

1. $\frac{\frac{1}{2} - 3.75}{3\frac{1}{4} + \frac{13}{8}} =$ (A) $-\frac{3}{2}$ (B) $-\frac{2}{3}$ (C) $-\frac{148}{195}$ (D) $-\frac{13}{18}$ (E) $-\frac{34}{39}$

2. Let $H = 3qN - 5$, where N is a constant. When $H = 10$, $q = 2$. Find q when $H = 25$.

(A) 4 (B) 6 (C) 12 (D) 1 (E) $\frac{8}{3}$

3. $\sum_{i=1}^5 (-1)^i (i + 2) =$ (A) 5 (B) -5 (C) 3 (D) -3 (E) 25

4. John travels at a constant speed of 50 mph for 3 hours and then travels at a constant speed of 62 mph for 5 hours. What is his average speed over the course of the trip?

(A) 56 mph (B) 57 mph (C) $57\frac{1}{2}$ mph (D) 58 mph (E) $58\frac{1}{2}$ mph

5. If $P(3, -5)$ lies on the graph of line l given by $ax + 7y = 12$, determine the slope of a line perpendicular to l .

(A) $\frac{47}{3}$ (B) $\frac{21}{47}$ (C) $-\frac{47}{21}$ (D) $-\frac{21}{23}$ (E) $\frac{7}{9}$

6. Brianna's mother is 20 years older than Brianna. Ten years ago, Brianna's mother was twice as old as Brianna. What is the mother's present age?

(A) 30 (B) 40 (C) 25 (D) 51 (E) 50

7. A 12 foot square garden has been planted to produce corn. Stalks are planted 18 inches apart in rows and stalks may be planted along the boundary. If the rows are 12 inches apart and each stalk produces three ears of corn, what is the largest yield for this plot?

(A) 288 ears (B) 312 ears (C) 333 ears (D) 351 ears (E) 432 ears

8. In a group of 50 students, 28 are taking a math course, 36 are taking an English course, and 22 are taking both a math and an English course. How many of the 50 students are taking neither a math nor an English course?

(A) 8 (B) 6 (C) 14 (D) 28 (E) 30

9. Two high school classes took the same exam. One class of 35 students had a mean grade of 70 while the other class of 25 had a mean grade of 85. What is the mean grade for all students in both classes?

(A) 77.5 (B) 72.43 (C) 74.75 (D) 76.25 (E) 78

10. How many functions can be defined from a domain $D = \{1, 2, 3\}$ onto a range $R = \{4, 5\}$?

(A) 5 (B) 6 (C) 7 (D) 8 (E) 9

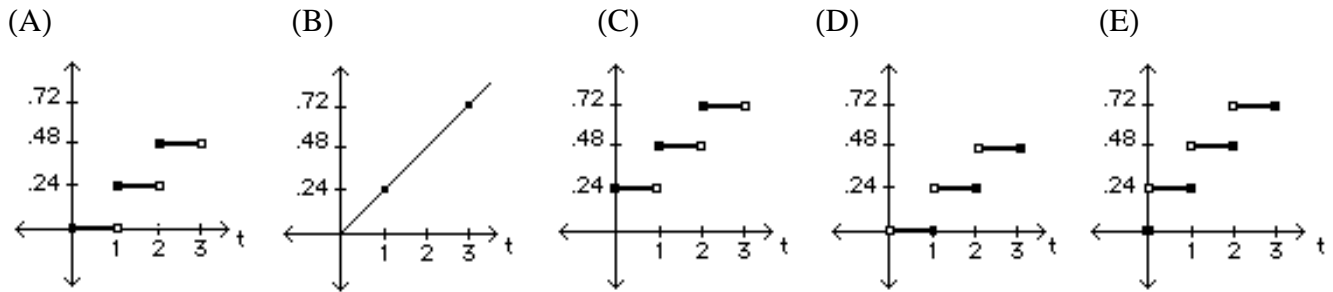
11. Ten liters of a 30% acid solution are obtained by mixing a 25% solution and a 50% solution. How many liters of the 25% solution must be used?

