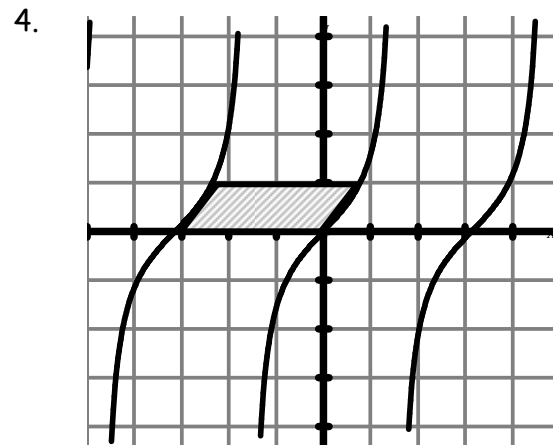


NOTA means "None of These Answers."
Diagrams are not necessarily drawn to scale.

1. A bug is traveling about the edge of a circular plate of diameter 10 cm. It has an angular velocity of $\frac{\pi}{180}$ radians per minute. If the bug starts at point P on the edge of the plate, then after 1 hour what is the linear distance in cm between point P and the bug?
- A. $2 - \sqrt{6} - \sqrt{2}$
 B. $\frac{5\sqrt{3}}{2}$
 C. 5
 D. 12
 E. NOTA
2. A ball is dropped from a height of 100 feet. Each time it rebounds to $\frac{1}{4}$ of its previous height. A second ball is dropped from a height of 80 feet and each time the rebound is $\frac{3}{4}$ of its previous height. If the balls travel R feet and S feet respectively then give the value of $|3R - S|$ to the nearest whole number. Consider that the balls each bounce an infinite number of times.
- A. 560 B. 160
 C. 80 D. 60
 E. NOTA

3. Martha, her sister, her daughter, and her son are playing volley ball on the beach. Martha's sister is directly across the net from Martha's son. Martha's daughter is diagonally across the net from the best player's sibling. The best player and the worst player are on the same side of the net. Who is the worst player?

- A. Martha
 B. Martha's son
 C. Martha's daughter
 D. Martha's sister
 E. NOTA



A parallelogram is drawn so that all vertices lie on the graph of $y = \tan x$ as shown. One vertex lies on the origin, and two sides of the parallelogram lie on the lines $y = 0$ and $y = 1$. What is the length of the longer diagonal of the parallelogram?

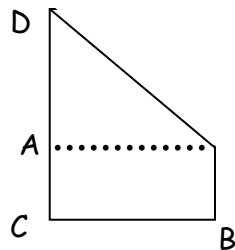
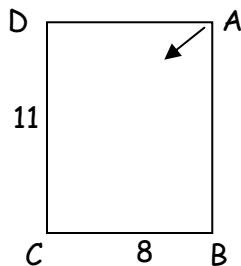
- A. $\sqrt{1 + \frac{9\pi^2}{16}}$ B. $\sqrt{\frac{\pi^2}{4} + \pi + 2}$
 C. $\sqrt{17}$ D. $\sqrt{\frac{25\pi^2}{16} + 1}$
 E. NOTA

5. For $2 < x < 5$, the expression $|2x - 1| + |5 - 3x| + |x - 6| = Ax + B$.
Give the value of $A + B$.

A. 2 B. 4
C. 8 D. 10
E. NOTA

6. A rectangular 8 by 11 piece of paper is folded as shown: vertex A is folded so that side \overline{AD} lies entirely on \overline{DC} . Give the area of the resultant quadrilateral shown in the second picture below.

A. 56
B. 52
C. 44
D. 43
E. NOTA



7. Given that $\sqrt{4 + \sqrt{4 + \sqrt{4 + \sqrt{4 + \sqrt{\dots}}}}} = 3$
what is the sum of the digits of the value of x ?

A. 3 B. 4
C. 5 D. 6
E. NOTA

8. For $0 < x < \pi$ the solution to $\frac{(2 + \cos x)^{-1}}{\left(3 + \frac{2}{2 + \cos x}\right)} = \frac{2}{19}$ is $x = \frac{A\pi}{B}$, where B is a positive prime number. Give the value of $A + B$.

