Directions: No calculators allowed.

(1) 2025 - [2025 - (2027 - 2028)] = ?

(a) -2026 (b) **-1** (c) 0 (d) 1 (e) 2

(2) What is $(2-5+9)^0 - 2^6 - 3! - (-1)^{99}$?

(a) **-68** (b) -70 (c) -36 (d) -63 (e) 0

(3) Greg put \$1000 in a checking account ten years ago. If he earns 12% simple interest, how much money (in dollars) will he have earned 20 years from now?

(a) 2400 (b) 2200 (c) 4800 (d) 3400 (e) **3600**

(4) How many gallons of 25% acid-solution must be added to 20 gallons of pure acid-solution to make a 60% acid-solution?

(a) 25 (b) $\frac{170}{9}$ (c) $\frac{170}{7}$ (d) $\mathbf{\frac{160}{7}}$ (e) $\frac{49}{2}$

(5) If $\frac{a}{b} = \frac{c}{d} = 3$, find $\frac{a+7c}{b+7d}$

(a) **3** (b) 5 (c)7 (d) 9 (e) 11

(6) When $a > 0, b > 0, c < 0$, which of the following is equivalent to $\sqrt{a^4b^2c^6}$?

(a) $abc^2\sqrt{c}$ (b) $-a^2bc^2$ (c) $a^2b^2c^3$ (d) a^2bc^3 (e) $\boldsymbol{-a^2bc^3}$

(7) A two-digit prime number is randomly selected. What is the probability that the sum of its digits is 11?

(a) $\frac{2}{21}$ (b) $\frac{2}{25}$ (c) $\boldsymbol{\frac{1}{7}}$ (d) $\frac{4}{25}$ (e) $\frac{4}{21}$

(8) What is the sum of the first 26 positive odd integers subtracted by the sum of the first 25 positive odd integers?

(a) 1 (b) 3 (c) 49 (d) **51** (e) 53

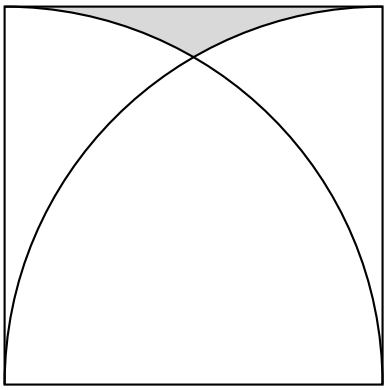
(9) When the temperature is 0 $^{\circ}C$ (Celsius), it is 32 $^{\circ}F$ (Fahrenheit). When the temperature is 5 degree $^{\circ}C$ (Celsius), it is 41 $^{\circ}F$ (Fahrenheit). There is a linear relation between the temperature F, in Fahrenheit, and C, in Celsius. For what degree of C are the temperatures in Fahrenheit and Celsius the same?

(a) **-40** $^{\circ}C$ (b) -30 $^{\circ}C$ (c) 40 $^{\circ}C$ (d) 30 $^{\circ}C$ (e) never the same

(10) A can finish a job in 5 hours. B first works on the job alone for one hour, and then A joins B to finish the rest of the job in 3 hours. How long would it take B to finish the job alone?

(a) 5 hours (b) **10 hours** (c) 15 hours (d) 20 hours (e) 18 hours

(11) Find the area of the shaded region, where the length of the square is 2.



(a) $\frac{3}{2}$ (b) $4-\sqrt{3}$ (c) $\mathbf{4-\sqrt{3}-\frac{2}{3}\pi}$ (d) $2-\frac{2}{3}\pi$ (e) $4-\frac{\sqrt{3}}{2}-\frac{2}{3}\pi$

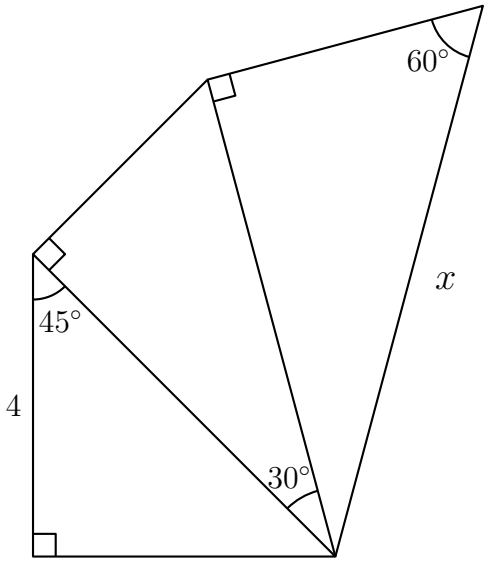
(12) Given a rectangle with length b and width a where $a < b$. Cut off a square with length a to get a new rectangle. If the new rectangle is similar to the older one, what is the ratio of a to b?