(A) 1 (B) 1.5 (C) 2 (D) 5 (E) 8

12. $\frac{1}{x - \sqrt{y}} + \frac{1}{\sqrt{y} + x} =$

(A) $\frac{1}{x}$ (B) $\frac{2x}{x^2 - y}$ (C) $\frac{-2x}{x^2 - y}$ (D) $\frac{2x}{x^2 + y}$ (E) $\frac{1}{x^2 - y}$

13. A local long distance company charges its customers \$.24 per minute for a long distance call. This company does **not** charge a fraction of this rate for parts of a minute. Instead, it rounds the length of the call up to the next full minute. Which of the following graphs shows the price p of a phone call lasting t minutes with this long distance carrier?



14. If the base of a triangle is increased by 10% and the altitude is decreased by 10%, what is the percent decrease in the area of the triangle?

- (A) 1% (B) 0.1% (C) 10% (D) 11% (E) 0%

15. Suppose that $\log_3 x = \log_y 5 = 2$. Then $(xy)^2 =$

- (A) 75 (B) 45 (C) 225 (D) 405 (E) 1875

16. Suppose that you are standing at the top of a lighthouse which is built on the edge of the sea. You are looking at a buoy and your eye level is 100 feet above sea level. If the angle of depression from the horizontal to your line of sight is 30° , how far off shore is the buoy?

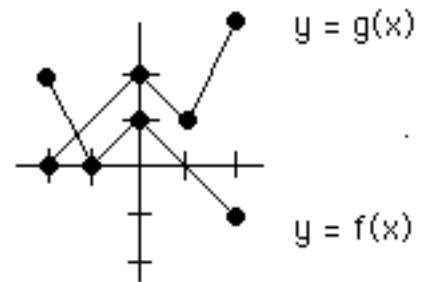
- (A) $100\sqrt{3}$ feet (B) $\frac{100\sqrt{3}}{3}$ feet (C) $50\sqrt{2}$ feet (D) $\frac{50\sqrt{3}}{2}$ feet (E) $\frac{100\sqrt{3}}{2}$ feet

17. Find the exact value of $\sec(\arctan 2)$, also denoted $\sec[\tan^{-1}(2)]$.

- (A) $\sqrt{5}$ (B) $\sqrt{3}$ (C) 1 (D) $\frac{1}{\sqrt{5}}$ (E) $\frac{1}{\sqrt{3}}$

18. The graph at right shows the graphs of two functions f and g . Which of the following describes the relationship between the two functions?

- (A) $g(x) = f(x)$ (B) $g(x) = f(-x) + 1$ (C) $g(x) = -f(x) + 1$
 (D) $g(x) = f(x - 1)$ (E) $g(x) = f(x + 1) - 1$



19. What is the largest power of 5 that divides $125!$?

- (A) 5^5 (B) 5^{11} (C) 5^{25} (D) 5^{31} (E) 5^{35}

20. The base 5 representation of an integer N is $A023$ where A is a digit from the set $\{0, 1, 2, 3, 4\}$. The base 7 representation of N is $106A$. What is the digit A ?

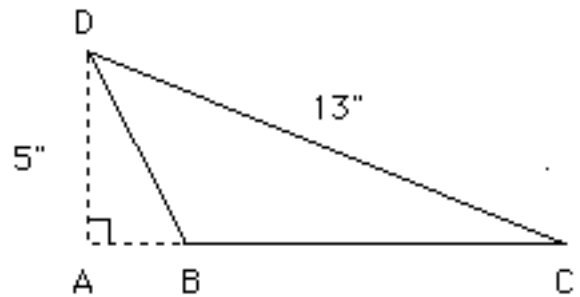
- (A) 0 (B) 1 (C) 2 (D) 3 (E) 4

21. A 3 inch by 5 inch rectangle is to be enlarged to a similar rectangle with a width of 4 inches. Determine the length of the diagonal of the enlarged rectangle.

