Math Power

March 21, 2020
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Spring SAT, 2020 Issue 8

Warm-ups

1. Mark is among six candidates seeking 359 voters for a president. What is the least number of votes for Mark to win?

Question set [**2 - 3**]

If a ball is thrown straight up at a certain speed after t seconds, its height h in feet will be

$h(t) = 40t - 16t^2$.

2. How long does it stay above the ground?

3. Find the maximum height of the ball and when it is attained.

4. If $5x + 2y = 25$ and $42 - 4x = 6y$, find the value of $3y + 2x$.

5. If $\frac{3}{11} + \frac{3}{11} + \frac{3}{11} = \frac{x}{33}$, what is the value of $\frac{x}{3}$?

6. A retailer set the price of a sweater to ensure 25% profit of its cost. The sweater is sold for \$48 after a 25% discount. How much is the cost?

7. Given that $2x - 4y = -8$ and $5x - 3y = 3$. Find the value of $3x - 6y$.

8. $\frac{3x}{x+2} + 1 = \frac{35}{2(3x+1)}$

9. Expand the expression: $(x^2y^3)^4$.

10. Simplify:
$\frac{a+b}{a-b} \div \frac{b+a}{b-a}$ $(a \neq b)$

11. If $x = yz$, which of the following must be equal to xy?
A) yz
B) yz^2
C) y^2z
D) x/y

12. If $p = \frac{4}{3}(x + y + z)$, then, in terms of p, what is the average of x, y and z?

13. If the sum of 8 consecutive odd integers is 160, what is the largest of these integers?

14. 25 percent of 171 is equivalent to $\frac{1}{2}$ of what number?

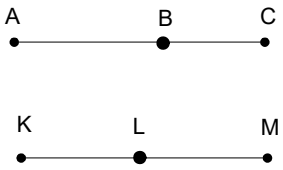
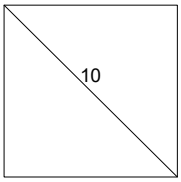


Figure not drawn to scale.

15. If AB = 2KL and 2BC = LM, what can we conclude?
A) AC > KM
B) AC < KM
C) KM = AC
D) None

16. The diagonal of the square below is 10 cm long. What is the area of the square?



17. Tina and Jose are drawing a ticket each from a box containing 3 concert tickets and 5 movie tickets. What is the probability that both will draw concert tickets?

18. If the cost of a pair of shoes for a retailer is $32 and he sells them for $56, what is his rate of profit based on the cost?

19. Tom bought a pair of trousers at a 30% discount sale for $35. What was the original price of the trousers?

20. Joyce saw a sweater that was originally $60 but was on sale for 20% off. There is a 15% successive discount if the customer applies a credit card at the time of purchase. How much is the saving if Joan buys such a sweater at the day she applies for a credit card?

Algebra 2

Question set [**21 - 24**]

Given two polynomials:
A = $x^2y-3y^2+5xy^2$ and
B = $-x^2y+3xy^2-3y^2$.
Simplify each of the following.

21. A + B

22. A - B

23. 2A + B

24. 3A - 2B

Question set [**25 - 27**]

Given $\frac{a}{b} = 2$, find the value for each of the following.

25. $\frac{4b}{a}$

26. $\frac{a+b}{a}$

27. $\frac{a+b}{a-b}$

28. $9a^4 + 12a^2b^2 + 4b^4$
Which of the following is equivalent to the expression shown above?
A) $(3a^2 + 2b^2)^2$ B) $(3a + 2b)^4$
C) $(9a^2 + 4b^2)^2$ D) $(9a + 4b)^2$

29. $9a^4 - 12a^2b^2 + 4b^4$
Which of the following is equivalent to the expression shown above?
A) $(3a^2 + 2b^2)^2$ B) $(3a - 2b)^4$
C) $(-3a^2 + 2b^2)^2$ D) $(3a - 2b)^2$

30. Solve the equation:
$\frac{3}{5}x + \frac{2}{3} = \frac{1}{2}$

31. $\frac{3(k-1)+5}{2} = \frac{17-(8+k)}{4}$
In the equation above, what is the value of k?
A) $\frac{9}{13}$ B) $\frac{5}{7}$
C) $\frac{8}{7}$ D) $\frac{8}{5}$

Question set [**32 - 33**]

In the xy-plane, let's study graph Γ of the function $f(x)=3x^2-bx+12$, where b is a constant.

32. If the point (3,6) lies on the graph, what is the value of b?

33. Suppose the point (1,2) lies on the graph. Find the product of the two roots. Let's break down into following steps:
a) Find the value of b.

b) Find the two roots of $f(x)$.

c) Can you derive a shortcut for the question without going through the steps of (a) and (b)?

34. Which of the following is equivalent to $-3x^2y + 9xy + 30y$?
A) $2y(x+3)(x-5)$ B) $-3y(x+2)(x-5)$
C) $-5y(x+2)(x-3)$ D) $3y(x-2)(x+5)$

35. $x^3(x^2-5) = -4x$
If $x > 0$, what is one possible solution to the equation above?

36. $\left(x+2\frac{1}{2}\right)^2=30\frac{1}{4}$
What are the solutions to the above equation?
A) x = 3.5 or -8.5 B) x = -3.5 or 8.5
C) x = 3.25 or -8.25 D) x = 3 or -8

37. $\frac{6x+2}{x+5}-\frac{3x-8}{x+5}$
Which of the following is equivalent to the expression above?
A) $\frac{3x-6}{x+5}$ B) $\frac{3x+10}{x+5}$
C) $\frac{3x-6}{2x+10}$ D) $\frac{3x+10}{2x+10}$

38. What are the solutions to $3x^2+12x+6=0$?
A) x = - 2 ± $\sqrt{2}$ B) x = - 2 ± $\frac{\sqrt{30}}{3}$
C) x = - 6 ± $\sqrt{2}$ D) x = - 6 ± $6\sqrt{2}$

39. Which of the following equations could represent a parabola that has a minimum value of -5 and whose axis of symmetry is the line x = 1?
A) $y=(x-1)^2-5$ B) $y=(x-1)^2+5$
C) $y=(x+5)^2-1$ D) $y=(x-5)^2+1$

40. $f(x)=(x-13)^2-175.5$
What is the value of f(12) - f(11)?
A) 3.5 B) 3
C) -3 D) -3.5

41. Solve the equation:
$$\frac{6}{x-1}-\frac{1}{x-2}=\frac{10}{2x-1}$$

42. If $(n + 3)(\frac{1}{5} - \frac{1}{9}) = 16$, then n =

43. If $x^2 - y^2 = 10$ and $x + y = 2.5$, what is the value of $y - x$?

44. For a number w, let $\blacktriangleleft w \blacktriangleright = -w^2(w - 1)$.
What is the value of $\blacktriangleleft (\blacktriangleleft -1 \blacktriangleright) \blacktriangleright$?

