Math Power

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SAT (Zoom, 2020) Issue 7

Warm-ups

1. Solve:
$\frac{1}{2}(x + 2)^2 = 98$

2. Find the roots of $2x^2 - 4 = 5x$.

3. If $y = 3$ and $\frac{x}{y} = x - y$, what is the value of x?

4. A sum of $6000 is deposited part of it at Bank A, offering 9% interest and the remainder at Bank B, offering 11%. The interest earned from Bank A is $160 less than that from Bank B. What is the amount of deposit at each bank?

5. Simplify $\frac{\sqrt{125}}{3\sqrt{5}}$.

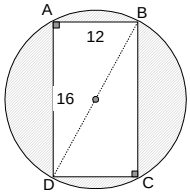
6. In the number line below, the coordinates of P and T as shown. Find the coordinate of S that is 3 times as far from point P as from point T.
(Hint: There are two possible locations for S.)

7. What is the greatest of 5 consecutive integers if the sum of these integers equals 185?

8. A grocer bought one dozen candy bars for $3.60. He sold the candy for $0.36 each. What percent of the cost is the profit?

Question set [**9 - 10**]

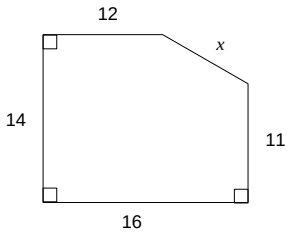
Rectangle ABCD inscribes in a circle.



9. What is the length of the diameter of the circle?

10. What is the area of shaded part? (Use 3.14 for π)

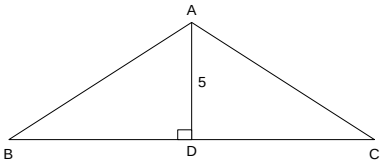
11. Four sides of a pentagon are given as in the figure.



(a) Find the perimeter.

(b) Find the area.

12. ΔABC is an isosceles. The length of AD, the height to the base, is 5 cm. The area of ΔABC is 60 cm^2. Find the perimeter of ΔABC.



13. Mona just bought a book from a bookstore that sells only biographies and novels. Which of the following must be true?
A) The book is not a biography of John Adams.
B) The book is a biography.
C) The book is not a dictionary.
D) The book is not a humorous novel.

14. If x is an integer, which of the following could NOT equal x^3?
A) -8
B) 0
C) 1
D) 16

15. If $\frac{x}{2}$ is an odd integer, then which of the following must be an even integer?
A) $\frac{1}{4}x$
B) $x+1$
C) $(\frac{1}{2}x)^2$
D) x

16. A home valued at $70,000 is assessed $900 in real estate taxes. At the same rate, how much are the taxes on a home assessed at $105,000?

17. On one test, Mr. Baker's 25 students averaged 88% on a test while Mr. Jensen's 30 students averaged 99%. What was the average over the two classes? Express your answer as a percent.

18. Cut a strip of rope 13 yards 5 feet 3 inch into three equal parts. What is the length of each part? (Give your answer in ___ yd ___ ft ___ in.)

19. Jesse used x^2 gallons of gasoline to drive 17 miles. How much gasoline will he need to travel 238 miles? (Proportion is not handy enough.)

20. Jon likes to jog in weekends. It is 8 miles from his home to a local park. It takes Jon 1 hr 50 min to get to the park. He returns along the same path without a rest. It takes him 2 hr 10 min to come back home. What is his average speed in miles per hour?

Algebra 2

Question set [**21 - 23**]

Use the equation instead of solving it.

