin \gamma + \cos \alpha = \frac{2\sqrt{7}}{3}$, then what is the value of $(\sin \gamma)(\cos \alpha)$?
- (A) $\frac{1}{9}$ (B) $\frac{1}{3}$ (C) $\frac{4}{9}$ (D) $\frac{2}{3}$ (E) $\frac{7}{9}$
76. The lengths of the legs of a right triangle are $\log 8$ and $\log 16$, and the length of the hypotenuse is $\log x$. What is x ?
77. The quadratic equation $x^2 + 4ax - 4.5a = 0$ has two solutions, x_1 and x_2 , such that $x_1^2 + x_2^2 = 25$. What is a possible value of parameter a ?
- (A) $\sqrt{2}$ (B) $2\sqrt{2}$ (C) 1 (D) 0 (E) -1
78. Cylinder C_1 , whose height and diameter are equal, is inscribed in sphere S . S is inscribed in cylinder C_2 , whose height and diameter are also equal. What is the ratio of the volumes of C_2 and C_1 ?
- (A) 2 (B) 4 (C) 8 (D) $\sqrt{2}$ (E) $2\sqrt{2}$
79. The population of a certain country grows geometrically. It increased from 3 million people in 2001 to 6 million in 2007. What year will it reach 12 million?
80. In how many ways can the number 2013 be written as the sum of two or more consecutive positive integers?
81. What is the number of real solutions of the equation

$$(x^2 - 5x + 5)^{(x^2 + 8x + 12)} = 1?$$

82. The number $\sqrt{2009 \cdot 2010 \cdot 2011 \cdot 2012 + 1}$ is a positive integer. What are its rightmost three digits?
- (A) 099 (B) 101 (C) 109 (D) 111 (E) 121
85. Members of the Alpha Club have created an ornament to designate membership in the club. The ornament consists of a hemisphere with radius 2 cm and a cone with radius 2 cm and altitude 2 cm. The base of the cone is joined to the flat surface of the hemisphere. What is the surface area of the ornament, in cm^2 ?
- (A) 12π (B) $\pi(8 + 4\sqrt{2})$ (C) $\pi(4 + 8\sqrt{2})$ (D) $12\sqrt{2}\pi$ (E) 24π