45. If $4x - 1 = 2\pi$, what is the value of $6x$ (in terms of π)?

46. The weights of the members of the backfield of the Adams High School are 184 lb, 178 lb, 191 lb, and 167 lb. Bill Walters weighs 183 lb. Compared to the average weight of the back fielders, Bill's weight is
A) 3 lb above the average
B) 5 lb above the average
C) 3 lb below the average
D) 5 lb below the average

Warm-ups

47. The average age of Alice, Brenda, Celia, Dana, Ellen is 12 years old. If the average age of Dana and Ellen is 9 years old. What is the average age of Alice, Brenda and Celia?

48. How many thirds are there in $\frac{3}{4}$?

49. Which of the following has the smallest value?
A) $\frac{.1}{2}$
B) $\frac{1}{.2}$
C) $\frac{.1}{.2}$
D) $\frac{.2}{.1}$

50. Which of the following has the smallest value?
A) $\frac{5}{8}$
B) $\frac{7}{12}$
C) $\frac{18}{37}$
D) $\frac{8}{15}$

51. Two hot dogs and a soda cost \$3.25. If three hot dogs and a soda cost \$4.50, what is the cost of two sodas?

52. In the figure, points P and T lie on line ℓ.

How many different points on ℓ are twice as far from point T as from point P?
A) None
B) One
C) Two
D) Four

53. This year is a leap year. If July 1 of this year falls on a Saturday, then July 1 of next year falls on what day of the week?

54. A dealer sold an overcoat for \$91. This was at a profit of 30% of the cost. What was the cost of the overcoat?

55. A price increased from \$145 to \$174, what was the percent increase?

56. Ms. Shapiro borrows \$500 at interest rate of 15% annually. How much does she need to pay back at the end of 4 months?

57. After a discount of 30%, a purse was sold for \$21.63. What was the original price?

58. Sharon went to visit her grandparents for the weekend, 50 miles away. The trip took her 1 hour to get there and $1\frac{1}{2}$ hours to get home. What was the average speed for the round trip?

59. It costs €135 to rent one square yard of space in Paris. At this rate, what is the rental cost in US dollars ($) per square foot? Assume that currencies exchange at the rate: 1 US dollar ($) = 0.75 Euro (€).

60. If the ratio of q to r is 4 to 5, which of the following could be true?
A) $q = 0, r = 4/5$
B) $q = 2, r = 5/2$
C) $q = 5, r = 6$
D) $q = 15, r = 12$

Rate Problems

61. 1 decagram = 10 grams
1,000 milligrams = 1 gram
A hospital stores one type of medicine in 2-decagram containers. Based on the information given in the box above, how many 1-milligram doses are there in one 2-decagram container?

62. The *pes*, a Roman measure of length, is approximately equal to 11.65 inches. It is also equivalent to 16 smaller Roman units called digits. Based on these relationships, 75 Roman digits is equivalent to how many feet, to the nearest hundredth? (12 inches = 1 foot)

63. On April 18, 1775, Paul Revere set off on his midnight ride from Charlestown to Lexington. If he had ridden straight to Lexington without stopping, he would have traveled 11 miles in 26 minutes. In such a ride, what would the average speed of his horse have been, to the nearest tenth of a mile per hour?

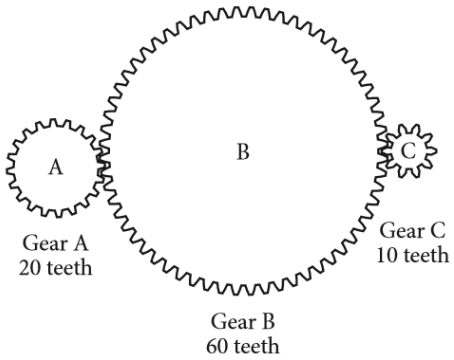
64. In the 1908 Olympic Games, the Olympic marathon was lengthened from 40 kilometers to approximately 42 kilometers. Of the following, which is closest to the increase in the distance of the Olympic marathon, in miles? (1 mile is approximately 1.6 kilometers.)

65. A school district is forming a committee to discuss plans for the construction of a new high school. Of those invited to join the committee, 15% are parents of students, 45% are teachers from the current high school, 25% are school and district administrators, and the remaining 6 individuals are students. How many more teachers were invited to join the committee than school and district administrators?

66. If 50 one-cent coins were stacked on top of each other in a column, the column would be approximately $3\frac{7}{8}$ inches tall. Approximate the number of one-cent coins to reach 31 inch tall.

67. Nick surveyed a random sample of the freshman class of his high school to determine whether the Fall Festival should be held in October or November. Of the 90 students surveyed, 25.6% preferred October. Based on this information, about how many students in the entire 225-person class would be expected to prefer having the Fall Festival in October?
A) 50
B) 60
C) 75
D) 80

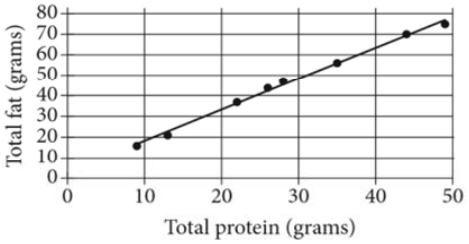
68. A gear ratio r:s is the ratio of the number of teeth of two connected gears. The ratio of the number of revolutions per minute (rpm) of two gear wheels is s:r. In the diagram below, Gear A is turned by a motor. The turning of Gear A causes Gears B and C to turn as well.



If Gear A is rotated by the motor at a rate of 100 rpm, what is the number of revolutions per minute for Gear C?

