

1. Solve for  $x$ :  $\sqrt{4x-3} = -2$

- (A) no solution    (B)  $-\frac{1}{4}$     (C)  $\frac{i\sqrt{2}+3}{4}$     (D) 3    (E)  $\frac{7}{4}$

2. Professor Abstract is asked to judge a beauty contest. Overwhelmed by the beauty of the ten contestants, he mops his brow and decides he must assign the first, second, and third prize completely at random. In how many ways can this be done?

- (A) 3    (B) 720    (C) 1000    (D) 30    (E) 256

3. Find the product of the mean, median, and (population) standard deviation of this data set: 3, 5, 6, 12, 14

- (A) 864    (B)  $192\sqrt{2}$     (C) 48    (D)  $144\sqrt{2}$     (E)  $73\sqrt{10}$

4. Two thousand one hundred Armstrong students took at least one mathematics course last year. Seven hundred fifty Armstrong students took at least one psychology course last year. Three hundred Armstrong students took both a mathematics course and a psychology course last year. How many Armstrong students took either a mathematics course or a psychology course last year?

- (A) 2850    (B) 3150    (C) 2250    (D) 1650    (E) 2550

5. An equilateral triangle is inscribed in a circle. Each side of the triangle measures  $a$ . What is the area of the circle?

- (A)  $\pi a^2$     (B)  $\frac{\pi a^2}{4}$     (C)  $\frac{\pi a^2}{3}$     (D)  $\frac{2\pi a}{\sqrt{3}}$     (E)  $\frac{3\pi a^2}{4}$

6. How many integers between 1 and 100, inclusive, are divisible by either 2 or 3?

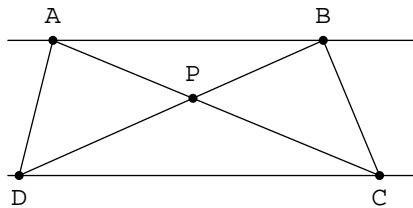
- (A) 83    (B) 67    (C) 50    (D) 33    (E) 16

7. Which of the expressions below determines the locus of points

$$\{(x, y) | \text{the distance from } (x, y) \text{ to } (1, 1) = \text{the distance from } (x, y) \text{ to } (-1, -1)\}?$$

- (A)  $x^2 + y^2 = 1$     (B)  $x = y$     (C)  $\{(0, 0)\}$     (D)  $y = x^3$     (E)  $x = -y$

8. In the figure below  $AB \parallel CD$ ,  $m(\overline{AB}) = 6$  and  $m(\overline{CD}) = 8$ .



If the area of  $\triangle DPC = 32$ , then the area of  $\triangle APB =$

- (A) 24    (B) 12    (C) 18    (D) 32    (E)  $\sqrt{108}$

9. A right triangle has perimeter 56 and area 84. Determine the lengths of the three sides.

(A)  $14, \frac{56}{3}, \frac{70}{3}$

(B) 17, 21, 18

(C) 24, 25, 7

(D) 31, 21, 4

(E)  $\frac{697}{40}, \frac{411}{5}, \frac{615}{40}$

10. If an integer between 1 and 200, inclusive, is randomly selected, what is the probability that it is a perfect square?

(A) .50

(B) .25

(C) .10

(D) .07

(E) .05

11. Let six points be placed in the plane so that no three are collinear. How many triangles can be formed so that every vertex of the triangle comes from this set of six points?

(A) 15

(B) 20

(C) 25

(D) 30

(E) 35

12. For what value(s) of  $x$  does the circle  $x^2 + y^2 = 10$  intersect the line  $x + y = 2$ ?

(A)  $-1$

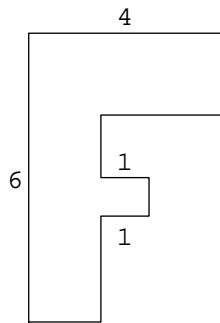
(B) 2

(C)  $-1, 3$

(D)  $1, -2$

(E)  $2, -3$

13. What is the perimeter of the figure below?



(A) 12

(B) 21

(C) 22

(D) 24

(E) 25

14. A pack of 100 cards, numbered 1 to 100, is thoroughly shuffled, and five cards are randomly drawn from it. What is the probability that the five cards will be drawn in increasing order?

(A)  $\frac{5!95!}{100!}$

(B)  $\frac{95!}{100!}$

(C)  $\frac{5!}{100!}$

(D)  $\frac{1}{5!}$

(E)  $\frac{1}{95!}$

15. Let  $f(x) = 6x^5 + cx^3 + 35$ , where  $c$  is an integer. Which of the following can *possibly* be a zero of  $f$ ?