- (A) $\sqrt{34}$ inches (B) $\frac{3\sqrt{34}}{4}$ inches (C) $\frac{4\sqrt{34}}{3}$ inches (D) $4\sqrt{34}$ inches (E) $3\sqrt{34}$ inches

22. Find the length of segment BC if segment AD has length 5 inches and the perimeter of triangle BCD is 28 inches.

- (A) $\frac{8}{3}$ inches
 (B) $\frac{28}{3}$ inches
 (C) $\frac{17}{3}$ inches
 (D) $\frac{20}{3}$ inches
 (E) $\frac{53}{6}$ inches



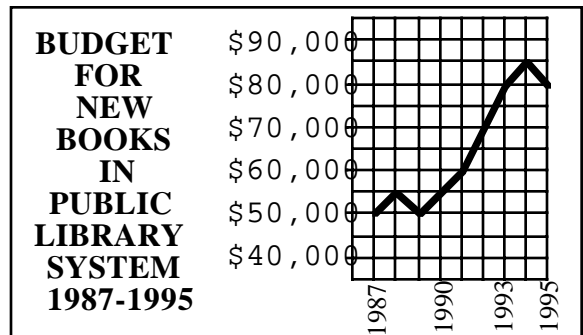
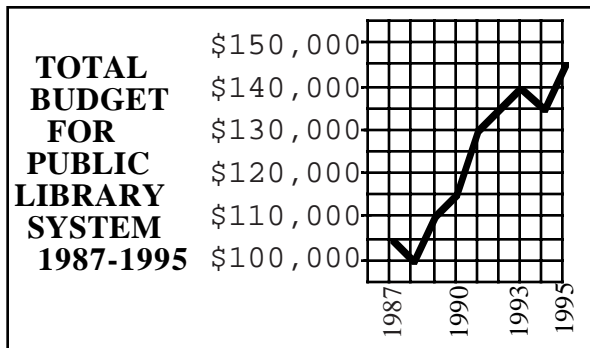
23. A vendor sells two sizes of pizza by the slice. Each slice has the shape of a circular sector. The small pizza has a 10 inch diameter and the large has a 20 inch diameter. Sue buys a slice from a small pizza with a central angle of 24° and Kathy buys a slice from the large pizza with a central angle of $\frac{\pi}{7}$ radians. Kathy's slice is how many times larger than Sue's slice?

- (A) $\frac{15}{14}$ (B) $\frac{40\pi}{7}$ (C) $\frac{30}{7}$ (D) $\frac{15}{4}$ (E) $\frac{15}{7}$

24. The zeros of a polynomial function $p(x) = 2x^3 - x^2 - 13x - 6$ are $-2, r_1$ and r_2 . Find $r_1 + r_2$.

- (A) $-\frac{1}{2}$ (B) $\frac{5}{2}$ (C) 1 (D) -2 (E) $\frac{3}{2}$

25. For how many of the years between 1987 and 1995 inclusive, was the budget for new books less than fifty percent of the total library budget?



- (A) three (B) four (C) five (D) six (E) seven

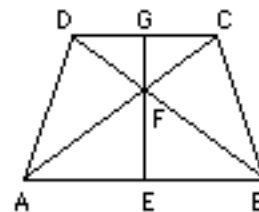
26. What is the probability that the sum of the numbers rolled on a pair of fair six-sided dice is a prime number?

- (A) $\frac{1}{2}$ (B) $\frac{7}{18}$ (C) $\frac{7}{36}$ (D) $\frac{2}{9}$ (E) $\frac{5}{12}$

27. A function, f , defined for all real numbers, satisfies: $f(x^2) = (x^2 + 1)f(x)$ and $f(2) = 3$. What is $f(256)$?

- (A) 384 (B) 1280 (C) 3072 (D) 65,535 (E) 196,605

28. An isosceles trapezoid ABCD (shown) has bases $AB = 10$, $CD = 6$. If the diagonals \overline{AC} and \overline{BD} intersect in point F and the altitude \overline{GE} , of length 8, passes through F, then what is the length of \overline{EF} ?



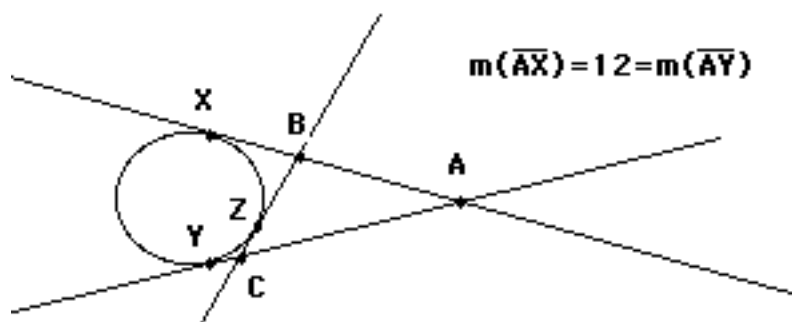
- (A) $5\sqrt{2}$ (B) 5 (C) 3 (D) 4 (E) None of these

29. A new professional tiddlywinks league will have teams from exactly four cities, to be chosen from: New York, Chicago, Los Angeles, Boston, Philadelphia, San Diego, and Atlanta. At least two of the cities must be among the largest three---New York, Chicago, and Los Angeles. New York and San Diego will not be in the league together. Los Angeles and Boston will not be in the league together. Philadelphia and San Diego will not be in the league together. Which of the following statements must be true?