69. Horsepower and watts are units of measure of power. They are directly proportional such that 5 horsepower is equal to 3730 watts. How much power, in watts, is equal to 2 horsepower?

70. **Total Protein and Total Fat for Eight Sandwiches**



The scatterplot above shows the numbers of grams of both total protein and total fat for eight sandwiches on a restaurant menu. The line of best fit for the data is also shown. According to the line of best fit, what is closest to the predicted increase in total fat, in grams, for every increase of 100 gram in total protein?

71. The total area of a coastal city is 92.1 square miles, of which 11.1 square miles is water. If the city had a population of 621,000 people in the year 2010, approximate the population density, in (nearest hundred) people per square mile of land area.

72. The normal systolic blood pressure P, in millimeters of mercury, for an adult male x years old can be modeled by the equation $P = \frac{x+220}{2}$. According to the model, by how many millimeters of mercury will the normal systolic blood pressure for an adult male
a) increase each year?

b) increase in 5 years?

73. Raj can exchange 15 Euros for 11 British Pounds. At this exchange rate, find the nearest integer of British Pounds that he receive in exchange for 100 Euros.

74. A bag of apples and oranges contains twice as many apples as oranges. If there are 42 total pieces of fruit in the bag, how many apples are in the bag?

75. A shade of green paint called *Groovy Green* is made by combining yellow paint and blue paint so that the ratio, by volume, of yellow to blue paint is 12 to 5. How many tablespoons of blue paint are needed to make 34 cups of Groovy Green? (1 cup = 16 tablespoons)

76. Every weekend for 48 hours, a law firm backs up all client files by scanning and uploading them to a secure remote server. On average, the size of each client file is 2.5 gigabytes. The law firm's computer can upload the scans at a rate of 5.25 megabytes per second. What is the maximum number of client files the law firm can back up each weekend? (1 gigabyte: 1,000 megabytes)
A) 362 B) 363
C) 464 D) 465

77. In a certain drug trial in which a drug designed to treat cancer was tested, exactly 48% of patients experienced improvement while take the drug. What is the fewest number of patients who could have participated in this trial?

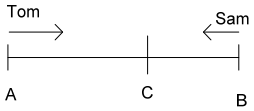
78. A pool has 600 gallons of water. A hose is then turned on, and water flows into the pool at the rate of 486 gallons per hour. How many gallons of water will be in the pool after 70 minutes?

79. When scuba divers ascend from deep water, they must either rise slowly or take safety breaks to avoid nitrogen buildup in their lungs. The length of time a diver should take to ascend is directly proportional to how many feet she needs to ascend. If a scuba diver can safely ascend 165 feet in 5.5 minutes, then how many feet can she ascend in 90 seconds?
A) 45 B) 60
C) 75 D) 80

80. In a study of bat migration habits, 240 male bats and 160 female bats have been tagged. If 100 more female bats are tagged, how many more male bats must be tagged so that $\frac{3}{5}$ of the total number of bats in the study are male?

Question set [**81 - 82**]

Tom walks 6.4 km an hour and Sam walks 4.6 km an hour. Tom starts walking at 12:00 pm, Sam starts walking at 1:30 pm, and they meet at 4:30 pm.



81. What is the distance from A to B?

82. What is the distance from A to C?

Question set [**83 - 85**]

Three cars all arrive at the same destination at 4:00 pm. The first car traveled 144 miles mostly by highway. The second car traveled 85 miles mainly on rural two-lane roads. The third car traveled 25 miles primarily on busy city streets.

83. The first car traveled at an average speed of 64 mph. The second car started its drive at 2:20 pm. How many minutes had the first car already been traveling before the second car started its drive?

84. At what average rate (miles per hour) did the second car travel?

85. The third car encountered heavy traffic for the first 60% of its trip and only averaged 15 mph. Then traffic stopped due to an accident, and the car did not move for 20 minutes. After the accident was cleared, the car averaged 30 mph for the remainder of the trip. At what time in the afternoon did the third car start its trip?

86. Nate walks 25 meters in 13.7 seconds. If he walks at this same rate, which of the following is closest to the distance he will walk in 4 minutes?
A) 400 meters B) 450 meters
C) 700 meters D) 1,400 meters

87. Each km of a 5 km race, my horse's average speed decreased 1 km/hr. If I averaged 5 km/hr at first, it took me ____ minutes to finish.

88. $\frac{2}{3}t = \frac{5}{2}$
What value of t is the solution of the equation above?

89. A certain package requires 3 centimeters of tape to be closed securely. What is the maximum number of packages of this type that can be secured with 6 meters of tape? (1 meter = 100 cm)

90. Graphene, which is used in the manufacture of integrated circuits, is so thin that a sheet weighing one ounce can cover up to 8 football fields. If a football field has an area of approximately $1\frac{1}{7}$ acres, approximate the number acres covered by 42 ounces of graphene in the nearest tens.

91. A company that makes wildlife videos purchases camera equipment for $32,400. The equipment depreciates in value at a constant rate for 12 years, after which it is considered to have no monetary value. How much is the camera equipment worth 4 years after it is purchased?

92. A local television station sells time slots for programs in 36-minute intervals. The price for each slot is $7,000. If the station operates 24 hours per day, every day of the week, what is the total sale if all slots are sold out on Saturday and Sunday?

93. The weight of an object on Venus is approximately $\frac{9}{10}$ of its weight on Earth. The weight of an object on J of its weight on Earth. If an object weighs 100 pounds on Earth, approximately how many more pounds does it weigh on Jupiter than it weighs on Venus?

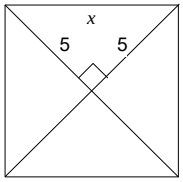
94. The weight of an object on Planet A is approximately $\frac{9}{11}$ of its weight on Earth. The weight of an object on I of its weight on Earth. If an object weighs 132 kg on Earth, approximately how many more pounds does it weigh on Planet B than it weighs on Planet A?

95. At a restaurant, n cups of tea are made by adding t tea bags to hot water. If $t = n + 2$, how many additional tea bags are needed to make each additional cup of tea?