(a) $\frac{3}{2}$ (b) 2 (c) $\frac{\sqrt{3}+\sqrt{2}}{2}$ (d) $\mathbf{\frac{\sqrt{5}-1}{2}}$ (e) $\frac{\sqrt{5}+1}{2}$

(13) If $x^4 + \frac{16}{x^4} = 73$ and $x > 0$, find $x + \frac{2}{x}$

(a) $\mathbf{\sqrt{13}}$ (b) 4 (c) 9 (d) 11 (e) $\sqrt{73}$

(14) Find x in the given diagram.



(a) $\frac{13\sqrt{2}}{3}$ (b) $\mathbf{\frac{16\sqrt{2}}{3}}$ (c) $\frac{8\sqrt{6}}{3}$ (d) $\frac{16\sqrt{3}}{3}$ (e) $\frac{3\sqrt{2}}{8}$

(15) What is the remainder when 314^{165} is divided by 7?

(a) 1 (b) 2 (c) 4 (d) 5 (e) **6**

(16) Jasmine and Rose are playing a game in which they take turns flipping an unfair coin, where the probability of getting heads is $\frac{1}{3}$. The first one to flip tails wins. Jasmine goes first. What is the probability that Jasmine wins?

(a) $\frac{1}{3}$ (b) $\frac{4}{5}$ (c) $\mathbf{\frac{3}{4}}$ (d) $\frac{2}{3}$ (e) $\frac{3}{5}$

(17) What is the sum of the digits of the largest prime factor of 555,555?

(a) 13 (b) 14 (c) 7 (d) **10** (e) 15

(18) Find $\frac{1}{1\cdot 3} + \frac{1}{3\cdot 5} + \cdots + \frac{1}{99\cdot 101}$

(a) $\frac{1}{3}$ (b) $\frac{100}{101}$ (c) $\mathbf{\frac{50}{101}}$ (d) $\frac{1}{2}$ (e) $\frac{99}{101}$

(19) In a chess board with 64 squares, 1 grain of rice is put onto the first square, 3 grains onto the second square, 9 on the third, and so on so forth. If this process is continued, how many pieces of rice in total are placed on the chessboard?

(a) $\frac{1}{2}(3^{63}-1)$ (b) $\mathbf{\frac{1}{2}(3^{64}-1)}$ (c) $3^{65}-1$ (d) $3^{64}-1$ (e) $3^{65}+1$

(20) At a party, 6 gentlemen check in their hats. In how many ways can their hats be returned so that no gentlemen gets the hat with which he arrived?

(a) **265** (b) 260 (c) 720 (d) 351 (e) 482

(21) What is the length of a diagonal of a regular pentagon with side length 2?

(a) $\sqrt{7}+\sqrt{2}$ (b) 3 (c) $\mathbf{1+\sqrt{5}}$ (d) $2(\sqrt{7}-1)$ (e) $2\sqrt{5}-1$

(22) You look up a staircase 10 steps tall. If you can go up one, two, or three steps at a time, how many ways are there to go up the staircase?

(a) 280 (b) 81 (c) 82 (d) 273 (e) **274**

(23) If you have a piece of noodle and randomly break it into 5 pieces, what is the probability that the 5 pieces can form a pentagon?

(a) $\frac{5}{16}$ (b) $\mathbf{\frac{11}{16}}$ (c) $\frac{3}{8}$ (d) $\frac{1}{32}$ (e) $\frac{31}{32}$

(24) Find the maximum number of regions that 7 intersecting planes in a space can form.

(a) 12 (b) 42 (c) 62 (d) **64** (e) 128

(25) Given a set $S = \{1, 2, 3, \ldots, 9\}$ of integers from 1 to 9, we call a family of subsets an antichain if no subset in the family is a proper subset of another. For example, $A = \{\{1, 2\}, \{1, 3\}, \{2, 3\}\}$ and $B = \{\{1, 2\}, \{3\}\}$ are antichains because no single set within the group fits completely inside another. Additionally, $C = \{\{1, 2\}, \{1, 2, 3\}, \{4\}\}$ is not an antichain as $\{1, 2\}$ is a subset of $\{1, 2, 3\}$. What is the size of a largest antichain of S?

(a) 84 (b) **126** (c) 128 (d) 256 (e) 512