Advanced Drills

Use these drills to push yourself with the toughest types of problems you are likely to encounter on SAT test day. Each drill has ten questions, with solutions that follow.

- Algebra Drill 1
- Algebra Drill 2
- Advanced Math Drill 1
- Advanced Math Drill 2
- Problem Solving and Data Analysis
- Geometry and Trigonometry
- Mixed Problems

If you are doing a drill under timed conditions, allow about 15 minutes to complete (longer than the chapter drills because of the increased average difficulty of the problems). Good luck!

Algebra Drill 1

1. Solve for x:

$$1\frac{7}{8}x + \frac{5}{32} = 3\frac{3}{4}x - 1\frac{1}{4}$$

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

(B) $2\frac{17}{32}$

(C) $\frac{15}{16}$

(D) $-\frac{45}{76}$

2. When 2 times a number is subtracted from 14, the result is 2 greater than the number. What is the number in question?

(A) $\frac{16}{3}$

(B) 4

(C) 12

(D) 16

3. In 2015, Andre had 210 coins in his collection. If Andre adds 5 new coins a year starting in 2015 through the end of 2022 and then adds 8 coins a year starting in 2023, how many coins will he have in his collection at the end of 2045?

(A) 224

(B) 421

(C) 429

(D) 434

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4. How many pairs (x, y) satisfy both $x - y > 3$ and $y - 5 > x$?

   (A) 0
   (B) 1
   (C) 2
   (D) Infinitely many

5. What is the solution (x, y) to the following set of equations?

$$4x - 3y = \frac{11}{3} \text{ and } -\frac{2}{3}x + \frac{1}{4}y = -\frac{13}{18}$$

   (A) $\left(\frac{4}{3}, \frac{5}{4}\right)$
   (B) $\left(\frac{5}{4}, \frac{4}{9}\right)$
   (C) $\left(-\frac{37}{12}, -\frac{16}{3}\right)$
   (D) $\left(\frac{7}{4}, 10\right)$

6. How many ordered pairs (x, y) satisfy the following system of equations?

$$(x - 2)(y + 5) = 0 \text{ and } 3x + y = 1$$

   (A) 0
   (B) 1
   (C) 2
   (D) Infinitely many

7. What are the solutions to the following series of equations?

$$\frac{3}{8}a + \frac{2}{3}b = 4.3 \text{ and } -12.9 + 1.125a = -2b$$

   (A) $a = 0.8$ and $b = 6$
   (B) $a = 16.8$ and $b = -3$
   (C) No solutions
   (D) Infinitely many solutions

8. Candidate M and Candidate N are the only candidates running for city mayor. If the total number of votes the two candidates receive is 50,000 and if Candidate M receives 3 times as many votes as Candidate N, what is the total number of votes Candidate N receives?

   (A) 12,500
   (B) 16,667
   (C) 21,500
   (D) 37,500

9. Jennifer's yearly salary, S, is modeled using the equation $S = 2{,}500Y + 40{,}000$, where Y represents how many years she has been working at the company. What does the number 2,500 represent in this equation?

   (A) The amount Jennifer's salary increases for each year she has been working
   (B) Jennifer's starting salary
   (C) The amount of money Jennifer has made in year Y
   (D) The number of hours Jennifer has worked in year Y

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10. If Avinash reads 2 fiction articles per day and 14 nonfiction articles per week, which expression models the total number of articles he would read in w weeks?

(A) $2w + 14$
(B) $16w$
(C) $28w$
(D) $112w$

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Algebra Drill 2

1. If $-(2x-4)+3(x-5)=-4$, what is the value of x?

   (A) -3
   (B) 5
   (C) 7
   (D) 15

2. If $g(x+2)=5x-4$, what is the value of $g(7)$?

   (A) 21
   (B) 29
   (C) 31
   (D) 41

3. John is having an undetermined number of people over for dinner. He needs to have 6 serving utensils (used by everyone collectively), plus a knife, fork, and spoon for each diner. Which of the following equations correctly models the total number of utensils, U, John will need for x number of diners, himself included?

   (A) $U=3x$
   (B) $U=9x$
   (C) $U=3x+6$
   (D) $U=6x+3$

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4. If $f(x) = 4x + 7$ and if $g(x) = -3x + 2$, what is the value of $f(g(3))$?