Answer Key

1. $359 \div 6 = 59\text{R}4$
   $59 + 2 = \boxed{61}$
2. $40t - 16t^2 = 0$
   $8t(5 - 2t) = 0$
   $t = 0$ or 2.5
   The ball will stay $\boxed{2.5 \text{ seconds}}$ above the ground.
3. The maximum of a downward parabola occurs at its line of symmetry:
   $t = \boxed{1.25 \text{ sec (when)}}$
   $8t(5- 2t)$
   $= 8(1.25)(5 - 2\times1.25)$
   $= 10(2.5)$
   $= \boxed{25 \text{ ft (height)}}$
4. $x = 3$ and $y = 5$
   $3y + 2x = \boxed{21}$
5. $\frac{3}{11}+\frac{3}{11}+\frac{3}{11}=\frac{x}{33}$
   $\frac{9}{11}=\frac{x}{33}$
   $\frac{x}{3} = \boxed{9}$
6. Method I)
   $\frac{3}{4}x = 48$
   $x = 64$ (original price)
   $64 \div 1.25 = \$51.20$

   Method II)
   Let x be the cost.
   $\frac{3}{4}(1.25x) = 48$
   $\frac{3}{4}(\frac{5}{4})x = 48$
   $x = \boxed{\$51.20}$
7. $2x - 4y = -8$
   $3x - 6y = \frac{3}{2}(2x - 4y) = \frac{3}{2}\times-8 = \boxed{-12}$
8. $\frac{3x}{x+2} + 1 = \frac{4x+2}{x+2}$
   $\frac{4x+2}{x+2} = \frac{35}{2(3x+1)}$
   $4(2x + 1)(3x + 1) = 35x + 70$
   $4(6x^2 + 5x + 1) = 35x + 70$
   $24x^2 + 20x + 4 = 35x + 70$
   $24x^2 - 15x - 66 = 0$
   $8x^2 - 5x - 22 = 0$
   $(8x + 11)(x - 2) = 0$
   $x = \boxed{\frac{-11}{8} \text{ or } 2}$
9. $(x^2y^3)^4 = x^8y^{12}$
10. -1
11. C
12. $\frac{1}{4}p$
13. $160 \div 8 = 20$ (= median = average)
    $20 + 1 + 3\times2 = \boxed{27}$
14. $\frac{1}{4}\times171 = \frac{1}{2}\times\boxed{85.5}$
15. D
16. $x = 5\sqrt{2}$
    $x^2 = \boxed{50 \text{ cm}^2}$



17. $\frac{3}{8}\times\frac{2}{7}=\boxed{\frac{3}{28}}$
18. $(56- 32) \div 32 = 75\%$
19. $1 - 30\% = 70\%$
    $\square\times70\% = 35$
    $\square = 35 \div 0.7 = \boxed{50}$
20. $60\times.8\times.85 = 40.80$
    $60 - 40.8 = \boxed{\$19.20}$
21. $8xy^2 - 6y^2$
22. $2x^2y+2xy^2$
23. $x^2y+13xy^2 - 9y^2$
24. $5x^2y+9xy^2 - 3y^2$
25. $\frac{b}{a}=\frac{1}{2}, \frac{4b}{a}=\frac{4}{2}=2$
26. $\frac{b}{a}=\frac{1}{2}, \frac{a+b}{a}=1+\frac{1}{2}=\frac{3}{2}$
27. $\frac{a+b}{a-b}=\frac{2+1}{2-1}=3$
28. A
29. C
30. $\frac{1}{2} - \frac{2}{3} = -\frac{1}{6}$
    $x = \frac{-5}{18}$
31. B
    $\frac{3k+2}{2}=\frac{9-k}{4}$
    Multiply 4 to both sides:
    $2(3k + 2) = 9 - k$
    $7k = 5$
    $k=\frac{5}{7}$
32. $3(3)^2 - b(3) + 12 = 6$
    $3b = 33$
    $b = 11$
33. a) $3 - b + 12 = 2$
    $b = 13$
    b) $3x^2 - 13x + 12 = 0$

$(3x - 4)(x - 3) = 0$
$x = \frac{4}{3}$ or 3
c) 4
$\frac{c}{a}=\frac{12}{3}=4$.

34. B

35. $x^3(x^2-5)=-4x$
$x^2(x^2-5)=-4$
$x^4-5x^2+4=0$
$(x^2 - 1)(x^2 - 4) = 0$
$x = \pm1$ or ±2
Since $x > 0$, so
$x = 1$ or 2 (only)

36. D
$(x+2.5)^2=5.5^2$
$x+2.5=\pm5.5$
$x=-2.5\pm5.5$ = 3 or - 8

37. B

38. A
$3x^2+12x+6=0$
$x^2+4x+2=0$
$x^2+4x+4=2$
$x+2=\pm\sqrt{2}$
$x=-2\pm\sqrt{2}$

39. A

40. C

41. $\frac{6}{x-1}-\frac{1}{x-2}=\frac{5x-11}{(x-1)(x-2)}$
$\frac{5x-11}{(x-1)(x-2)}=\frac{10}{2x-1}$
$(5x - 11)(2x - 1) = 10(x - 1)(x - 2)$
$10x^2 - 27x + 11 = 10x^2 - 30x + 20$
$3x = 9$
$x = \boxed{3}$

42. $(n + 3)4 = 16\times45$
$n + 3 = 4\times45$
$n = 177$

43. $x^2 - y^2 = (x + y)(x - y)=2.5(x - y) = 10$
$x - y = 4$
$y - x = \boxed{-4}$

44. $\blacktriangleleft -1 \blacktriangleright = 2$
$\blacktriangleleft 2 \blacktriangleright = -4(1) = \boxed{-4}$

45. $4x = 2\pi + 1$
$2x = \pi + \frac{1}{2}$
$6x = \boxed{3\pi + \frac{3}{2}}$

46. A
Method (I)
183 - 184 = -1
183 - 178 = 5
183 - 191 = -8
183 - 167 = 16
The sum of all the differences is 12. The average is $\frac{1}{4}(12) = 3$ (above)
Method (II)
The average weigh to the backfielders
$= \frac{1}{4}(184+178+191+167)$
= 180
Thus, 183-180 = 3 (lb) above the average.