(A) 2

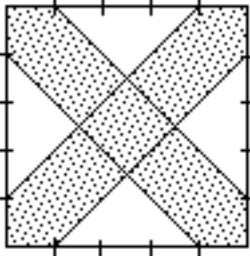
(B) 3

(C)  $\frac{7}{3}$

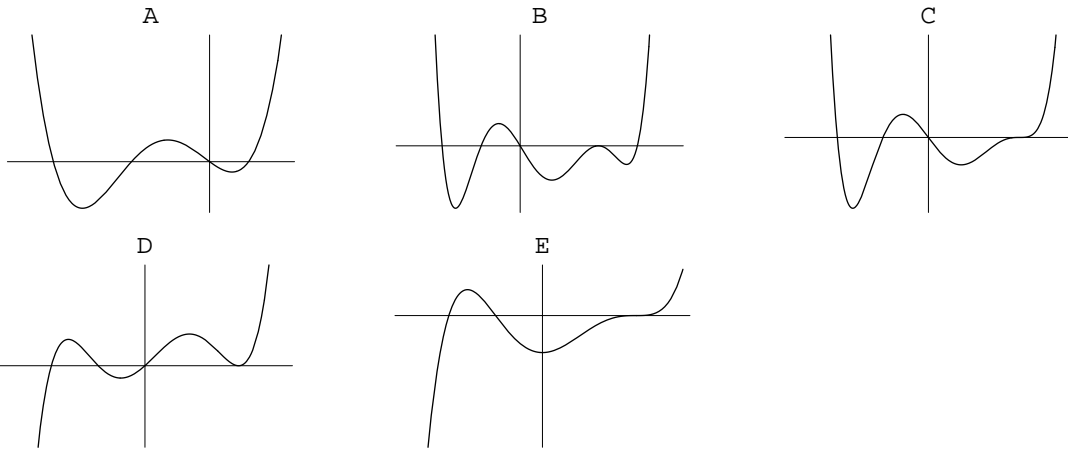
(D)  $\frac{2}{5}$

(E) 4

16. Assuming the marks divide the square's sides into equal portions, the percent of the square which is shaded is



- (A) 60%                      (B) 64%                      (C) 68%                      (D) 72%                      (E) 75%
17. Which of the following is equal to  $\sin x \cos x \tan x \cot x \sec x \csc x$ ?
- (A)  $\sin^3 x$                       (B)  $\sec^2 x - \tan^2 x$                       (C)  $\sin x - \cos x$
- (D)  $x$                       (E)  $\sin^2 x - \cos^2 x$
18. Which of the following is the graph of a fourth degree polynomial?



19. When dropped on a hard surface, a Super Ball takes a series of bounces, each one  $\frac{9}{10}$  as high as the preceding one. If a Super Ball is dropped from a height of 10 feet, the total distance it travels before coming to rest is:
- (A) 100 ft                      (B) 200 ft                      (C) 190 ft
- (D) 180 ft                      (E) an infinite distance
20. The product, in base eight, of the two base eight numbers 777 and 7777 is:
- (A) 7,777,777                      (B) 7,766,777                      (C) 7,767,001                      (D) 10,000,001                      (E) 7,776,701
21. A (base ten) two-digit number is selected at random. What is the probability that the number is four times the sum of its digits?
- (A) 0                      (B)  $\frac{9}{10}$                       (C)  $\frac{4}{9}$                       (D)  $\frac{1}{25}$                       (E)  $\frac{2}{45}$

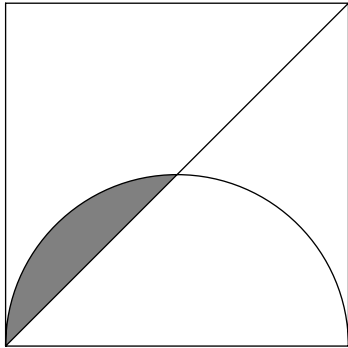
22. The two shortest altitudes of a right triangle have lengths 24 cm and 30 cm. Find the length of the longest altitude.

- (A) 32 cm      (B) 36 cm      (C) 40 cm      (D) 48 cm      (E) 50 cm

23. If  $\sin \theta = \frac{2}{3}$ , then  $\cos 2\theta$  is

- (A)  $\frac{1}{9}$       (B)  $\frac{4\sqrt{5}}{3}$       (C)  $\frac{5}{9}$       (D)  $\frac{\sqrt{5}}{3}$       (E)  $-\frac{\sqrt{5}}{3}$

24. A semicircle is inscribed in a unit square with a diameter on one side of the square. Find the area of the shaded region bounded by this semicircle and one of the diagonals of the square.



