Mathematics Test

Time: 60 minutes for 60 questions

Directions: Each question has five answer choices. Choose the best answer for each question, and then shade in the corresponding oval on your answer sheet.

1. Which of the following numbers completes the sequence 3, 8, 14, 21, 29, ___?

   (A) 35
   (B) 36
   (C) 37
   (D) 38
   (E) 39

2. Beth got a job painting dorm rooms at her college. At top speed, she could paint 5 identical rooms during one 6-hour shift. How long did she take to paint each room?

   (F) 50 minutes
   (G) 1 hour and 10 minutes
   (H) 1 hour and 12 minutes
   (J) 1 hour and 15 minutes
   (K) 1 hour and 20 minutes

3. If $5x + 3 = 10x - 17$, what is the value of x?

   (A) 1
   (B) 2
   (C) 3
   (D) 4
   (E) 5

4. The number 4 is the smallest positive integer that has exactly three factors: 1, 2, and 4. If k is the next-highest integer that also has exactly three factors, what is the sum of the three factors of k?

   (F) 13
   (G) 14
   (H) 16
   (J) 18
   (K) 20

5. William earned $3,200 per month as a teacher for the ten months from September to June. Then he took a job as a barista at a local café, where he earned $2,000 per month during July and August. What was his average monthly pay for the 12 months?

   (A) $2,400
   (B) $2,500
   (C) $2,600
   (D) $2,800
   (E) $3,000

6. When you multiply a number by 4 and then subtract 7, the result is the same as if you first subtracted 7 from the same number and then multiplied by 11. What is the number?

   (F) 10
   (G) 13
   (H) 19
   (J) 23
   (K) 31

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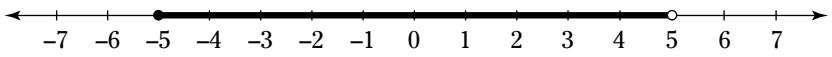
7. Which of the following inequalities is represented by the following number line?



(A) $-5 < x < 5$

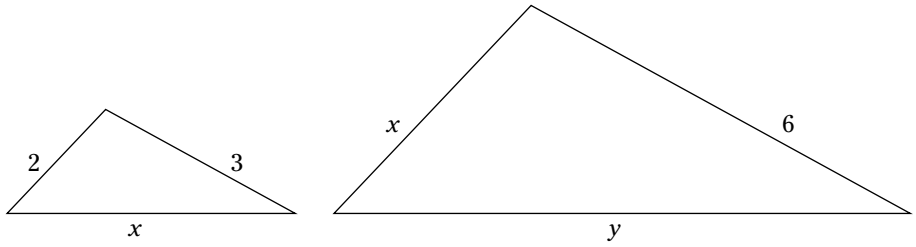
(B) $-5 \leq x < 5$

(C) $-5 < x \leq 5$

(D) $|x| < 5$

(E) $5 \leq |x|$

8. In the following figure, the two triangles are similar. The lengths of their sides are shown. What is the value of y in terms of x?



(F) $x + 1$

(G) $x + 2$

(H) $x + 3$

(J) $x + 4$

(K) $x + 5$

9. Which of the following is equal to $(n - 3)^2$ if $n = 11$?

(A) $(n + 6)(n - 6)$

(B) $(n + 5)(n - 7)$

(C) $(n + 4)(n - 8)$

(D) $(n + 3)(n - 9)$

(E) $(n + 2)(n - 10)$

10. A square field has an area of 22,500 square feet. To the nearest foot, what is the diagonal distance across the field?

(F) 150 feet

(G) 178 feet

(H) 191 feet

(J) 212 feet

(K) 260 feet

Go on to next page

11. What is the slope of a line on a standard *xy*-plane that passes through the point (1, 3) and (4, –3)?

(A) –1

(B) 2

(C) –2

(D) $\frac{1}{2}$

(E) $-\frac{1}{2}$

12. Andrea wants to fill in two sections of her backyard with sod that must be purchased in 2-x-2-foot squares. If the two sections measure 30 x 40 feet and 60 x 80 feet, how many squares of sod does she need to buy?