- I. San Diego and Boston will not be in the league together.
 II. If either Chicago or San Diego is in the league, both will be.
 III. If Boston is in the league, then Chicago is in the league.

- (A) I only (B) I and II only (C) I and III only (D) II and III only (E) I, II, and III

30. In the figure below line \overleftrightarrow{AB} is tangent to the circle at point X, line \overleftrightarrow{AC} is tangent to the circle at point Y, and line \overleftrightarrow{BC} is tangent to the circle at point Z. If the length of segment $\overline{AX} = 12 =$ the length of segment \overline{AY} , then what is the perimeter of triangle ABC?

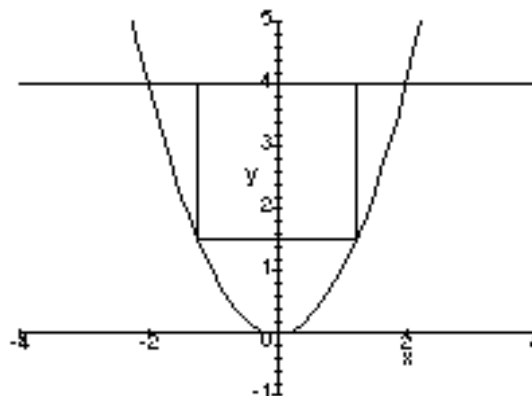


- (A) 24 (B) $12\sqrt{2}$ (C) 12 (D) 18 (E) $8\sqrt{3}$

31. A drawer has 8 red socks, 6 blue socks, and 4 white socks. A blindfolded person takes socks out of the drawer, one at a time. What is the minimum number of socks which must be taken from the drawer until she is guaranteed to have three matching pairs?

- (A) 6 (B) 7 (C) 8 (D) 9 (E) 10

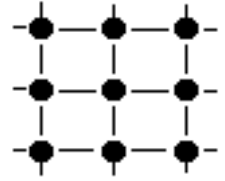
32. Two adjacent vertices of a square are on the line $y = 4$ and the remaining two vertices are on the parabola $y = x^2$ (see figure.) The exact area of the square is



- (A) $6 - 2\sqrt{5}$
 (B) $\sqrt{5} - 1$
 (C) $7 + 2\sqrt{5}$
 (D) $1 + \sqrt{5}$
 (E) $24 - 8\sqrt{5}$

33. How many triangles can be formed so that each vertex is a point on a regular 3×3 grid (see diagram at right)?

- (A) 48 (B) 36 (C) 38 (D) 76 (E) 84



34. How many integers between 1 and 1000 inclusive are divisible by 6 but are not divisible by either 9 or 15?

- (A) 66 (B) 11 (C) 78 (D) 89 (E) 166

35. Find all real solutions of $9^x - 9^{x-1} = 24$.

- (A) 3 (B) 2 (C) $\frac{3}{2}$ (D) $\frac{1}{2}$ (E) $\frac{1}{3}$

36. Find the greatest value of the function $f(x) = \frac{2x^2 + 4x + 11}{x^2 + 2x + 5}$.

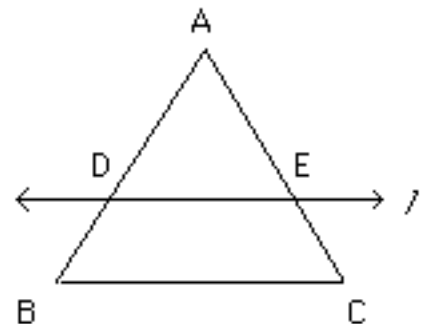
- (A) $\frac{9}{4}$ (B) 2 (C) $\frac{11}{5}$ (D) 0 (E) $\frac{17}{8}$