A. 9 B. 7
C. 5 D. 4
E. NOTA

9. If $x^2 = 100$ and $y^2 = 25$, let R be the least possible value of $|x - y|$ and let S be the least possible value of $|x + y|$ (R and S need not use the same values of x and y). Give the value of $R + S$.

A. 0 B. 5 C. 10
D. 30 E. NOTA

10. If x is the 5th term in the sequence $\frac{25}{3}, 9, \frac{49}{5}, \frac{32}{3}, x$
and y is the 6th term in the sequence $4, 5, \sqrt{41}, \sqrt{66}, \sqrt{107}, y$
then $7x + y^2 =$

A. 178 B. 254
C. 267 D. 293 E. NOTA

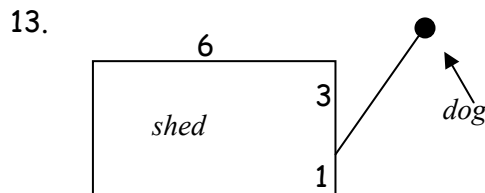
11. The dog named Jam is heavier than the dog named Jelly. Copper weighs more than Brandi but less than Pumkin. Brandi weighs more than Jelly. Pumkin weighs less than Jam. If all of these names are of dogs, then which is the third heaviest dog?

- A. Jam B. Copper C. Brandi
D. Pumkin E. NOTA

12. *As I was going to the City of Lights,
I crossed the path of seven knights.
Every knight had seven cages,
Every cage had seven dogs,
Every dog had seven pups,
Pups, dogs, cages, knights,
How many were going to the City of Lights?*

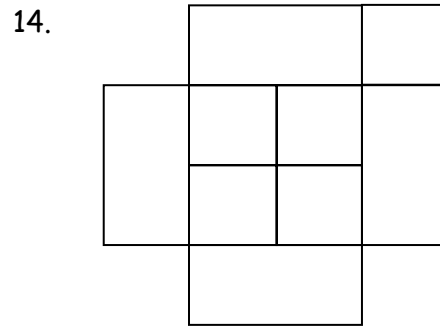
How many people and/or animals mentioned in this poem were going to the City of Lights?

- A. 2801 B. 2794 C. 2409
D. 2401 E. NOTA



A rectangular shed has dimensions 4 feet by 6 feet. A 4-foot rope is attached at the ground, 3 feet from one corner. If a dog is attached to the rope, and ignoring the length and height of the dog, find the amount of square feet of ground the dog can roam outside of the shed.

- A. $\frac{17}{2}\pi$ B. $\frac{19}{2}\pi$
C. $\frac{41}{4}\pi$ D. $\frac{21}{2}\pi$ E. NOTA



If all quadrilaterals which appear to be square are indeed square, how many squares are in the diagram above?

- A. 9 B. 10 C. 11
D. 12 E. NOTA

15. Which statement below is true?

- A. There exists a positive integer power x such that $2^x = 6^x$
B. 403 can be written as the sum of two perfect square integers.
C. The sum of any two consecutive triangular numbers is always a square number.
D. There exist 3 distinct positive integers x, y and z such that $x^3 + y^3 = z^3$.
E. NOTA

16. If $r = 8\cos(4\theta)$ is graphed then two points P and Q have coordinates (r, θ)

for $\theta = \frac{\pi}{4}$ and $\theta = -\frac{\pi}{4}$ respectively.

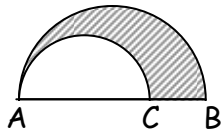
What is the distance PQ ?

- A. 0 B. $8\sqrt{2}$
C. 16 D. $4\sqrt{2} - \frac{\pi}{4}$
E. NOTA

17. For $x \geq 1$, the product of five consecutive integers $x, x+1, x+2, x+3$, and $x+4$ is always divisible by which of the following?

- A. 8 B. 60
C. 114 D. 140
E. NOTA

18. Two semi-circles are drawn so the smaller's diameter \overline{AC} lies on the larger's diameter \overline{AB} . The larger radius is 4 and $AC=2(BC)$. Give the area of the shaded region.



- A. $\frac{40}{9}\pi$ B. 9π
C. 10π D. $\frac{128}{3}\pi$
E. NOTA

19. Lines L_1 and L_2 are parallel. L_1 has equation $6x - 8y = 12$, and the lines are a distance of 8 apart. If the possible equations for L_2 are $3x + By = C$ and $3x + Dy = E$ then give the value of $|C - E|$.