(F) 1,000

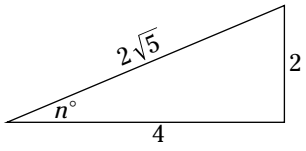
(G) 1,250

(H) 1,500

(J) 1,600

(K) 2,000

13. In the following triangle, what is the value of sec n?



(A) $\sqrt{5}$

(B) $2\sqrt{5}$

(C) $\frac{\sqrt{5}}{2}$

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

(E) $\frac{2\sqrt{5}}{5}$

14. If $pq - 3r = 2$, what is the value of q in terms of p and r?

(F) $2p + 3pr$

(G) $2p - 3pr$

(H) $\frac{3r+2}{p}$

(J) $\frac{3r-2}{p}$

(K) $\frac{2-3r}{p}$

15. If $f(x) = 4x^2 - 5x - 5$ and $g(x) = 2^x - 4$, what is the value of $\frac{g(6)}{f(-5)}$?

(A) 1

(B) 2

(C) $\frac{1}{2}$

(D) $\frac{2}{3}$

(E) $\frac{3}{4}$

16. If you multiply two integers together and then add 4, the result is 40. Which of the following could NOT be the sum of the two numbers?

(F) 12

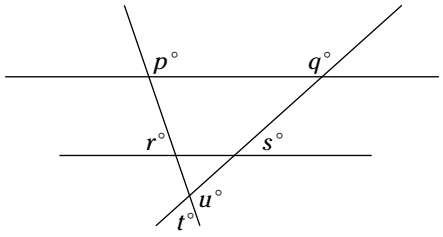
(G) 13

(H) 15

(J) 18

(K) 20

17. In the following figure, the two horizontal lines are parallel. Which of the following does NOT equal 180°?



(A) $(p + r)°$

(B) $(p + t)°$

(C) $(q + s)°$

(D) $(r + s + t)°$

(E) $(t + u)°$

Go on to next page

18. If a and b are the two values of t that satisfy the equation $t^2 - 6t + 8 = 0$, with $a > b$, what is the value of $a - b$?

(F) 2

(G) 4

(H) 6

(J) 8

(K) 10

19. A rectangular box has two sides whose lengths are 3 centimeters and 9 centimeters and a volume of 135 cm^3. What is the area of its largest side?

(A) 27 cm^2

(B) 36 cm^2

(C) 39 cm^2

(D) 45 cm^2

(E) 48 cm^2

20. If you graph the lines $3x + 2y = -2$ and $5x - y = 14$ on a standard xy-graph, at which point will the lines intersect?

(F) (1, –7)

(G) (2, –4)

(H) (–5, 4)

(J) (–9, 3)

(K) (11, 2)

21. Which of the following equals $12x^2y^3z^4 - 30xy^2 + 24x^2y^5z$?

(A) $6xy^2(2yz^3 - 5 + 4xy^3)$

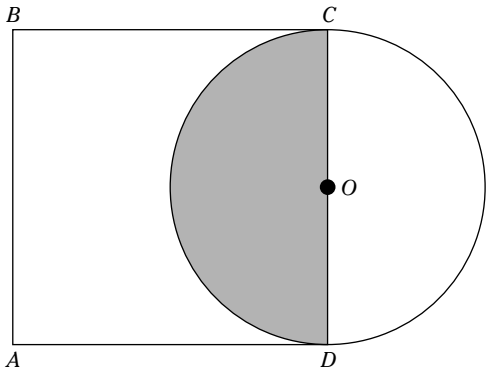
(B) $6xy^2(2xyz^4 - 5 + 4xy^3z)$

(C) $6xy^2z(2xyz^3 - 5 + 4xy^3)$

(D) $12x^2y^3(yz^4 - 5 + 2y^2z)$

(E) $12x^2y^3z(xy^2z^3 - 5z + 2y^2)$

22. In the following figure, $ABCD$ is a square and is a diameter of the circle centered at O. If the area of the square is 100, what is the area of the shaded region?