37. Find the sum of all of the digits of all two-digit positive integers.

- (A) 45 (B) 99 (C) 450 (D) 855 (E) 900

38. Equilateral triangle ABC is cut by line l such that $l \parallel BC$. If $AC = 1$ and the area $\triangle DAE$ is equal to the area of trapezoid BDEC, find the height of $\triangle DAE$. (Drawing not to scale)

- (A) $\frac{\sqrt{3}}{8}$ (B) $\frac{\sqrt{2}}{2}$ (C) $\frac{\sqrt{6}}{4}$ (D) $\frac{\sqrt{3}}{2}$ (E) $\frac{\sqrt{2}}{4}$



39. Papa Domonique has three sizes of pizza, 12 inch diameter at \$8.00, 16 inch diameter at \$10.00 and 20 inch diameter at \$12.00. He only sells whole pizzas (Don't even ask for pizza by the slice!!). What is the difference between the maximum and minimum price you can pay for exactly 236π in² of Papa Domonique's pizza?

- (A) \$6.00 (B) \$12.00 (C) \$10.00 (D) \$4.00 (E) \$8.00

40. The numbers a , b , c , and d are consecutive terms in a strictly increasing geometric sequence (with common ratio between consecutive terms). In terms of a and b , find the y -intercept of the line all of whose points are equidistant from the points (a, b) and (c, d) .

- (A) $\frac{b}{a}$ (B) $-\frac{a}{b}$ (C) $\frac{(a^2 + b^2)^2}{2a^2b}$ (D) $\frac{b^3 + a^2b}{2a^2}$ (E) $\frac{a^2}{b^2}$

98 entries

1. What is the sum of the prime factors of 1998?

(A) 222 (B) 42 (C) 43 (D) 122 (E) 48

2. How many even numbers, k , in the interval $100 \leq k \leq 300$ do not have a digit 6 in their decimal representation?

(A) 72 (B) 73 (C) 74 (D) 75 (E) 76

3. What is the minimum number of lines determined by 5 points in a plane with no four collinear?

(A) 4 (B) 5 (C) 6 (D) 7 (E) 8

4. Find the least value of the polynomial $p(x) = x^4 - 4x^3 + 6x^2 - 4x + 6$.

(A) 0 (B) 6 (C) 5 (D) 1 (E) -3

5. Isosceles triangle with $AB = AC$ and BC of length 2 is inscribed in circle ζ with center O . Point P is the midpoint of radius OA and the area of $\triangle BPC$ is $\frac{2}{3}$ the area of $\triangle BAC$. What is the radius of circle ζ ?

(A) $\frac{1}{3}\sqrt{2}$ (B) $\frac{2}{3}\sqrt{2}$ (C) $\frac{1}{3}\sqrt{3}$ (D) $\frac{2}{3}\sqrt{3}$ (E) $\sqrt{3}$

6. If $\cot \theta = -\frac{5}{2}$ where $\frac{\pi}{2} \leq \theta \leq \pi$, then $\cos \theta =$

(A) $\frac{5\sqrt{29}}{29}$ (B) $-\frac{5\sqrt{29}}{29}$ (C) $\frac{2\sqrt{29}}{29}$ (D) $-\frac{2\sqrt{29}}{29}$ (E) 5

7. Evaluate : $7^0 - 27^{2/3} + 4^{-2}$

(A) $-\frac{127}{16}$ (B) $-\frac{143}{16}$ (C) -6 (D) 8 (E) -24

8. If $125^{x-1} = 625^{3-x}$, then the value of x is

(A) $\frac{15}{7}$ (B) 2 (C) $\frac{11}{7}$ (D) $\frac{11}{4}$ (E) $\frac{9}{7}$

9. Given a circle whose equation is $x^2 + y^2 - 8y - 12 = 0$ and a parabola given by $y = (x - 2)^2 + 3$, compute the distance between the center of the circle and the vertex of the parabola.

(A) $\sqrt{5}$ (B) $\sqrt{53}$ (C) $\sqrt{29}$ (D) $\sqrt{2}$ (E) 3

10. Mrs. Smith's fifth period Algebra II class contains 12 boys and 15 girls. If $\frac{3}{4}$ of the boys and $\frac{2}{3}$ of the girls are present today, how many student in the class are absent?