21. If $5x + 6 = a$, what is the value of $10x + 3$ in terms of a?

22. If $5x - 6 = 2a$, what is the value of $15x - 3$ in terms of a?

23. If $15x - 6 = 3a$, what is the value of $10x - 3$ in terms of a?

24. Which of the following is equivalent to the expression $(\frac{x^{\frac{1}{2}}}{x^{-2}})^2$?

A) x^2 B) $(\frac{x^2}{x})^{\frac{1}{2}}$

C) $(\frac{x^2x^{\frac{1}{3}}}{x^4})^3$ D) $(\frac{x^3x^4}{x^{-3}})^{\frac{1}{2}}$

25. Which of the following expressions is equivalent to $25x^2-\frac{4}{9}$?

A) $\sqrt{5x-\frac{2}{3}}$ B) $x(5x-\frac{2}{3})$

C) $(5x+\frac{2}{3})(5x-\frac{2}{3})$ D) $(25x+\frac{2}{3})(25x-\frac{2}{3})$

26. If $t < 0$ and $t^2 - 2 = 0$, what is the value of $3t^2 + \sqrt{2}t + 4$?

27. $f(x) = -\frac{1}{2}(x+7)(x-5) - 2$

Which of the following equivalent forms exhibits the maximum value of f as a constant coefficient?

A) $f(x) = -\frac{1}{2}x^2 - 24$

B) $f(x) = -\frac{1}{2}(x^2 + 2x - 24)$

C) $f(x) = -2(x-1)^2 - 21$

D) $f(x) = -\frac{1}{2}(x+1)^2 + 16$

28. $h = -4.9t^2 + 25t$

The equation above expresses the approximate height h, in meters, of a ball t seconds after it is launched vertically upward from the ground with an initial velocity of 25 meters per second. After approximately how many seconds will the ball hit the ground?

A) 3.5 B) 4.0
C) 4.0 D) 5.0

29. How many real values of x satisfy the equation: $9x^4-2x^2+\frac{1}{9}=0$?

A) 0 B) 1
C) 2 D) 3

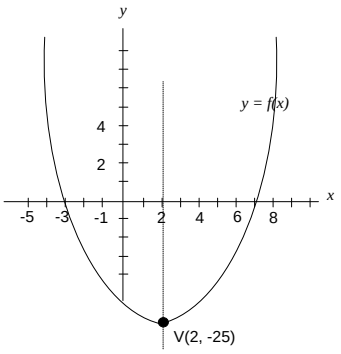
30. Which of the following is equivalent to the expression $x^4-x^3-x^2$?

A) $x(x^2-x-1)$ B) $x(x-x^2-x^3)$
C) $x(1-x-x^2)$ D) $x^2(x^2-x-1)$

31. $9x^4-30x^2y^2+25y^4$

Which of the following is equivalent to the expression shown above?

A) $(3x^2+5y^2)^2$ B) $(3x^2-5y^2)^2$
C) $(9x^2+25y^2)^2$ D) $(9x-25y)^4$

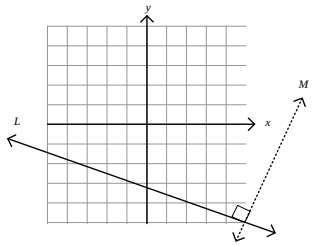


32. Which of the following could be an equation represented by the graph above?

A) $y = (x + 3)(x - 7)$ B) $y = (x - 3)(x + 7)$
C) $y = x(x - 3) + 25$ D) $y = (x - 4)^2 - 25$

Question set [**33 - 34**]

Basic slope notions.

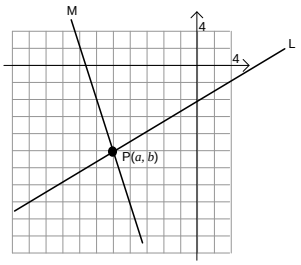


33. What is the slope of the line L in the graph above?

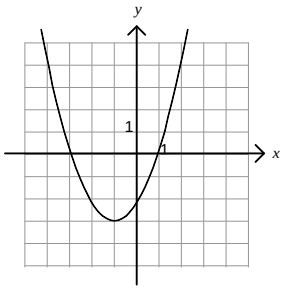
A) -1 B) $-\frac{1}{6}$
C) $-\frac{1}{3}$ D) $-\frac{1}{2}$