   (A) -27
   (B) -21
   (C) -7
   (D) 19

5. Under a new state law, a massage therapist will be required to charge sales tax on her services. If the sales tax rate is 7%, by what ratio would she need to multiply the current price of her services to determine the new total amount customers will pay under the new law?

   (A) $\frac{7}{100}$
   (B) $\frac{7}{10}$
   (C) $\frac{107}{100}$
   (D) $\frac{170}{100}$

6. If $6(2a - b) = 4b$, what is the ratio of b to a?

   (A) $\frac{2}{3}$
   (B) $\frac{5}{6}$
   (C) $\frac{6}{5}$
   (D) $\frac{12}{5}$

7. The total operational costs C for a restaurant are modeled by the equation $C = 2M + 50{,}000$, where M represents the number of meals served. What does the 50,000 represent in the equation?

   (A) The total operational costs
   (B) The fixed operational costs
   (C) The cost per meal
   (D) The minimum number of meals served

8. The total costs C to operate a factory are represented by the function $C(n) = an + b$, where n is the number of days the factory is operational. If the daily operations costs were to increase beyond the given rate and if the initial startup costs were to decrease beyond the given rate, how would this affect the constants a and b?

   (A) a would increase, and b would increase.
   (B) a would increase, and b would decrease.
   (C) a would decrease, and b would increase.
   (D) a and b would remain the same.

9. How will the function $f(x) = 4x - 5$ be affected by the translation

$$g(x) = f(x - 1) + 2?$$

   (A) It will be shifted up 2 units and 1 unit to the left.
   (B) It will be shifted down 1 unit and 2 units to the left.
   (C) It will be shifted up 2 units and 1 unit to the right.
   (D) It will be shifted down 1 unit and 2 units to the right.

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10. A company is conducting an online campaign to increase its social media followers. The number of social media followers, N, is estimated by the equation $N = 30W + 250$, where W represents the number of weeks of the campaign (and $W > 0$). What does the number 250 represent in the equation?

    (A) The number of weeks of the campaign
    (B) The number of new social media followers each week
    (C) The number of social media followers at the start of the campaign
    (D) The number of social media followers at the end of W weeks

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Advanced Math Drill 1

1. An element's half-life is the amount of time that it takes for the element to decay by half. If there is x amount of element Z initially, which of the following represents the amount A of Z that would remain after n whole half-lives of Z had passed?

   (A) $A = \frac{x}{2n}$

   (B) $A = \frac{x}{2^n}$

   (C) $A = \frac{n}{2x}$

   (D) $A = \frac{x}{2^{n-1}}$

2. $\sqrt[5]{32x^8y^{11}}$ is equivalent to which of the following?

   (A) $2xy^2\sqrt[5]{x^3y}$

   (B) $2x^5y^{10}\sqrt[5]{x^3y}$

   (C) $2x^3y^6\sqrt[5]{xy}$

   (D) $2xy^2\sqrt[5]{2x^3y^2}$

3. If $x > 0$, then $\frac{1}{2x} + \frac{1}{3x}$ is equivalent to which of the following?

   (A) $\left(\frac{25}{6x^2}\right)^{\frac{1}{2}}$

   (B) $\left(\frac{4}{25x^2}\right)^{\frac{1}{2}}$

   (C) $\left(\frac{5}{6x}\right)^2$

   (D) $\left(\frac{25}{36x^2}\right)^{\frac{1}{2}}$

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4. If $x^2 + ax = b$, where a and b are constants, what are the solutions for x?

   (A) $x = -\frac{a}{2} \pm \sqrt{2b + \frac{a^2}{2}}$

   (B) $x = -\frac{a}{2} \pm \sqrt{b + \frac{a^2}{4}}$

   (C) $x = -\frac{b}{2} \pm \sqrt{\frac{a^2}{2} - 2b}$

   (D) $x = -\frac{a}{2} \pm \sqrt{b^2 + \frac{a^2}{4}}$

5. $6x^2 + 15xy + 6y^2 = ?$

   (A) $3(2x + y)^2$
   (B) $(3x + y)(x + 3y)$
   (C) $(3x + 3y)(2x + 2y)$
   (D) $3(x + 2y)(2x + y)$