(F) 25π

(G) 50π

(H) 100π

(J) $\frac{5\pi}{2}$

(K) $\frac{25\pi}{2}$

23. Anderson has a phone plan that charges a monthly rate of \$50 for the first 1,000 minutes plus \$0.25 for each additional minute. Which of the following functions models Anderson's plan for all $m > 1{,}000$, with m as the number of minutes per month and $f(m)$ as the monthly charge?

(A) $f(m) = 0.25m$

(B) $f(m) = 0.25m + 50$

(C) $f(m) = 0.25m - 200$

(D) $f(m) = 0.25m - 950$

(E) $f(m) = 0.25m + 1{,}000$

24. What is the x-intercept of a line that passes through the point (3, 4) and has a slope of 2?

(F) –2

(G) –1

(H) 0

(J) 1

(K) 2

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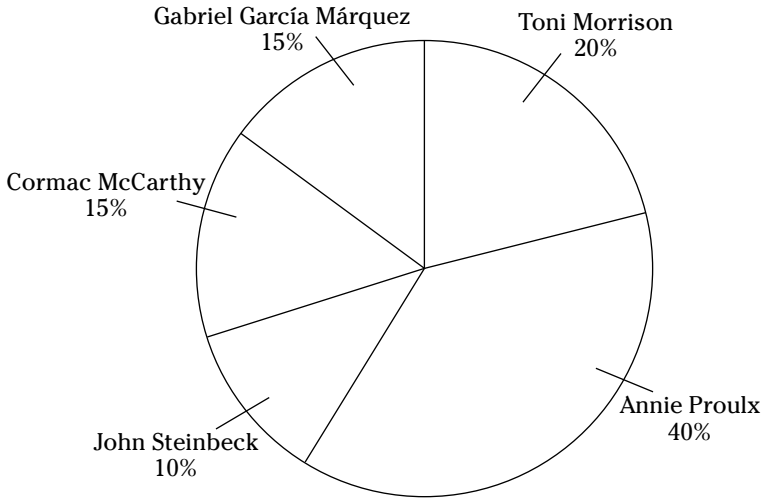
Questions 25 and 26 refer to the following figure, which shows a graph of the percentage of votes tallied by an online book club regarding the next author that the club should focus on.



25. Which of the following pairs of authors received exactly 30 percent of the votes altogether?

(A) Cormac McCarthy and Toni Morrison

(B) Gabriel García Márquez and Toni Morrison

(C) Toni Morrison and Annie Proulx

(D) Toni Morrison and John Steinbeck

(E) Annie Proulx and John Steinbeck

26. If exactly 260 people voted, how many votes did Cormac McCarthy receive?

(F) 15

(G) 30

(H) 33

(J) 39

(K) 45

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27. Anne and Katherine are both saving money from their summer jobs to buy bicycles. If Anne had \$150 less, she would have exactly $\frac{1}{3}$ as much as Katherine. And if Katherine had twice as much, she would have exactly 3 times as much as Anne. How much money have they saved together?

(A) \$300

(B) \$400

(C) \$450

(D) \$625

(E) \$750

28. What is the solution set for x for the inequality $|2x + 7| > 11$?

(F) $2 < x < 9$

(G) $-9 < x < 2$

(H) $x < 2$ or $x > 9$

(J) $x < -2$ or $x > 9$

(K) $x < -9$ or $x > 2$

29. On a standard xy-graph, what is the distance between $(-2, 4)$ and $(1, -2)$?

(A) 5

(B) $3\sqrt{2}$

(C) $2\sqrt{3}$

(D) $5\sqrt{3}$

(E) $3\sqrt{5}$

30. If $\log_5 x = 2$, what is $\sqrt{x}$?

(F) 5

(G) 25

(H) 32

(J) $\sqrt{5}$

(K) $4\sqrt{2}$

31. If $pq + 12 = 3p + pr$, and $q - r = 7$, what is the value of p?

(A) -3

(B) -4

(C) $\frac{1}{3}$

(D) $\frac{3}{5}$

(E) $-\frac{6}{5}$

32. On his first day working out, Anthony did 30 push-ups. On each successive day, he did exactly 3 more push-ups than on the previous day. After completing his push-ups on the 30th day, how many push-ups had he completed on all 30 days?