47. $12\times5 = 60$ (total of 5)
$2\times9 = 18$ (total of 2)
60 - 18 = 42 (total of 3)
$42\div3 = \boxed{14}$

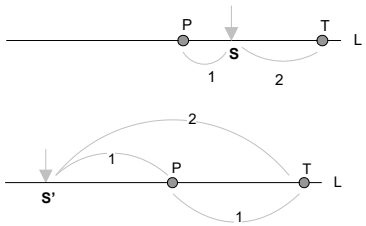
48. $\frac{3}{4}\div\frac{1}{3} = \boxed{2\frac{1}{4}}$

49. A

50. C
The only one less than $\frac{1}{2}$ is $\frac{18}{37}$.

51. \$1.50

52. C
There are two desired points S and S'. As the figure below shows, S is an ideal point since PS:ST=1:2. S' is another ideal point since PS':S'T=1:2.



53. Next year is not a leap year.
$365\div7 = 52$R1
Saturday + 1 = Sunday

54. $91=\square\times(1+30\%)$
$\square = 91\div1.3 = \boxed{\$70.00}$

55. $174 \div 145 = 1.2$
$1.2 - 1 = 0.2 = 20\%$

56. $15\%\times\frac{1}{3} = 5\%$
$5\%\times500 = 25$
500 + 25 = \$525

57. $0.7\times\square = 21.63$
$\square = 21.63\div0.7 = \boxed{\$30.90}$

58. total distance = $2\times50 = 100$
total time = 1 + 1.5 = 2.5
$100\div2.5 = \boxed{40 \text{ mph}}$

59. 1 square yard = $(3 \text{ ft})^2 = 9$ square ft
€135÷0.75 = \$180
$180\div9 = \boxed{\$20 \text{ per square foot}}$

60. B

61. $20\times1000 = \underline{20{,}000}$

62. 4.55

63. $\frac{11}{26}\times60 = \underline{25.4}$

64. $\frac{42-40}{1.6}=\frac{2}{1.6}=\frac{1}{0.8}=\frac{5}{4} = \underline{1.25}$

65. 8

parents	15%
teachers	45%
admin	25%
students	15%
total	100%

45% - 25% = 20%
20% : 15%
= 4 : 3
= 8 : 6

66. $8\times3\frac{7}{8} = 31$
$8\times50 =$ 400 coins

67. B
$225\times25.6\% = 57.6 \approx 60$

68. 200

69. $3730\times\frac{2}{5} = 1492$

70. total increased fat = $\frac{35-20}{10}\times 100 =$ 150 gram

71. 92.1 – 11.1 = 81
621,000÷81 = 7,690 ≈ 7700

72. a) 1/2 or 0.5
b) 5×0.5 = 2.5

73. 15×6.6 = 99
11×6.6 = 73

74. Apple: ⅔
Orange: ⅓
42×⅔ = 28

75. y : b : Groovy
12 : 5 : 17
24 : 10 : 34 (cups)
10 cups of blue are needed.
10×16 = 160 (teaspoon)

76. A
5.25×60×60×48/2,500
= 362.88

77. $\frac{48}{100}=\frac{12}{25}$
The fewest number of participants = 25

78. $486\times\frac{70}{60} = 81\times7 = 567$
567 + 600 = 1167 gal

79. A
ft : min
165 : 5.5
= 30 : 1
= 45 : 1.5

80. male : female = 3 : 2
male $240 + x = 390$
female 160+100 = 260
$x = 150$

81. 6.4×1.5 = 9.6
6.4 + 4.6 = 11
11×3 = 33
33 + 9.6 = 42.6 km

82. 9.6 + 19.2 = 28.8 km

83. $\frac{144}{64}=\frac{9}{4}=2\frac{1}{4}$
4:00 - 2:15 = 1:45 (when the first started)
2:20 - 1:45 = 35 min ahead

84. 4:00 - 2:20 = 1:40 = $1\frac{2}{3}$ hr
$85\div1\frac{2}{3} = 51$ mph

85. $T_1=\frac{distance}{speed}=\frac{60\%\times25}{15}=1(hr)$
T_2 = 20 min = $\frac{1}{3}$ hr
$T_3=\frac{distance}{speed}=\frac{40\%\times25}{30}=\frac{1}{3}(hr)$
$T_1 + T_2 + T_3 = 1\frac{2}{3}$ hr = 1 hr 40 min
4:00 - 1:40 = 2:20 pm = 220

86. B

87. The horse averages
5 km/hr in the 1st mile
4 km/hr in the 2nd mile
3 km/hr in the 3rd mile
2 km/hr in the 4th mile
1 km/hr in the 5th mile.
The total time is
$60\times(\frac{1}{5}+\frac{1}{4}+\frac{1}{3}+\frac{1}{2}+1)$ min
= 12 + 15 + 20 + 30 + 60
= 137 min

88. 15/4

89. 600÷3 = 200

90. $42\times8\times1\frac{1}{7} = 8\times48 = 384 \approx$ 380

91. $32{,}400\times\frac{2}{3} = 10800\times2=$ $21,600

92. $\frac{24\times60\times2}{36}=\frac{80\times6\times6}{36} = 80$
80×7000 = $560,000

93. 100×(2.3 – 0.9) = 140
C

94. $132\times(\frac{23}{12}-\frac{9}{11}) =$ 145 kg

95. 1

Reading & Writing

March 30, 2020
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Name: (First)_____(Last)_____

School: _____ Grade:_____

SENTENCE COMPLETION 2
READING COMPREHENSION 5
READING COMPREHENSION 9
READING COMPREHENSION 13
SENTENCE IMPROVEMENT 16
WRITING & LANGUAGE 18
WRITING & LANGUAGE 20

Sentence Completion

Select the best match to complete each of the following sentences.