34. What is the slope of the (dashed) line M, perpendicular to L?

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

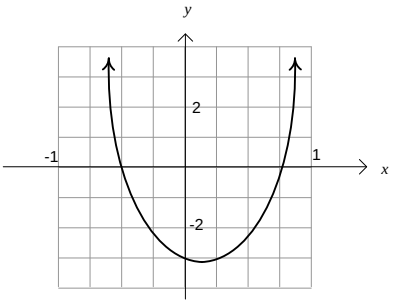


35. Two line meet at the point $P(a, b)$ in the figure above. What is the value of $a + b$?
A) 10 B) -10
C) -10.5 D) -20



36. The following quadratic equations are all representations of the graph shown above. Which equation could you use to find the minimum value of the function, without doing any additional work?
A) $y=\frac{3}{4}(x+1)^2-3$
B) $y=\frac{3}{4}(x+3)(x-1)$
C) $y=\frac{3}{4}(x^2+2x-3)$
D) $y=\frac{3}{4}x^2+\frac{3}{2}x-\frac{9}{4}$

37. If $\frac{x^{a^2}}{x^{b^2}}=x^{16}$, $x > 1$, and $a + b = 2$, what is the value of $a - b$?



Note: Each coordinate uses a different scale.

38. Which of the following represent the parabola in the graph above?
A) $y = (x - \frac{1}{2})(x + \frac{3}{4})$
B) $y = (x + \frac{1}{2})(x - \frac{3}{4})$
C) $y = (2x + 1)(4x - 3)$
D) $y = \frac{1}{2}(x + 1)(x - 3)$

39. If $2\sqrt{x} = x - 3$, which of the following is the solution set for x?
A) {-1, 9} B) {1, -9}
C) {9} D) {1, 9}

40. If $\sqrt{17 - 4x} = x - 3$, which of the following is the solution set for x?
A) {-2, 4} B) {2, -4}
C) {4} D) {2, 4}

Warm-ups

41. If $x \blacklozenge y = (x - y)^2$ for all integers, which of the following must be true?
I. $x \blacklozenge y = y \blacklozenge x$
II. $x \blacklozenge y = x \blacklozenge (-y)$
III. $x \blacklozenge (-y) = (-x) \blacklozenge y$

42. Each ticket for a video game asks for $2.00, while each ticket for bumper car ride asks for $5.00. A total of $250 was raised by selling 80 tickets. How many tickets for video game are sold?

43. Factor the following:
$-4a^2b + 8ab - 6ab^2$

44. The average of n numbers is a. What is the new average if x is subtracted from each number?

45. If the smallest of 5 consecutive odd integers is 45, what is the average of these numbers?

46. The average of B and another number is A. What is the other number?

47. How many 3-digit odd positive integers are there?

48. How many three-person committees can be chosen from a group of eight people?

49. A shipping container holds 15 blocks of cheese. If each block of cheese weighs $1\frac{1}{4}$ pounds, how many containers are needed to package an order of 600 pounds of cheese?

Question set [**50 - 51**]

There are 3 football tickets and 2 baseball tickets in a red box. There are 4 rock concert tickets and 1 folk concert in a blue box. Poloma selects a ticket from each box without looking.

50. What is the probability that Poloma will select one football ticket and one folk concert ticket?

51. What is the probability of getting a football ticket and a rock concert ticket?

Question set [**52 - 54**]

Martin has 5 blue socks and 8 black socks in his drawer. He picks one sock at random and then the other.

52. What is the probability of getting a pair of blue socks?

53. What is the probability of getting a pair of mismatching socks?

54. What is the probability of getting a pair of black socks?

Question set [**55 - 56**]

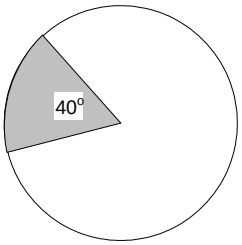
A batter hitting rate is 0.3, which means he can hit 3 times in 10 tries.

55. What is the probability that she will get two hits in two trials?

56. What is the probability that she will get at least one hit in two trials?

57. What percent of 4 is $\frac{2}{3}$ of 8?

58. Naomi cuts a wedge (40° angle as shaded below) from a silver disk. If a whole disk of silver weighs 2.79 grams, how many grams does the wedge weigh?