(F) fewer than 500

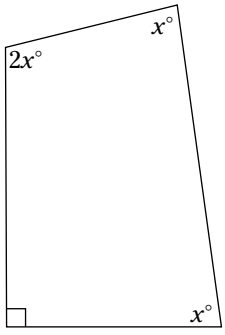
(G) between 500 and 1,000

(H) between 1,000 and 1,500

(J) between 1,500 and 2,000

(K) more than 2,000

33. The following figure is a quadrilateral with one right angle. The other angles are labeled. What is the value of x?



(A) 54

(B) 56.25

(C) 60

(D) 67.5

(E) 72

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34. If a cube has a volume of k cm^3 and a surface area of $10k$ cm^2, what is its height in centimeters?

(F) $\frac{1}{2}$

(G) $\frac{3}{4}$

(H) $\frac{3}{5}$

(J) $\frac{4}{5}$

(K) $\frac{3}{10}$

35. If $8^{n-1} = \sqrt{2}$, then $n =$

(A) $\frac{3}{2}$

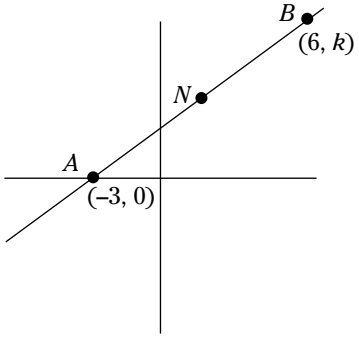
(B) $\frac{4}{3}$

(C) $\frac{5}{4}$

(D) $\frac{7}{6}$

(E) $\frac{11}{10}$

36. In the following graph, N is the midpoint of $\overline{AB}$. Which of the following answer choices are the coordinates of N?



(F) $(3, k)$

(G) $\left(\frac{3}{2}, 3\right)$

(H) $\left(\frac{3}{2}, k\right)$

(J) $\left(\frac{3}{2}, \frac{k}{2}\right)$

(K) $\left(\frac{k}{2}, \frac{k}{3}\right)$

37. If $\frac{a}{b} - \frac{c}{d} = 0$ and $bc = 7$, which of the following statements must be true?

(A) a and b are directly proportional.

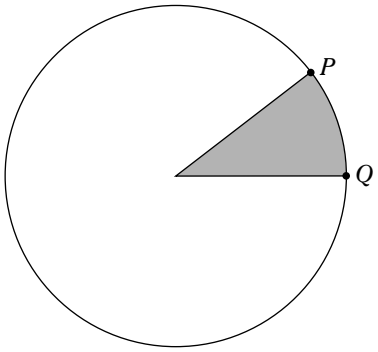
(B) a and c are inversely proportional.

(C) a and d are inversely proportional.

(D) b and c are directly proportional.

(E) c and d are inversely proportional.

38. In the following figure, the area of the shaded region is 10% of the area of the circle. If the radius of the circle is 10, what is the arc length from P to Q?



(F) π

(G) 2π

(H) 4π

(J) 5π

(K) 10π

39. Given that $i^2 = -1$, what is the value of $(4 + 2i)(4 - 2i)$?

(A) 12

(B) 20

(C) $16 - 4i$

(D) $4 + 16i$

(E) $12 - 16i$

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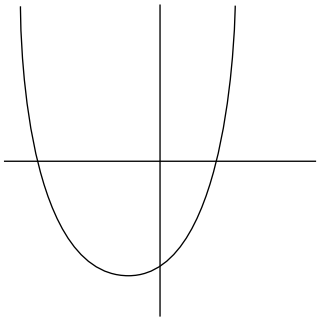
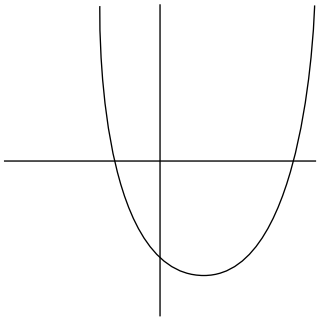
40. Which of the following could be the graph of the equation $y = 175x^2 - 33x - 2{,}000$?