1. New data measuring the _____ of land beneath the oceans permit accurate generalizations about the topography of the seafloor.
   A) pigments
   B) contours
   C) remnants
   D) populations

2. As a young physics instructor, Richard Feynman discovered that he had the gift of sharing his _____ his subject and making that excitement _____.
   A) commitment to .. impersonal
   B) propensity for .. futile
   C) knowledge of .. inaudible
   D) passion for .. contagious

3. If you are seeking _____ that will resolve all our ailments, you are undertaking an impossible task.
   A) a precedent
   B) a panacea
   C) a direction
   D) a contrivance

4. A scientist should not automatically reject folkways that might at first seem silly or superstitious; scientific qualifications are not a license for _____, nor do they _____ prejudice or bias.
   A) experimentation .. eliminate
   B) humility .. advocate
   C) rigidity .. console
   D) smugness .. legitimate

5. The editorial claimed that the gubernatorial candidate lacked worldly wisdom and that this _____ would likely be his undoing.
   A) indecisiveness
   B) naivete
   C) venality
   D) sarcasm

6. Because scholarship in that field is still in its nascent stage, many researchers have argued that to develop _____ model would be _____, but to demonstrate progress toward a model is essential at this time.
   A) a tentative .. decisive
   B) a superfluous .. inadvisable
   C) an impressive .. vital
   D) a definitive .. premature

7. Following the decree banning _____ acts, suspected _____ could be forcibly detained without the filing of formal charges.
   A) supportive .. opponents
   B) rebellious .. conformists
   C) seditious .. insurrectionists
   D) apolitical .. loyalists

8. Laila performed her tasks at the office with _____, completing all her projects in record time.
   A) conformity
   B) deliberation
   C) exasperation
   D) alacrity

9. Well-publicized disagreements in the scientific community have _____ so many laypersons that they now _____ new warnings about the health effects of popular foods.
   A) bedazzled .. ridicule
   B) vindicated .. exaggerate
   C) disqualified .. minimize
   D) exasperated .. discount

10. The patient bore the pain _____, neither wincing nor whimpering when the incision was made.
A) marginally
B) sardonically
C) poorly
D) stoically

11. For a long time, most doctors maintained that taking massive doses of vitamins was relatively harmless; now, however, some are warning that excessive dosages can be _____.
A) inane
B) toxic
C) healthy
D) wasteful

12. The critics were distressed that an essayist of such glowing _____ could descend to writing such dull, uninteresting prose.
A) amiability
B) promise
C) ill-repute
D) obscurity

13. Ms. Rivers gave a performance of noteworthy _____ her piano repertoire ranged from classical music to jazz.
A) polish
B) duration
C) intensity
D) scope

14. During the Dark Ages, hermits and other religious _____ fled the world to devote themselves to silent contemplation.
A) skeptics
B) convictions
C) altruists
D) recluses

15. Renowned for maintaining her _____ even in the most chaotic situations, Frances was utterly _____
A) dignity .. incorrigible
B) composure .. imperturbable
C) prosperity .. blunt
D) equanimity .. clairvoyant

16. The beauty of Mount McKinley is usually cloaked: clouds _____ the summit nine days out of ten.
A) elevate
B) release
C) attain
D) shroud

17. Unhappily, the psychology experiment was _____ by the subjects' awareness of the presence of observers in their midst.
A) marred
B) palliated
C) clarified
D) muted

18. There is nothing _____ or provisional about Moore's early critical pronouncements; she deals _____ with what were then radical new developments in poetry.
A) dogmatic .. arbitrarily
B) positive .. expertly
C) shallow .. superficially
D) tentative .. confidently

19. Unlike other examples of _____ verse, Milton's "Lycidas" does more than merely mourn for the death of King Edward; it also denounces corruption in the Church in which the King was ordained.
A) free
B) humorous
C) didactic
D) elegiac

20. Orangutans are _____ apes: they typically conduct most of their lives up in the trees of tropical rain forests.
A) transitory
B) arboreal
C) recessive
D) indigenous

Reading Comprehension

This passage is adapted from Brian Greene, "How the Higgs Boson Was Found." ©2013 by Smithsonian Institution. The Higgs boson is an elementary particle associated with the Higgs field. Experiments conducted in 2012–2013 tentatively confirmed the existence of the Higgs boson and thus of the Higgs field.

Nearly a half-century ago, Peter Higgs and a handful of other physicists were trying to understand the origin of a basic physical feature: mass. You can think of mass as an object's heft or, a little more precisely, as the resistance it offers to having its motion changed. Push on a freight train (or a feather) to increase its speed, and the resistance you feel reflects its mass. At a microscopic level, the freight train's mass comes from its constituent molecules and atoms, which are themselves built from fundamental particles, electrons and quarks. But where do the masses of these and other fundamental particles come from?

When physicists in the 1960s modeled the behavior of these particles using equations rooted in quantum physics, they encountered a puzzle. If they imagined that the particles were all massless, then each term in the equations clicked into a perfectly symmetric pattern, like the tips of a perfect snowflake. And this symmetry was not just mathematically elegant. It explained patterns evident in the experimental data. But—and here's the puzzle—physicists knew that the particles did have mass, and when they modified the equations to account for this fact, the mathematical harmony was spoiled. The equations became complex and unwieldy and, worse still, inconsistent.

What to do? Here's the idea put forward by Higgs. Don't shove the particles' masses down the throat of the beautiful equations. Instead, keep the equations pristine and symmetric, but consider them operating within a peculiar environment. Imagine that all of space is uniformly filled with an invisible substance—now called the Higgs field—that exerts a drag force on particles when they accelerate through it. Push on a fundamental particle in an effort to increase its speed and, according to Higgs, you would feel this drag force as a resistance. Justifiably, you would interpret the resistance as the particle's mass. For a mental toehold, think of a ping-pong ball submerged in water. When you push on the ping-pong ball, it will feel much more massive than it does outside of water. Its interaction with the watery environment has the effect of endowing it with mass. So with particles submerged in the Higgs field.

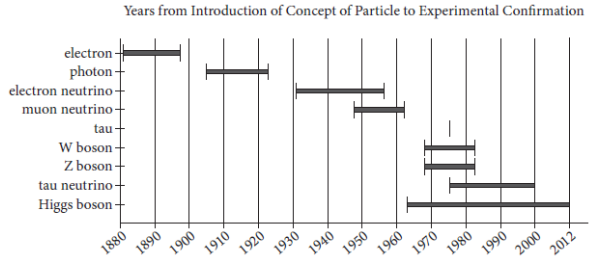
In 1964, Higgs submitted a paper to a prominent physics journal in which he formulated this idea mathematically. The paper was rejected. Not because it contained a technical error, but because the premise of an invisible something permeating space, interacting with particles to provide their mass, well, it all just seemed like heaps of overwrought speculation. The editors of the journal deemed it "of no obvious relevance to physics."