59. A car can travel 32 miles on $1\frac{1}{3}$ gallon of gas. How many gallons of gas are needed for a distance of 240 miles?

60. $y = 2x^2 + bx + c$ and $y = 4$ (where k is a constant) have two intersections: A(-3, 4) and (6, 4). Find the value for $b + c$.

Interpretation of Coefficients

61. A musician has a new song available for downloading or streaming. The musician earns \$0.09 each time the song is downloaded and \$0.002 each time the song is streamed. Which of the following expressions represents the amount, in dollars, that the musician earns if the song is downloaded d times and streamed s times?
A) $0.002d + 0.09s$
B) $0.002d - 0.09s$
C) $0.09d + 0.002s$
D) $0.09d - 0.002s$

62. $y = 19.99 + 1.50x$
The equation above models the total cost y, in dollars, that a company charges a customer to rent a truck for one day and drive the truck x miles. The total cost consists of a flat fee plus a charge per mile driven. When the equation is graphed in the xy-plane, what does the y-intercept of the graph represent in terms of the model?
A) A flat fee of \$19.99
B) A charge per mile of \$1.50
C) A charge per mile of \$19.99
D) Total daily charges of \$21.49

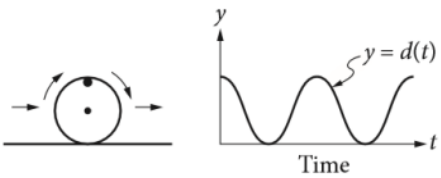
63. Of the following four types of savings account plans, which option would yield exponential growth of the money in the account?
A) Each successive year, 2% of the initial savings is added to the value of the account.
B) Each successive year, 1.5% of the initial savings and $100 is added to the value of the account.
C) Each successive year, 1% of the current value is added to the value of the account.
D) Each successive year, $100 is added to the value of the account.

64. $C = \frac{5}{9}(F - 32)$
The equation above shows how a temperature F, measured in degrees Fahrenheit, relates to a temperature C, measured in degrees Celsius. Based on the equation, which of the following must be true?
I) A temperature increase of 1 degree Fahrenheit is equivalent to a temperature increase of $\frac{5}{9}$ degree Celsius.
II) A temperature increase of 1 degree Celsius is equivalent to a temperature increase of 1.8 degrees Fahrenheit.
III) A temperature increase of $\frac{5}{9}$ degree Fahrenheit is equivalent to a temperature increase of 1 degree Celsius.
A) I only
B) II only
C) III only
D) I and II only

65. While preparing to run a marathon, Amelia created a training schedule in which the distance of her longest run every week increased by a constant amount. If Amelia's training schedule requires that her longest run in week 4 is a distance of 8 miles and her longest run in week 16 is a distance of 26 miles, which of the following best describes how the distance Amelia runs changes between week 4 and week 16 of her training schedule?
A) Amelia increases the distance of her longest run by 0.5 miles each week.
B) Amelia increases the distance of her longest run by 2 miles each week.
C) Amelia increases the distance of her longest run by 2 miles every 3 weeks.
D) Amelia increases the distance of her longest run by 1.5 miles each week.

66. $x + y = 75$
The equation above relates the number of minutes, x, Maria spends running each day and the number of minutes, y, she spends biking each day. In the equation, what does the number 75 represent?
A) The number of minutes spent running each day
B) The number of minutes spent biking each day
C) The total number of minutes spent running and biking each day
D) The number of minutes spent biking for each minute spent running

67. A painter will paint n walls with the same size and shape in a building using a specific brand of paint. The painter's fee can be calculated by the expression $nKlh$, where n is the number of walls, K is a constant with units of dollars per square foot, l is the length of each wall in feet, and h is the height of each wall in feet. If the customer asks the painter to use a more expensive brand of paint, which of the factors in the expression would change?
A) h
B) l
C) K
D) n

68. 