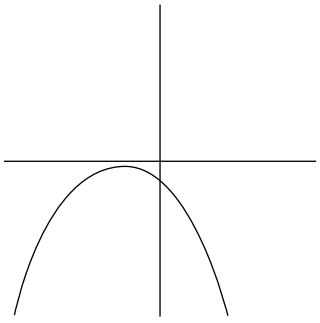
(F)



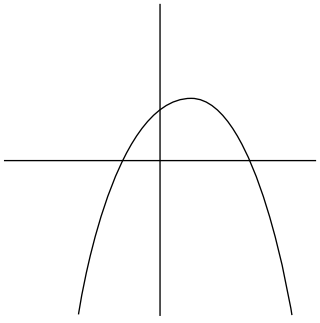
(G)



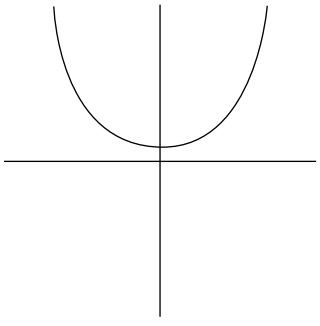
(H)



(J)



(K)



41. Sebastian bought a meal at a restaurant and left a 15% tip. With the tip, he paid exactly \$35.19. How much did the meal cost without the tip?

(A) \$28.98

(B) \$29.91

(C) \$30.15

(D) \$30.60

(E) \$30.85

42. If $\sin a = \frac{7}{8}$, what is the value of $\cos a$?

(F) $\frac{8}{7}$

(G) $\frac{\sqrt{15}}{7}$

(H) $\frac{\sqrt{15}}{8}$

(J) $\frac{7\sqrt{15}}{15}$

(K) $\frac{8\sqrt{15}}{15}$

43. In the real numbers, which of the following is the domain of the function $f(x) = \frac{\sqrt{x-3}}{x-3}$?

(A) $x \geq 3$

(B) $x > 3$

(C) $x < -3$

(D) $-3 < x < 3$

(E) $x < -3$ or $x > 3$

44. Andrea and Zach are both waiting for an appointment with a guidance counselor. When they arrived, each received a card from the secretary, telling the hour and minute of his or her arrival. Two minutes ago, Andrea had been waiting exactly $\frac{1}{2}$ as many minutes as Zach. Three minutes from now, Andrea will have been waiting exactly $\frac{2}{3}$ as long as Zach. If the time is now 11:30, at what time did Andrea arrive?

(F) 11:16

(G) 11:18

(H) 11:20

(J) 11:23

(K) 11:25

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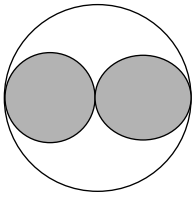
45. In the following figure, each circle is tangent to the other two circles, and the two shaded circles are identical to each other. What is the ratio of the shaded region to the nonshaded region?



(A) 1:1

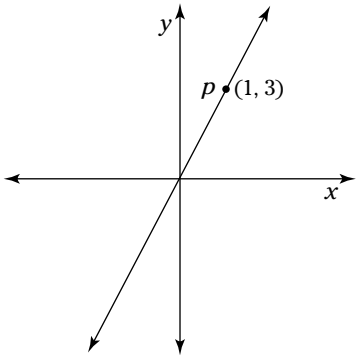
(B) 4:5

(C) 5:4

(D) 4:π

(E) π:4

46. In the following figure, the line passes through the origin and through $P = (1, 3)$. If you were to draw a new line perpendicular to the first that also passes through P, what would be the equation of this new line?