6. What are the solution(s) for x in the equation below?

$$x - 6 = \sqrt{75 - 2x}$$

   (A) 13
   (B) 13 and -3
   (C) -3 and 3
   (D) No solution

7. At what points will $f(x) = 8x^2 - 22x + 15$ intersect the x-axis?

   (A) 15
   (B) $\frac{3}{2}$ and $\frac{5}{4}$
   (C) $-\frac{5}{4}$ and $-\frac{3}{2}$
   (D) $\frac{5}{4}$ and $\frac{15}{2}$

8. Which value of n will cause the value of $f(x) = xn$ to be consistently positive and increase the most rapidly, given that x is greater than 1 and that n is an even integer?

   (A) -2
   (B) -1
   (C) 1
   (D) 2

9. To see if two sets of data are correlated, one can calculate the correlation coefficient between two populations, r_{xy}, using the formula $r_{xy} = \frac{s_{xy}}{s_x s_y}$, where s_{xy} is the covariance of the population, s_x is the standard deviation of population x, and s_y is the standard deviation of population y. If the dispersion of population x and the dispersion of population y both increase while the covariance between the populations remains the same, what would happen to the correlation coefficient of the two populations?

   (A) It would decrease.
   (B) It would increase.
   (C) It would stay the same.
   (D) It cannot be determined.

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10. If the function $f(x) = x^n + 3^{xm}$ has 5 zeros and if $f(x)$ is multiplied by -1, how many zeros will the resulting function have?

(A) -5
(B) 4
(C) 5
(D) 6

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Advanced Math Drill 2

1. A particular savings account provides no interest in the first year of a deposit and 3% annual compounded interest on a deposit for each year thereafter. If x dollars are deposited initially, which of the following equations expresses the total amount of money $A(n)$ in the account n years later, where n is an integer greater than 2?

   (A) $A(n) = x\,[(0.03)^n]$
   (B) $A(n) = x\,[(0.97)^n]$
   (C) $A(n) = x\,[(0.03)^{n-1}]$
   (D) $A(n) = x\,[(1.03)^{n-1}]$

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2. What is the value of x in the following equation?

$$x^2 + 9 = -6x$$

(A) -3
(B) 0
(C) 3
(D) No solution

3. For $y < 0$, which of the following is equivalent to $\frac{3}{x^2 y}$?

(A) $\frac{3x^{-2}}{\sqrt[4]{y^2}}$
(B) $\frac{3x^{-2}}{-\sqrt[4]{y^4}}$
(C) $\frac{3x^{\frac{1}{2}}}{\sqrt[4]{y^4}}$
(D) $\frac{3x^{-2}}{\sqrt[4]{y^4}}$

4. For positive x and y, $x^{-\frac{3}{4}} y^{\frac{4}{3}}$ is equivalent to

(A) $-\frac{x^3 y^4}{x^4 y^3}$
(B) $\frac{\sqrt[4]{y^3}}{\sqrt[3]{x^4}}$
(C) $\frac{y\sqrt[3]{y}}{\sqrt[4]{x^3}}$
(D) $\frac{y^4\sqrt[3]{y}}{x^3\sqrt[4]{x}}$

5. What are the possible values of x in the following equation?

$$3x^2 + 12x + 6 = 0$$

(A) $-12 \pm \sqrt{3}$
(B) $-2 \pm \sqrt{2}$
(C) $-2 \pm \sqrt{3}$
(D) $2 \pm \sqrt{2}$

6. If $x^2 + x - 12 = 0$ and if $x < 0$, what is the value of x?

(A) -6
(B) -4
(C) -3
(D) 3

7. $64x^6 - 16y^8$ is equivalent to which of the following expressions?

(A) $16(4x^3 + y^4)(x^3 - y^4)$
(B) $16(4x^3 - y^4)(x^3 - y^4)$
(C) $16(2x^3 + y^4)(2x^3 - y^4)$
(D) $16(2x^6 - y^8)(2x - y)$

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8. Solve the following equation for all possible x values.

   (A) 3
   (B) 3 and 8
   (C) -3 and -8
   (D) Infinitely many solutions

9. The graph of $x - 4 = y^4$ has a minimal x value that compares in what way to the minimal x value of the graph $x = y^4$?

   (A) It is 4 less.
   (B) It is 4 greater.
   (C) They are the same.
   (D) The answer cannot be determined.