- (A)  $\frac{\pi - 1}{4}$       (B)  $\pi - \frac{1}{2}$       (C)  $\frac{\pi - 1}{8}$       (D)  $\frac{\pi - 2}{16}$       (E)  $\frac{\pi - 2}{4}$

25. The number of real numbers satisfying the equation  $\sqrt{x} = (2 - x)\sqrt{x}$  is

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

26. For what nonzero values of  $k$  is the parabola  $y = 2x^2 + 2x + k$  tangent to the  $x$ -axis?

- (A) 2      (B) 4      (C) 8      (D)  $\frac{1}{2}$       (E)  $\frac{1}{4}$

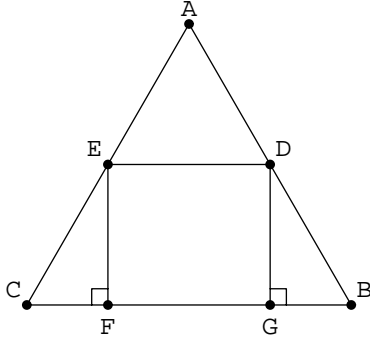
27. Suppose that  $A$ ,  $B$ ,  $C$  and  $D$  are all real positive numbers. If  $D = C\sqrt[n]{AB}$ , then  $n$  equals

- (A)  $\frac{\log D - \log C}{\log A + \log B}$       (B)  $\frac{\log A + \log B}{\log D - \log C}$       (C)  $\frac{\log A \log B}{\frac{\log D}{\log C}}$   
 (D)  $\frac{\frac{\log D}{\log C}}{\log A \log B}$       (E)  $\frac{\log(A + B)}{\log(D - C)}$

28. Let  $f(x) = 2x^2 - 3x + 1$ . If the graph of a function  $y = g(x)$  is formed by shifting the graph of  $f$  2 units up and 3 units to the right, then  $g$  is given by

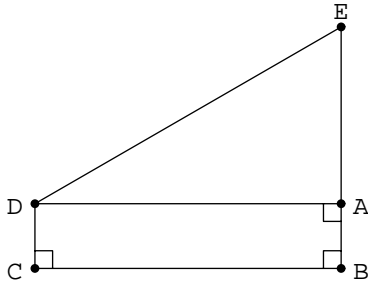
- (A)  $g(x) = 3x^2 + 9x + 12$       (B)  $g(x) = 2x^2 - 11x + 18$       (C)  $g(x) = 2x^2 - 15x + 21$   
 (D)  $g(x) = 2x^2 - 15x + 30$       (E)  $g(x) = 2x^2 + 9x + 12$

29. In the given figure, let  $\triangle ABC$  be equilateral, and let  $D$  and  $E$  be midpoints of  $\overline{AB}$  and  $\overline{AC}$ , respectively. The ratio of the area of the quadrilateral  $DEFG$  to the area of  $\triangle ABC$  is



- (A)  $\frac{5}{8}$       (B)  $\frac{1}{2}$       (C)  $\frac{3}{8}$       (D)  $\frac{3}{4}$       (E)  $\frac{1}{3}$

30. In the given figure, the length of  $\overline{AE}$  is 2 units, the measure of  $\angle DEA = 60^\circ$ , and the total area of the figure is 6 square units. The length of  $\overline{AB}$  is



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

31. A jumbo rectangular chocolate bar measures 10 cm in length, 5 cm in width, and 2 cm in thickness. Due to the escalating costs of cocoa, management decides to reduce the volume of the candy bar by 28%. They would like to keep the same thickness and reduce the length and width by the same number of centimeters. What is the length of the reduced candy bar?

- (A) 7.2 cm      (B) 9 cm      (C) 4 cm      (D) 1 cm      (E) 9 cm<sup>2</sup>

32. Four suspects of a crime made the following statements to the police.

Andi: Carla did it.

Bob: I did not do it.

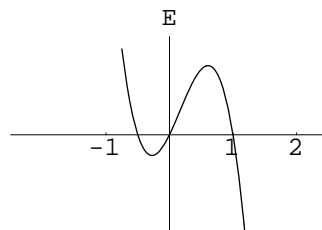
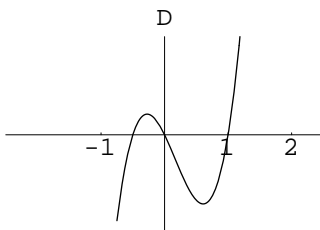
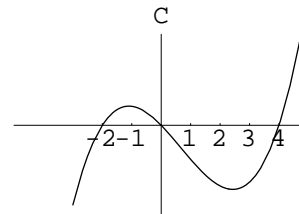
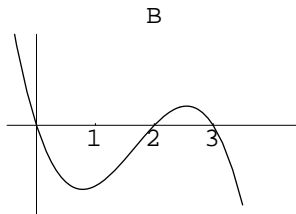
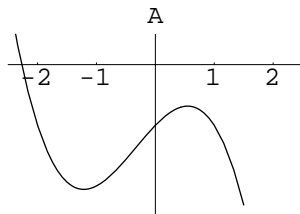
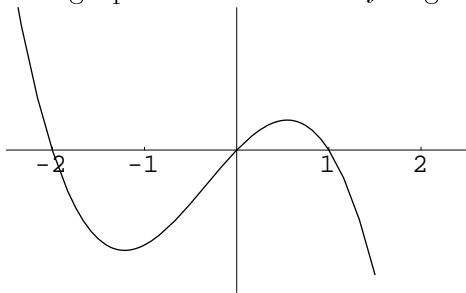
Carla: Dave did it.