- A. 80 B. 76
C. 16 D. 12
E. NOTA

20. The three least possible positive integers which each have exactly 4 positive integral factors have sum ____.

- A. 41 B. 24
C. 20 D. 18
E. NOTA

21. Given: $\sin A = 2 \sin x \cos x$ and $\cos B = 1 - 2 \sin^2 y$. If $x + y = 12^\circ$ then for A, B, x and y each in the interval $[0, 90^\circ]$, $A + B = \underline{\hspace{2cm}}^\circ$

- A. 6 B. 12
C. 24 D. 48
E. NOTA

22. $f(x) = (x-3)^4(x+2)^3(x-8)^2$ and set S contains the integer values of x for which $f(x) > 0$.

$g(x) = (2-x)^5(x-10)^2$ and set T contains the integer values of x for which $g(x) > 0$. Which is $S \cap T$?

- A. $\{-1, 0, 1\}$ B. $\{4, 5, 6, 7\}$
C. $\{1, 4\}$ D. $\{0, 1, 3, 4\}$
E. NOTA

23. How many intersection points over the interval $[0, \pi]$ do the graphs of $y = |\cos(2x)|$ and $y = \frac{1}{2}$ have?

- A. 4 B. 5
C. 8 D. 9
E. NOTA

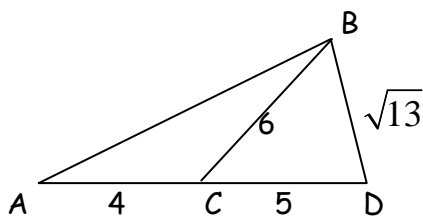
24. The least real solution of $x^2 - |5x| + 6 = 0$ is ____.

- A. 6 B. 3
C. -2 D. -6
E. NOTA

25. In a jar which is full of sand, there are 20 grams of sand. 10% is blue, 20% pink, and the rest is white, all evenly mixed. An amount of the mixture must be removed and replaced by pure pink sand in order to have the same amount of white and pink sand. If this is done, then tell the fractional amount of pink sand there will be in the resulting mixture.

- A. $\frac{7}{15}$ B. $\frac{1}{2}$
 C. $\frac{13}{20}$ D. $\frac{3}{4}$ E. NOTA

26.



In triangle ABD, C lies on \overline{AD} so that $AC=4$, $CD=5$, $BC=6$ and $BD= \sqrt{13}$. What is the area of $\triangle ABC$?

- A. 15 B. $\frac{48}{5}$
 C. 8 D. $\frac{36}{5}$ E. NOTA

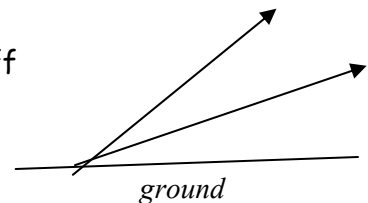
27. Joe tosses a die. If the result is a 1 or a 2, then he loses \$1. If the result is 3, 4, 5 or 6, then he wins the face amount (e.g. if the die shows a 3 then he wins \$3) in dollars. If Joe plays this game then what is his expected winnings to the nearest cent?

- A. \$2.00 B. \$2.33
 C. \$2.67 D. \$2.75
 E. NOTA

28. Sally works 30 hours a week at \$8 an hour. Her rent is now \$800 a month, but at the end of the month the rent will increase 15%. If we use 30 days as a month, how many more hours per month will Sally have to work to increase her pay the same amount as the rent increase?

- A. 12 B. 15
 C. 18 D. 20
 E. NOTA

29. A jet takes off at x mph, with a 60 degree angle with the ground, on Day 1.



On Day 2 it takes off from the same point at a 30 degree angle with the ground, again at x mph. The positive difference in altitudes at one hour after take-off is kx miles. Give the value of k .

- A. 2 B. $\frac{\sqrt{3}-1}{2}$
 C. $\frac{\sqrt{3}}{2}$ D. $\frac{1}{2}$
 E. NOTA

30. For statements x, y, z and k , for premises *If x then y .*
If y then z .
 k or $\sim x$.
 $\sim z$.

Which is/are (a) valid conclusion(s)?

- I. $\sim k$ II. $\sim x$ III. $\sim y$

- A. I, II only B. I, III only
 C. II, III only D. none are valid
 E. NOTA