But Higgs persevered (and his revised paper appeared later that year in another journal), and physicists who took the time to study the proposal gradually realized that his idea was a stroke of genius, one that allowed them to have their cake and eat it too. In Higgs's scheme, the fundamental equations can retain their pristine form because the dirty work of providing the particles' masses is relegated to the environment.

While I wasn't around to witness the initial rejection of Higgs's proposal in 1964 (well, I was around, but only barely), I can attest that by the mid-1980s, the assessment had changed. The physics community had, for the most part, fully bought into the idea that there was a Higgs field permeating space. In fact, in a graduate course I took that covered what's known as the Standard

Model of Particle Physics (the quantum equations physicists have assembled to describe the particles of matter and the dominant forces by which they influence each other), the professor presented the Higgs field with such certainty that for a long while I had no idea it had yet to be established experimentally.

On occasion, that happens in physics. Mathematical equations can sometimes tell such a convincing tale, they can seemingly radiate reality so strongly, that they become entrenched in the vernacular of working physicists, even before there's data to confirm them.



Adapted from the editors of The Economist, "Worth the Wait." ©2012 by The Economist Newspaper Limited.

21. According to the passage, why has it become necessary for physicists to remove references to mass from the Standard Model?

22. What is meant by the image of a "mental toehold" [45]?

23. Why should the experimental validation of the existence of the Higgs boson/field matter to everyone?

24. When, according to quantum field theory, did the Higgs field come into existence?

25. Why do you suppose Greene emphasized "mathematically elegant" [23] and "the beautiful equations" [34]?

26. Over the course of the passage, the main focus shifts from
A) a technical account of the Higgs field to a description of it aimed at a broad audience.
B) a review of Higgs's work to a contextualization of that work within Higgs's era.
C) an explanation of the Higgs field to a discussion of the response to Higgs's theory.
D) an analysis of the Higgs field to a suggestion of future discoveries that might build upon it.

27. The main purpose of the analogy of the ping-pong ball [46] is to
A) popularize a little-known fact.
B) contrast competing scientific theories.
C) criticize a widely accepted explanation.
D) clarify an abstract concept.

28. The author most strongly suggests that the reason the scientific community initially rejected Higgs's idea was that the idea
A) addressed a problem unnoticed by other physicists.
B) only worked if the equations were flawless.
C) rendered accepted theories in physics obsolete.
D) appeared to have little empirical basis.

29. Which choice provides the best evidence for the answer to the previous question?
A) [34-37] ("Instead … environment")
B) [51-55] ("In 1964 … mathematically")
C) [55-60] ("Not … speculation")
D) [77-80] ("The physics … space")

30. The author notes that one reason Higgs's theory gained acceptance was that it
A) let scientists accept two conditions that had previously seemed irreconcilable.
B) introduced an innovative approach that could be applied to additional problems.
C) answered a question that earlier scientists had not even raised.
D) explained why two distinct phenomena were being misinterpreted as one phenomenon.

31. Which choice provides the best evidence for the answer to the previous question?
A) [41-45] ("Push … mass")
B) [48-51] ("Its interaction … field")
C) [64-72] ("But … environment")
D) [90-96] ("On occasion … them")

32. Which statement best describes the technique the author uses to advance the main point of the last paragraph?
A) He recounts a personal experience to illustrate a characteristic of the discipline of physics.
B) He describes his own education to show how physics has changed during his career.
C) He provides autobiographical details to demonstrate how Higgs's theory was confirmed.
D) He contrasts the status of Higgs's theory at two time periods to reveal how the details of the theory evolved.

33. As used in [88], "established" most nearly means
A) validated.
B) founded.
C) introduced.
D) enacted.

34. What purpose does the graph serve in relation to the passage as a whole?
A) It indicates that the scientific community's quick acceptance of the Higgs boson was typical.
B) It places the discussion of the reception of the Higgs boson into a broader scientific context.
C) It demonstrates that the Higgs boson was regarded differently than were other hypothetical particles.
D) It clarifies the ways in which the Higgs boson represented a major discovery.

35. Which statement is best supported by the data presented in the graph?
A) The Wboson and the Z boson were proposed and experimentally confirmed at about the same time.
B) The Higgs boson was experimentally confirmed more quickly than were most other particles.
C) The tau neutrino was experimentally confirmed at about the same time as the tau.
D) The muon neutrino took longer to experimentally confirm than did the electron neutrino.

36. Based on the graph, the author's depiction of Higgs's theory in the mid-1980s is most analogous to which hypothetical situation?
A) The muon neutrino was widely disputed until being confirmed in the early 1960s.
B) Few physicists in 2012 doubted the reality of the tau neutrino.
C) No physicists prior to 1960 considered the possibility of the W or Z boson.
D) Most physicists in 1940 believed in the existence of the electron neutrino.

Reading Comprehension

This passage is adapted from Alan Ehrenhalt, The Great Inversion and the Future of the American City. ©2013 by Vintage. Ehrenhalt is an urbanologist—a scholar of cities and their development. Demographic inversion is a phenomenon that describes the rearrangement of living patterns throughout a metropolitan area.

Line

We are not witnessing the abandonment of the suburbs, or a movement of millions of people back to the city all at once. The 2010 census certainly did not turn up evidence of a middle-class stampede to the nation's cities. The news was mixed: Some of the larger cities on the East Coast tended to gain population, albeit in small increments. Those in the Midwest, including Chicago, tended to lose substantial numbers. The cities that showed gains in overall population during the entire decade tended to be in the South and Southwest. But when it comes to measuring demographic inversion, raw census numbers are an ineffective blunt instrument. A closer look at the results shows that the most powerful demographic events of the past decade were the movement of African Americans out of central cities (180,000 of them in Chicago alone) and the settlement of immigrant groups in suburbs, often ones many miles distant from downtown. Central-city areas that gained affluent residents in the first part of the decade maintained that population in the recession years from 2007 to 2009. They also, according to a 2011 study by Brookings, suffered considerably less from increased unemployment than the suburbs did. Not many young professionals moved to new downtown condos in the recession years because few such residences were being built. But there is no reason to believe that the demographic trends prevailing prior to the construction bust will not resume once that bust is over. It is important to remember that demographic inversion is not a proxy for population growth; it can occur in cities that are growing, those whose numbers are flat, and even in those undergoing a modest decline in size.