10. Which of the following functions represents the reflection across the x axis of

$$y = 3(x - 5)^2 + 4?$$

   (A) $y = -3(x + 5)^2 - 4$
   (B) $y = -3(x - 5)^2 - 4$
   (C) $y = 3(-x - 5)^2 + 4$
   (D) $y = 3(-x + 5)^2 + 4$

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Problem Solving and Data Analysis Drill

1. If there are 4 cars for every 5 trucks in the parking lot (with no other types of vehicles), what is the ratio of cars to the total number of vehicles in the parking lot?

   (A) 1 to 5
   (B) 4 to 9
   (C) 5 to 9
   (D) 4 to 5

2. On Monday, the highest temperature reached was 70 degrees Fahrenheit. On Tuesday, the highest temperature increased by 20%. On Wednesday, the highest temperature decreased by 25% from the previous day. What was the difference between Monday's and Wednesday's highest temperatures in degrees Fahrenheit?

   (A) 5
   (B) 7
   (C) 14
   (D) 21

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3. A recipe calls for 3 cups of sugar. There are 16 tablespoons in a cup and 3 teaspoons in a tablespoon. If a cook has 1.5 cups of sugar available in the pantry, how many teaspoons of sugar must the cook obtain from other sources to follow the recipe?

   (A) 72
   (B) 104
   (C) 144
   (D) 216

Price per Gallon of Milk	Number of Gallons Sold
$1.50	650
$0.90	780
$1.95	530
$2.80	330
$3.40	190

4. Which of these functions best models the relationship between the number of gallons of milk sold, $N(g)$, and the price per gallon of milk, g?

   (A) $N(g) = 530 + 590(g - 1.95)^2$
   (B) $N(g) = 1{,}000 - 240g$
   (C) $N(g) = 1{,}000 + 240g$
   (D) $N(g) = 780 - 360(g - 0.9)^2$

	Employed	Unemployed
Population X	890	112
Population Y	748	205

5. What is the difference between the unemployment percentage in Population Y and the unemployment percentage in Populations X and Y combined, calculated to the nearest tenth?

   (A) 5.0%
   (B) 5.3%
   (C) 5.8%
   (D) 6.2%

Questions 6–7 use the following table.

Election Results

	Candidate A	Candidate B	Total
Columbus	350,000	270,000	620,000
Cleveland	180,000	195,000	375,000
Total	530,000	465,000	995,000

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6. Of all eligible voters in Columbus, 40% actually voted in the election. How many total eligible voters did Columbus have?

   (A) 248,000
   (B) 875,000
   (C) 1,550,000
   (D) 2,487,500

7. Suppose that a survey of total 200 randomly selected voters from both cities accurately predicted the results of the election. How many of the people surveyed would have been supporters of Candidate A from Columbus?

   (A) 50
   (B) 70
   (C) 113
   (D) 132

Questions 8—9 use the following table.

Grade	Test 1	Project 1	Test 2	Project 2	Total
A	5	8	9	7	29
B	7	6	5	10	28
C	6	7	4	5	22
D	4	1	3	2	10
F	1	1	3	0	5
Total	23	23	24	24	94

8. The median letter grade for assignments in the class is:

   (A) A
   (B) B
   (C) C
   (D) D

9. For which assignment is the standard deviation of the grade results the least?

   (A) Test 1
   (B) Project 1
   (C) Test 2
   (D) Project 2

10. An online shopping site allows customers to post 1-star, 2-star, 3-star, 4-star, and 5-star reviews for products. If an item currently has an average star rating of 2.3 based on a total of 10 reviews, what is the minimum number of reviews that could bring up the overall average rating to at least a 3.0?

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

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Geometry and Trigonometry Drill

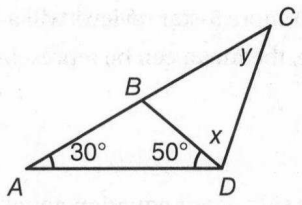
1. A box in the shape of a rectangular prism has dimensions 20 inches by 30 inches by 12 inches. Inside the box are four solid cubes, each with edge lengths of 4 inches. If the inside of the larger box is empty except for the solid cubes, what is the volume of empty space in the box?