(F) $y = 3x + 4$

(G) $y = \frac{1}{3}x + 4$

(H) $y = \frac{1}{3}x + \frac{10}{3}$

(J) $y = -\frac{1}{3}x + 4$

(K) $y = -\frac{1}{3}x + \frac{10}{3}$

47. If $\begin{vmatrix} 6 & x & y \\ 9 & 7 & 5 \end{vmatrix} + \begin{vmatrix} x & y & z \end{vmatrix} = \begin{vmatrix} 9 & 7 & 5 \end{vmatrix}$, then $x + y + z =$

(A) 4

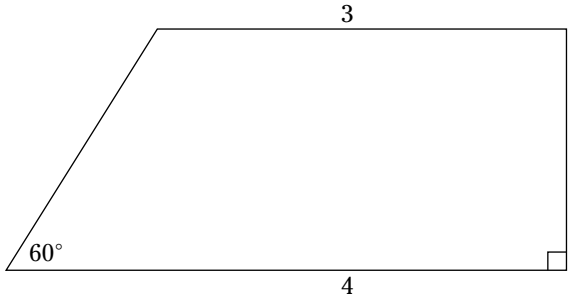
(B) 5

(C) 6

(D) 7

(E) 8

48. What is the area of the trapezoid in the following figure?



(F) 7

(G) $7\sqrt{2}$

(H) $7\sqrt{3}$

(J) $\frac{7\sqrt{3}}{2}$

(K) $\frac{7\sqrt{3}}{4}$

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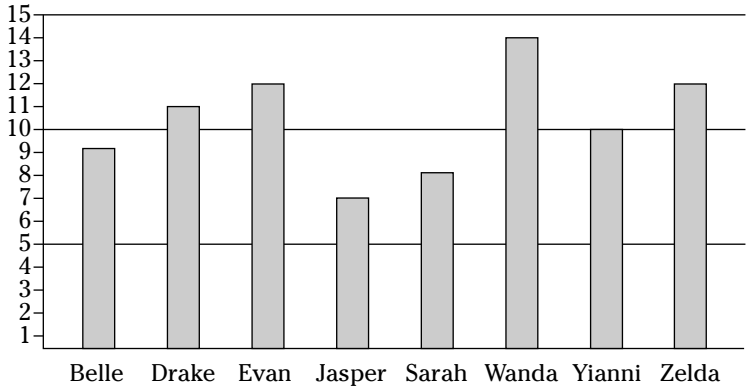
49. The following graph shows the number of new bank accounts that eight account executives have opened so far this week. Which of the following answer choices is the median number of accounts opened among these eight people?



(A) 9.5

(B) 10

(C) 10.5

(D) 11

(E) 12

50. If $x^2 - x - 2 > 0$, which of the following is the solution set for x?

(F) $x > -1$

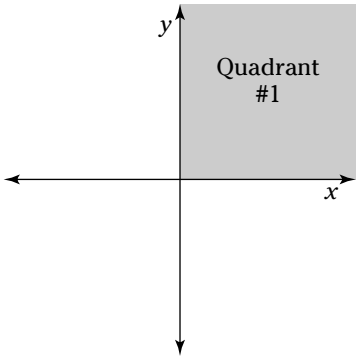
(G) $x > 2$

(H) $-1 < x < 2$

(J) $x < -1$ or $x > 2$

(K) No solutions are possible.

51. If you plot the equation $x^2 + (y - 2)^2 = 4$ as a circle on a standard xy-graph, what is the area of the circle's region that will lie in Quadrant 1, as shown in the following figure?



(A) 0

(B) π

(C) 2π

(D) 4π

(E) 16π

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52. If $a + 2b = 2$, what is the value of $\left(\frac{a}{b-1}\right)+\left(\frac{a}{b-1}\right)^2+\left(\frac{a}{b-1}\right)^3$?

(F) –6

(G) 8

(H) 10

(J) –12

(K) 14

53. On an *xy*-graph, three corners of a parallelogram are located at (3, 3), (4, – 4), and (–2, –1). Which of the following points could be the remaining corner?

(A) (8, 0)

(B) (8, –1)

(C) (–1, 9)

(D) (–3, 6)

(E) (–5, 7)

54. Doug, who runs track for his high school, was challenged to a race by his younger brother, Matt. Matt started running first, and Doug didn't start running until Matt had finished a quarter-mile lap on the school track. Doug passed Matt as they both finished their sixth lap. If both boys ran at a constant speed, with Doug running 2 miles an hour faster than Matt, what was Matt's speed?