The figure on the left above shows a wheel with a mark on its rim. The wheel is rolling on the ground at a constant rate along a level straight path from a starting point to an ending point. The graph of $y = d(t)$ on the right could represent which of the following as a function of time from when the wheel began to roll?
A) The speed at which the wheel is rolling
B) The distance of the wheel from its starting point
C) The distance of the mark on the rim from the center of the wheel
D) The distance of the mark on the rim from the ground

69. Salim wants to purchase tickets from a vendor to watch a tennis match. The vendor charges a one-time service fee for processing the purchase of the tickets. The equation
$T = 15n + 12$
represents the total amount T, in dollars, Salim will pay for n tickets. What does 12 represent in the equation?
A) The price of one ticket, in dollars
B) The amount of the service fee, in dollars
C) The total amount, in dollars, Salim will pay for one ticket
D) The total amount, in dollars, Salim will pay for any number of tickets

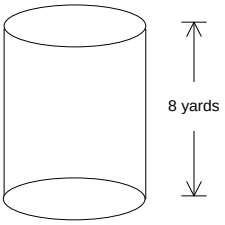
70. $h(t) = -16t^2 + 110t + 72$
The function above models the height h, in feet, of an object above ground t seconds after being launched straight up in the air. What does the number 72 represent in the function?
A) The initial height, in feet, of the object
B) The maximum height, in feet, of the object
C) The initial speed, in feet per second, of the object
D) The maximum speed, in feet per second, of the object

71. A cylindrical can containing pieces of fruit is filled to the top with syrup before being sealed. The base of the can has an area of 75 cm^2, and the height of the can is 10 cm. If 110 cm^3 of syrup is needed to fill the can to the top, which of the following is closest to the total volume of the pieces of fruit in the can?

72. Jim has identical drinking glasses each in the shape of a right circular cylinder with internal diameter of 3 inches. He pours milk from a gallon jug into each glass until it is full. If the height of milk in each glass is about 6 inches, what is the largest number of full milk glasses that he can pour from one gallon of milk? (Note: There are 231 cubic inches in 1 gallon.)

Question set [**101 - 102**]

A dairy farmer uses a storage silo that is in the shape of the right circular cylinder below. The volume of the silo is 72π cubic yards.



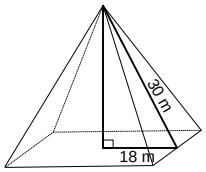
73. What is the diameter of the base of the cylinder, in yards?

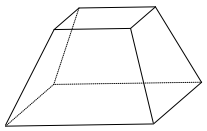
74. What is the surface area (in square yards) of the side around the silo?

75. The volume of a rectangular shipping crate being loaded onto a barge for international shipment across the Panama Canal is 79,860 cubic feet. If the length to width to height ratio of the crate is 5:4:3, what is the length of the crate in feet?

76. The surface area of a rectangular box is 1300 sq. feet. If the length to width to height ratio of the crate is 4:3:2, what is the volume of the box?

77. A cube of cheese is 4 cm wide, 4 cm long and 4 cm high. Six faces of the cube are covered with thin layer of wax. The cheese is then cut into 64 small cubes with sides of length 1 cm. How many of these small cubes have no wax on them?





78. When the top of a pyramid is cut off, the remaining base part is called a frustum. Suppose the top third (based on the height) of the square pyramid shown above is removed. What will be the volume, in cubic meters, of the remaining frustum?

Answer Key

1. $(x + 2)^2 = 14^2$
   $x + 2 = \pm 14$
   $x = -2 \pm 14 = 12$ or -16

2. $\frac{5\pm\sqrt{57}}{4}$

3. $4\frac{1}{2}$
   $\frac{1}{3}x = x - 3$
   $x = 4\frac{1}{2}$

4. $0.09x + 160 = 660 - 0.11x$
   $0.2x = 500$
   $x = \$2500$ (Bank A)
   $\$6000 - x = \$3500$ (Bank B)