   (A) 248 cubic inches
   (B) 1,800 cubic inches
   (C) 6,944 cubic inches
   (D) 7,200 cubic inches

2. A right triangle has a hypotenuse of 10 inches and legs that measure 8 inches and 6 inches. What is the area of the triangle in square inches?

   (A) 12
   (B) 18
   (C) 24
   (D) 36

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3. In triangle ACD above, point B is on $\overline{AC}$, and B and D form a line. What is the sum of $\angle x$ and $\angle y$ in degrees?

   (A) 100
   (B) 110
   (C) 120
   (D) 140

4. If a circle has the equation $(x-4)^2+(y-6)^2=9$, what is the equation of the circle if it is reflected directly across the x-axis?

   (A) $(x+4)^2+(y+6)^2=-9$
   (B) $(x-4)^2-(y+6)^2=-9$
   (C) $(x+4)^2-(y+6)^2=9$
   (D) $(x-4)^2+(y+6)^2=9$

5. If the area of an equilateral triangle is $2\sqrt{3}$ square units, what is the perimeter of the triangle?

   (A) 6
   (B) $4\sqrt{3}$
   (C) $6\sqrt{2}$
   (D) $6\sqrt{3}$

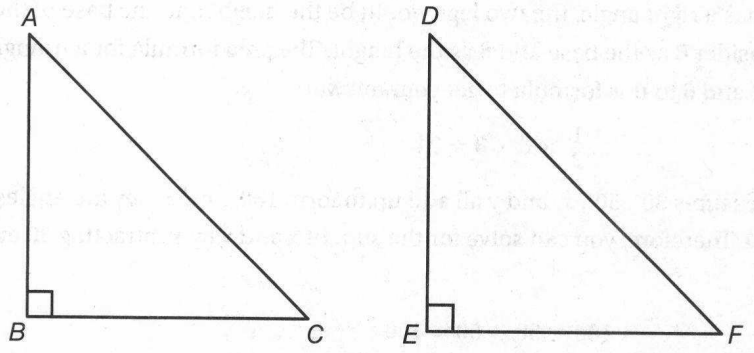
6. Given that $\angle X$ is between 0 and 90 degrees, and that $\cos X = Y$, what is the *sine* of an angle with the measure $(90-X)$ degrees?

   (A) $90-Y$
   (B) Y
   (C) $\frac{2}{3}$
   (D) 90

7. An angle measuring 3π radians would be equivalent to how many angles with a measure of 45°?

   (A) 4
   (B) 8
   (C) 9
   (D) 12

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8. Triangles ABC and DEF are similar to one another. If the cosine of $\angle BAC$ is $\frac{12}{13}$, and the length of $\overline{DE}$ is 24 units, what is the length of $\overline{DF}$?

(A) 14
(B) 20
(C) 26
(D) 30

9. Over a 20-second time period, Jeff runs in a circle of 8 feet in radius around a pole. Assuming that Jeff starts the time period at a radius of 8 feet from the pole, the graph during this interval of his time (as the x-coordinates) and his distance from the pole (as the y-coordinates) would have a slope of what?

(A) -1
(B) 0
(C) 1
(D) 2

10. A rectangular dog park is x feet wide and y feet long. The park is to be fenced in along its sides with wooden material, except for part of one side where there will be a metal gate that is g feet long. How long must the fence material be in order to meet these conditions?

(A) $2x + 2y - g$
(B) $2x + 2y + g$
(C) $xy - g$
(D) xyg

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Mixed Drill

1. Which of the following lines is perpendicular to $5y - 2.5x = -10$?

   (A) $y = -2x + 8$
   (B) $y = 0.5x + 2$
   (C) $y = 2x - 7$
   (D) $y = 0.4x + 10$

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Questions 2–3 use the following table.