(F) 10.5 miles per hour

(G) 10 miles per hour

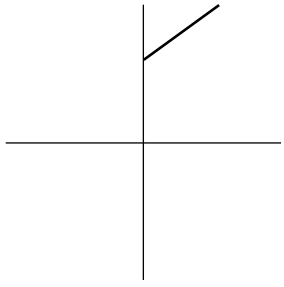
(H) 9 miles per hour

(J) 8 miles per hour

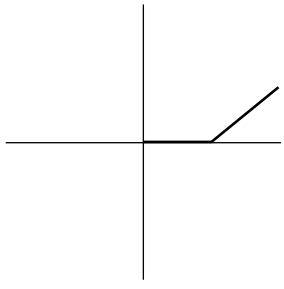
(K) 7.5 miles per hour

55. When calculating a certain tax, Simone found that no tax is due for all income up to p dollars, with $p > 0$. Income greater than p dollars is taxed at a rate of 15%. Which of the following graphs accurately represents this tax?

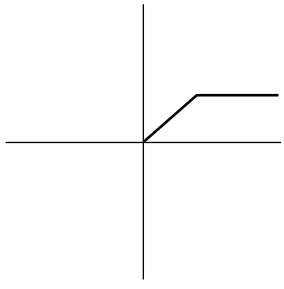
(A)



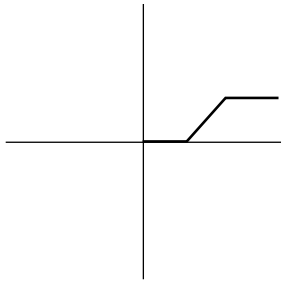
(B)



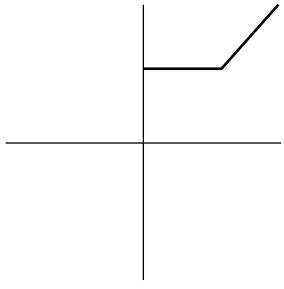
(C)



(D)



(E)



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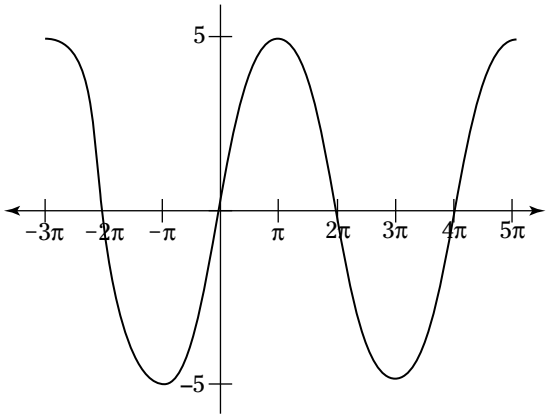
56. The following figure shows the graph of $y = 5\sin\frac{x}{2}$. Which of the answer choices are the correct amplitude and period of this function?



(F) amplitude = 5, period = π

(G) amplitude = 5, period = 2π

(H) amplitude = 5, period = 4π

(J) amplitude = 10, period = 2π

(K) amplitude = 10, period = 4π

57. If the equation $x^2 + mx + n = 0$ has two solutions, $x = k$ and $x = 2k$, what is the value of mn in terms of k?

(A) $2k^2$

(B) $-2k^2$

(C) $-2k^3$

(D) $6k^3$

(E) $-6k^3$

58. When she chooses a password, Eloise always uses exactly ten different characters: five letters (A, B, C, D, and E) and five numbers (2, 3, 4, 5, and 6). Additionally, she always ensures that no pair of letters is consecutive and that no pair of numbers is consecutive. How many different passwords conform to these rules?

(F) fewer than 1,000

(G) between 1,000 and 10,000

(H) between 10,000 and 100,000

(J) between 100,000 and 1,000,000

(K) more than 1,000,000

59. If the least common multiple of 9, 10, 12, and v is 540, which of the following could be v?

(A) 18

(B) 24

(C) 27

(D) 36

(E) 45

60. The equation $y = ax^b + c$ produces the following (x, y) coordinate pairs: (0, 2), (1, 7), and (2, 42). What is the value of abc?

(F) 10

(G) 20

(H) 30

(J) 40

(K) 60

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