(A) 19 (B) 6 (C) 9 (D) 10 (E) 8

11. Points A and C lie on a number line with coordinates -13 and 17 , respectively. Find the coordinate of the point $\frac{3}{5}$ of the way from C to A.

- (A) 11 (B) -1 (C) 5 (D) 6 (E) -7

12. If $P(3, -7)$ lies on the graph of $y = f(x)$ then which point must lie on the graph of $y = 2f(x) + 4$?

- (A) $(3, -3)$ (B) $(6, -3)$ (C) $(3, -10)$ (D) $(6, -11)$ (E) $(10, -7)$

13. $\frac{3+2i}{4-i} =$ (A) $\frac{3}{4} - 2i$ (B) $\frac{10}{17} + \frac{11}{17}i$ (C) $\frac{10}{15} + \frac{11}{15}i$ (D) $\frac{3}{4} - \frac{1}{2}i$ (E) $\frac{14}{17} + \frac{11}{17}i$

14. If $A = \{1, 2, 3, 4\}$ and $B = \{2, 3, 5\}$, how many elements are contained in set C where $C = \{(x, y) \mid (x, y) \in A \times B \text{ and } y > x + 1\}$?

- (A) 6 (B) 7 (C) 4 (D) 5 (E) 3

15. How many solutions of $\sin 3\theta = \frac{\sqrt{2}}{2}$ lie in the interval $\frac{2\pi}{3} < \theta \leq \frac{11\pi}{4}$?

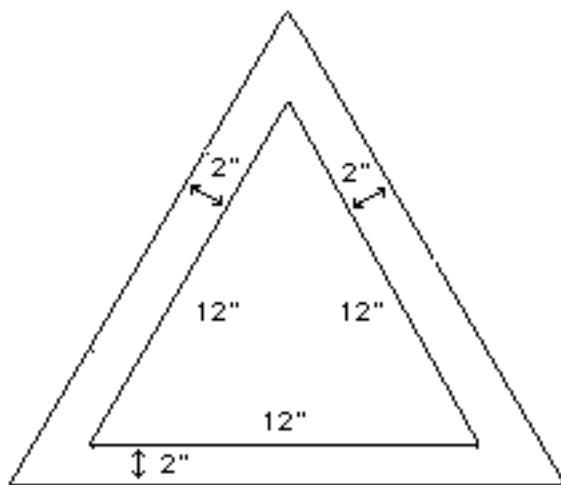
- (A) 2 (B) 3 (C) 4 (D) 5 (E) 6

16. The radius of the earth is approximately 4000 miles. Given that Miami, Florida and Erie, Pennsylvania are on the same longitudinal line and that Erie has a latitude of 44°N while Miami has a latitude of 14°N , how far apart are these two cities?

- (A) 20,940 miles (B) 2094 miles (C) 4188 miles (D) 488 miles (E) 2000 miles

4. An equilateral triangular picture has edges of length 12 inches. The width of the frame is 2 inches as shown in the diagram. What is the exact size in square inches of the total area of the framed picture?

- (A) 72 in^2 (B) $54 + 36\sqrt{2} \text{ in}^2$
(C) $108 + 72\sqrt{2} \text{ in}^2$
(D) 36 in^2 (E) 200 in^2



3. How many diagonals (segments joining non-adjacent vertices) does a ten-sided regular polygon have?

- (A) 10 (B) 20 (C) 30 (D) 35 (E) 70

4. A degree – 3 polynomial with rational coefficients has constant term 2 and one of the roots is $\sqrt{2}$. One of the other roots must be

(A) $\sqrt{2}$ (B) $-\sqrt{2}$ (C) 2 (D) -2 (E) $2 - \sqrt{2}$

5. For some number b, $\log_b 3 = 4$ and $\log_b 2 = 2.5$. What is $\log_b 4.5$?

(A) 5.5 (B)

4. The line t is a transversal cutting lines a and b such that the interior angles on the same side of t have measures $(x^2)^\circ$ and $(3x)^\circ$. If a and b are parallel, what is the value of x?

(A) 20 (B) 15 (C) 12 (D) 30 (E) 32

5. In the diagram, what is the sum of the measures of the five angles A, B C, D, and E, at the points of the five–pointed star?

(A) 180° (B) 270° (C) 360° (D) 540° (E) None of these