Hours of Sleep per Night

	More Than 8	6–8	Less Than 6	Total
Under Age 13	15	8	1	24
Ages 13–18	13	17	14	44
Ages 19–22	18	12	20	50
Total	46	37	35	118

2. The least possible median age of those surveyed would be which of the following?

   (A) 13
   (B) 15
   (C) 19
   (D) Cannot be determined from the given information

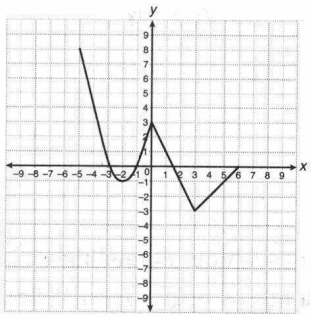
3. The mean number of hours of sleep of all those surveyed is

   (A) 6.5
   (B) 7.5
   (C) 8.5
   (D) Cannot be determined from the given information

4. For values of a not equal to zero, $\left(\frac{2}{\sqrt[3]{a}}\right)^6$ equals

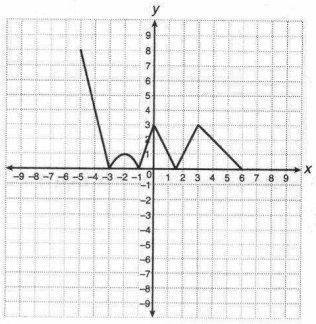
   (A) 2a−2
   (B) 12a−2
   (C) $64a\frac{1}{2}$
   (D) $64a^{-2}$

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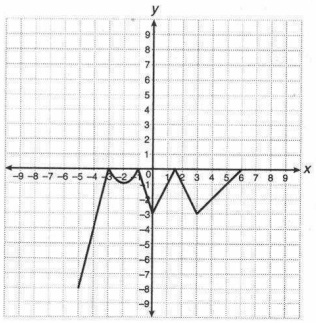


5. The graph of $y = f(x)$ is shown above. Which of the following graphs best represents the graph of $y = |f(x)|$?

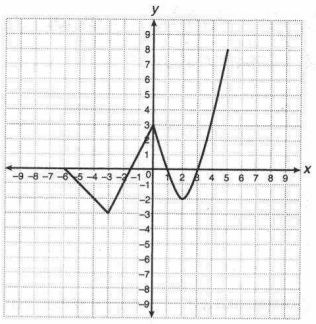
(A)



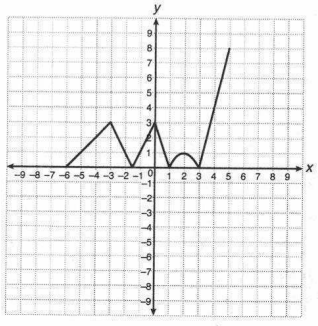
(B)



(C)



(D)



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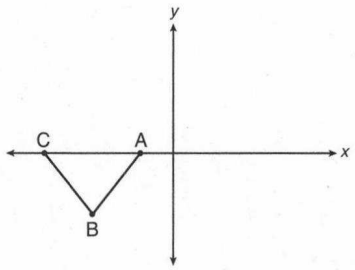
6. Which of the following is equivalent to $(6x^3 + 3x^2 - 1) + (4x^3 - 4x^2 + 2x + 3)$?

   (A) $11x^6 + 2$
   (B) $10x^3 - 7x^2 + 2x + 2$
   (C) $10x^3 - x^2 + x + 3$
   (D) $10x^3 - x^2 + 2x + 2$

7. Peter makes \$15 per hour when he works 40 hours a week. For each hour exceeding 40, he is paid 50% more than his usual hourly rate. Assuming that Peter has worked at least 40 hours in a particular week, which inequality properly expresses the range of hours, h, he must work to make over \$800 in that week?

   (A) $800 < 600 + 22.5 \times (h - 40)$
   (B) $800 < 600 + 22.5h$
   (C) $800 < 600 + 7.5 \times (h - 40)$
   (D) $800 < 40 + 15h$

8. In the xy-plane below, ABC is an equilateral triangle with sides of length 2. If point A has coordinates $(-2, 0)$, what are the coordinates of point B?



   (A) $(-\sqrt{3}, -3)$
   (B) $(-2, -\sqrt{3})$
   (C) $(-3, \sqrt{2})$
   (D) $(-3, -\sqrt{3})$

9. In a pet store with 30 customers, 60% of the customers like dogs and 11 customers like cats. What is the minimum number of customers who like both cats and dogs?

   (A) 0
   (B) 1
   (C) 4
   (D) 7

10. The function f is defined below. If $f(n)$ and n are both integers, what is the largest value that n can be?

$$f(n) = \frac{2}{\sqrt[4]{n - 300}}$$

   (A) 0
   (B) 301
   (C) 316
   (D) 426

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