5. $\frac{5}{3}$

6. Let s be the coordinate of point S.
   S is always on the right side of P, so $s - 1 > 0$. (Why?)
   Since SP = 3ST
   $s - 1 = 3|s - 7|$
   $s - 1 = \pm 3(s - 7)$

   Case 1:
   $s - 1 = 3(s - 7)$
   $2s = 20$
   $s = \boxed{10}$

   Case 2:
   $s - 1 = -3(s - 7)$
   $4s = 22$
   $s = \boxed{5.5}$

7. $185 \div 5 = 37$
   $37 + 2 = \boxed{39}$

8. $3.6 \div 12 = 0.3$
   $(0.36 - 0.3) \div 0.3 = 0.2 = 20\%$

9. Apply Pythagorean proportion:
   $(12, 16, x) = 4(3, 4, 5)$
   $x = \boxed{20}$

10. circle area $= 10^2\pi = 314$
    area of the shaded region
    $= 314 - 12 \times 16$
    $= 314 - 192$
    $= 122$

11. (a) $x = 5$, perimeter $= 12 + 5 + 11 + 16 + 14 = 58$
    (b) area $= 14 \times 16 - \frac{1}{2}(3 \times 4) = 218$

12. area(ΔABD) $= 60 \div 2 = 30$
    $BD = 30 \times 2 \div 5 = 12$
    $AB = 13$ ($5^2 + 12^2 = 13^2$)
    perimeter $= AB + AC + BC = 2 \times 13 + 2 \times 12 = \boxed{50}$ cm

13. C

14. D

15. D
    $\frac{x}{2}$ is an odd number, x must be an even number by itself.

16. $105 \div 70 = 1.5$
    $900 \times 1.5 = \boxed{\$1350}$

17. 94%

18. $\boxed{4 \text{ yd } 2 \text{ ft } 9 \text{ in}}$
    Apply long division as below.

	4 yd	**2 ft**	**9 in**
3	13	5	3
	12	8	27
	1	6	27
		2	0

19. $238 \div 17 = 14$
    $\boxed{14x^2}$

20. $2 \times 8 = 16$ mi
    1 hr 50 min + 2 hr 10 min = 4 hr
    $16 \div 4 = \boxed{4 \text{ miles per hour}}$.

21. $2(5x + 6) = a$
    $10x + 12 = a$
    $10x + 3 = 2a - 9$

22. $3(5x - 6) = 6a$
    $15x - 18 = 6a$
    $15x - 3 = 6a + 15$

23. $15x - 6 = 3a$
    $5x - 2 = a$
    $10x - 4 = 2a$
    $10x - 3 = 2a + 1$

24. D
    $$(\frac{x^{\frac{1}{2}}}{x^{-2}})^2 = x^5$$

25. C

26. $t^2 = 2$, $t = -\sqrt{2}$
    $\sqrt{2}t = -2$
    $3t^2 + \sqrt{2}t + 4 = 6 - 2 + 4 = 8$

27. D

28. D
    $-4.9t^2 + 25t = t(-4.9t + 25) = 0$
    $t = 0$ or $25/4.9 = 5.10 \approx 5$ sec

29. C
$(3x^2 - \frac{1}{3})^2 = 0$

30. D

31. B

32. A
D is not good because the roots do not match.

33. C

34. B
The product of the slopes of two perpendicular lines is -1.

35. D

36. A

37. $a^2 - b^2 = 16$
$(a + b)(a - b) = 16$
$a - b = 8$

38. C
y-intercept = -3

39. C
$4x = (x - 3)^2$
$4x = x^2 - 6x + 9$
$x^2 - 10x + 9 = 0$
$(x - 1)(x - 9) = 0$
$x = 9$ (1 is no good)

40. C
$4x = (x - 3)^2$
$17 - 4x = x^2 - 6x + 9$
$x^2 - 2x - 8 = 0$
$(x + 2)(x - 4) = 0$
$x = -2$ or 4 (-2 ruled out)

41. I & III
(I) is true since
$(x - y)^2 = (-(y - x))^2 = (y - x)^2$.
(II) is false since
$x - y)^2 = (x + y)$ only when $y = 0$
which is not true in this case.
(III) is true since
$x \blacklozenge -y = (x + y)^2 = (-(x + y))^2 =$
$(-x - y)^2 = -x \blacklozenge y$