Dave: Carla lied when she said I did it.

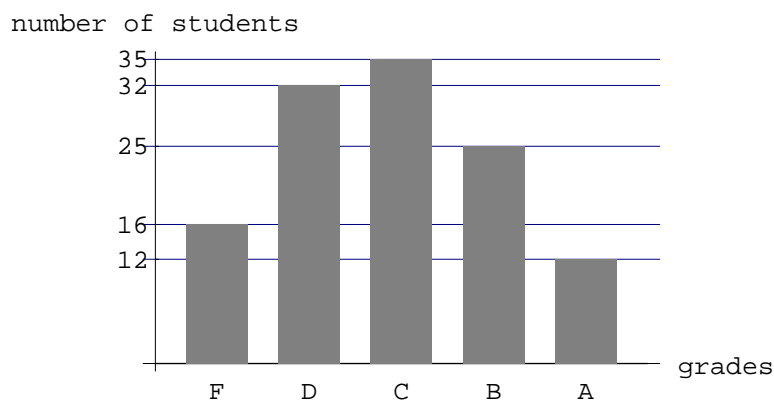
If the crime was committed by only one person, and exactly one of the four suspects told the truth, who committed the crime?

- (A) Andi      (B) Bob      (C) Carla  
 (D) Dave      (E) None of the four suspects

33. Phone numbers in a certain town are of the form 214- \* \* \* \*. If you live in this town, what is the probability that your phone number contains five identical digits?
- (A) 3%                      (B) 0.0003                      (C) 0.001                      (D) 0.003                      (E) 0.1%
34. A rectangular classroom seats seventy-two students. If the seats were arranged with three more seats in each row, there would be two fewer rows. Find the original number of rows.
- (A) 7                      (B) 6                      (C) 9                      (D) 8                      (E) 12
35. A family is traveling due East at a constant rate of 60 miles per hour on a road that passes to the north of a famous landmark. At noon, the family's position relative to the landmark is  $30^\circ$  West of North. One hour later, their position is  $30^\circ$  East of North. How far from the landmark were they at the moment when they were closest to it?
- (A)  $30\sqrt{2}$  mi                      (B)  $30\sqrt{3}$  mi                      (C) 60 mi                      (D) 30 mi                      (E)  $10\sqrt{3}$  mi
36. A math professor needs to bring four items to the classroom: the textbook, his notes, a graphing calculator, and a pen. It is equally likely that the professor will forget or remember each of these items. Assuming that the professor has forgotten at least one item, what is the probability that he has forgotten exactly two items?
- (A)  $\frac{2}{13}$                       (B)  $\frac{1}{4}$                       (C)  $\frac{1}{5}$                       (D)  $\frac{3}{8}$                       (E)  $\frac{2}{5}$
37. Two men and two boys need to cross a lake. Their boat will carry either one man or two boys. What is the fewest number of one-way trips it will take to get everybody to the other side of the lake?
- (A) 4                      (B) 5                      (C) 8                      (D) 9                      (E) 11
38. The graph of the function  $f$  is given below. Which of the graphs corresponds to  $y = f(-2x)$ ?



39. The following histogram shows the grade distributions for a large university math class. If a pie chart were to be constructed for this same data, what would be the central angle, measured in degrees, for the sector corresponding to the number of  $A$  students?



- (A)  $12^\circ$                       (B)  $24^\circ$                       (C)  $10^\circ$                       (D)  $36^\circ$                       (E)  $20^\circ$
40.        Add the reciprocals of the two  
             Roots of  $x^2 + px + q$   
             Set equal to zero.  
             Then you'll be a hero  
             By finding the answer that's true:

- (A)  $-\frac{p}{q}$                       (B)  $\frac{q}{p}$                       (C)  $\frac{p}{q}$                       (D)  $-\frac{q}{p}$                       (E)  $pq$