42. Let x tickets be sold for video game, so $80 - x$ tickets be sold for bumper car ride.
$2x + 5(80 - x) = 250$
$400 - 3x = 250$
$3x = 150$
$x =$ 50 (tickets for video game)

43. $2ab(-2a+4 - 3b)$

44. $a - x$

45. $45 + 2\times2 =$ 49

46. 2A-B

47. □□□
From 1 to 9 for the first digit
From 0 to 9 for the second digit
1, 3, 5, 7, and 9 for the third digit
$9\times10\times5 =$ 450

48. ${}_8C_3 = \frac{8\cdot7\cdot6}{1\cdot2\cdot3} = 56$

49. $600\div(15\times1\frac{1}{4}) = 40\div1\frac{1}{4} = 40\times\frac{4}{5} =$ 32 (containers)

50. $\frac{3}{5}\times\frac{1}{5} = \frac{3}{25}$

51. $\frac{3}{5}\times\frac{4}{5} = \frac{12}{25}$

52. $\frac{5}{13}\cdot\frac{4}{12} = \frac{5}{39}$

53. P(a mismatching pair) = P(first blue, then black) + P(first black, then blue) $= \frac{5}{13}\cdot\frac{8}{12} + \frac{8}{13}\cdot\frac{5}{12} = \frac{20}{39}$

54. $\frac{8}{13}\cdot\frac{7}{12} = \frac{14}{39}$

55. $0.3\times0.3 = 0.09$ or 9%.

56. P(none) $= 0.7\times0.7 = 0.49$
P(at least one) $= 1 - 0.49 = 0.51$

57. $4x = \frac{2}{3}\times8$
$x = \frac{4}{3} =$ $133\frac{1}{3}\%$

58. $\frac{40}{360}\times2.79 = \frac{1}{9}\times2.79 =$ 0.31 g

59. $240\times\frac{1\frac{1}{3}}{32} = 15\times\frac{2}{3} =$ 10 gal

60. $\frac{-b}{2} = 6 - 3 = 3$
$b = -6$
$f(-3) = 4$
$18 - 3(-6) + c = 4$
$c = -32$
$b + c =$ -38

61. C

62. A

63. C

64. D

65. D
$\frac{26-8}{16-4}=\frac{18}{12}=1.5$ mi

66. C

67. C

68. D

69. B

70. A

71. $10\times75 = 750$
$750 - 110 =$ 640

72. $volume=\pi R^2\times H=\pi(1.5)^2\times6=13.5\pi\approx42\ in^3$
$231\div42 = 5.45$
ans = 5 glasses

73. $72\pi = 8\times9\pi$
radius = 3
Diameter is 6 yards.

74. $6\pi\times8 = 48\pi$ yard^2

75. Let the dimensions be
$5x$, $4x$, and $3x$

$(3x)(4x)(5x)=60x^3=79860$
$x^3 = 1331$
$x = 11$
The length is $5x = 55$ ft.

76. Let the dimensions be
a, b, and c ($4x$, $3x$, and $2x$)
The surface area = $2(ab + bc + ca)$
$= 2(12 + 6 + 8)x^2 = 52x^2 = 1300$
$x = 5$
volume = $abc = 24x^3 = 24\times125 = 3000$ cu. feet

77. 4 - 2 = 2
2×2×2 = 8 cubes

78. pyramid volume = $\frac{1}{3}\times$base$\times$height
the length of base square = 2×18 = 36
the spatial height = $\sqrt{30^2-18^2}=24$
$\frac{1}{3}\times36^2\times24=10{,}368$
What is the volume of the $\frac{1}{3}$-top portion?
volume of ($\frac{1}{3}$ top) = $\left(\frac{1}{3}\right)^3\times10{,}368=384$
10,368 - 384 = 9984