America's major cities face enormous fiscal problems, many of them the result of public pension obligations they incurred in the more prosperous years of the past two decades. Some, Chicago prominent among them, simply are not producing enough revenue to support the level of public services to which most of the citizens have grown to feel entitled. How the cities are going to solve this problem, I do not know. What I do know is that if fiscal crisis were going to drive affluent professionals out of central cities, it would have done so by now. There is no evidence that it has.

The truth is that we are living at a moment in which the massive outward migration of the affluent that characterized the second half of the twentieth century is coming to an end. And we need to adjust our perceptions of cities, suburbs, and urban mobility as a result.

Much of our perspective on the process of metropolitan settlement dates, whether we realize it or not, from a paper written in 1925 by the University of Chicago sociologist Ernest W. Burgess. It was Burgess who defined four urban/suburban zones of settlement: a central business district; an area of manufacturing just beyond it; then a residential area inhabited by the industrial and immigrant working class; and finally an outer enclave of single-family dwellings.

Burgess was right about the urban America of 1925; he was right about the urban America of 1974. Virtually every city in the country had a downtown, where the commercial life of the metropolis was conducted; it had a factory district just beyond; it had districts of working-class residences just beyond that; and it had residential suburbs for the wealthy and the upper middle class at the far end of the

continuum. As a family moved up the economic ladder, it also moved outward from crowded working-class districts to more spacious apartments and, eventually, to a suburban home. The suburbs of Burgess's time bore little resemblance to those at the end of the twentieth century, but the theory still essentially worked. People moved ahead in life by moving farther out.

But in the past decade, in quite a few places, this model has ceased to describe reality. There are still downtown commercial districts, but there are no factory districts lying next to them. There are scarcely any factories at all. These close-in parts of the city, whose few residents Burgess described as dwelling in "submerged regions of poverty, degradation and disease," are increasingly the preserve of the affluent who work in the commercial core. And just as crucially newcomers to America are not settling on the inside and accumulating the resources to move out; they are living in the suburbs from day one.

United States Population by Metropolitan Size/Status, 1980–2010

Chart 1

2010 Population Shares by Metro Size (%)

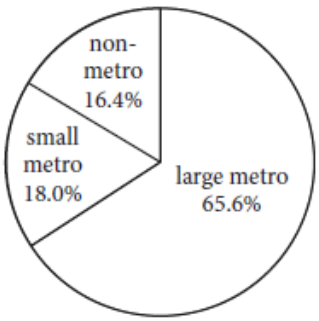
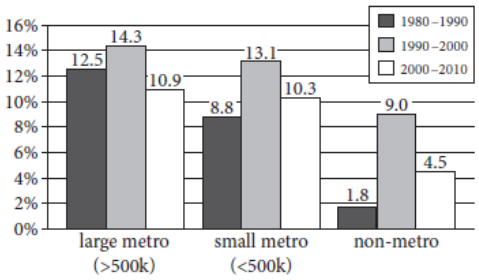


Chart 2

Growth Rates by Metro Size



Adapted from William H. Frey, "Population Growth in Metro America since 1980: Putting the Volatile 2000s in Perspective." Published 2012 by Metropolitan Policy Program, Brookings Institution.

37. Why do you think as of the turn of the present century there are "scarcely any factories at all" [96] adjacent to commercial downtown districts in urban America?

38. What do you believe was the impact of the Burgess paper [65-70]?

39. Why did cities in the South and Southwest [12] tend to gain population in the decade of the 2000s?

40. Why do you think newcomers to America today are "living in the suburbs from day one" [104-105]?

41. What is the analytical value of the new concept of demographic inversion?

42. Which choice best summarizes the first paragraph of the passage [1-38]?
A) The 2010 census demonstrated a sizeable growth in the number of middle-class families moving into inner cities.
B) The 2010 census is not a reliable instrument for measuring population trends in American cities.
C) Population growth and demographic inversion are distinct phenomena, and demographic inversion is evident in many American cities.
D) Population growth in American cities has been increasing since roughly 2000, while suburban populations have decreased.

43. According to the passage, members of which group moved away from central-city areas in large numbers in the early 2000s?
A) The unemployed
B) Immigrants
C) Young professionals
D) African Americans

44. In [37], "flat" is closest in meaning to
A) static.
B) deflated.
C) featureless.
D) obscure.

45. According to the passage, which choice best describes the current financial situation in many major American cities?
A) Expected tax increases due to demand for public works
B) Economic hardship due to promises made in past years
C) Greater overall prosperity due to an increased inner-city tax base
D) Insufficient revenues due to a decrease in manufacturing

46. Which choice provides the best evidence for the answer to the previous question?
A) [40-43] ("America's … decades")
B) [47-49] ("How … not know")
C) [49-51] ("What … now")
D) [54-57] ("The truth … end")

47. The passage implies that American cities in 1974
A) were witnessing the flight of minority populations to the suburbs.
B) had begun to lose their manufacturing sectors.
C) had a traditional four-zone structure.
D) were already experiencing demographic inversion.

48. Which choice provides the best evidence for the answer to the previous question?
A) [61-65] ("Much … Ernest W. Burgess")
B) [65-66] ("It was … settlement")
C) [75-82] ("Virtually … continuum")
D) [82-86] ("As … home")

49. As used in [77], "conducted" is closest in meaning to
A) carried out.
B) supervised.
C) regulated.
D) inhibited.

50. The author of the passage would most likely consider the information in chart 1 to be
A) excellent evidence for the arguments made in the passage.
B) possibly accurate but too crude to be truly informative.
C) compelling but lacking in historical information.
D) representative of a perspective with which the author disagrees.

51. According to chart 2, the years 2000–2010 were characterized by
A) less growth in metropolitan areas of all sizes than had taken place in the 1990s.
B) more growth in small metropolitan areas than in large metropolitan areas.
C) a significant decline in the population of small metropolitan areas compared to the 1980s.
D) roughly equal growth in large metropolitan areas and nonmetropolitan areas.

52. Chart 2 suggests which of the following about population change in the 1990s?
A) Large numbers of people moved from suburban areas to urban areas in the 1990s.
B) Growth rates fell in smaller metropolitan areas in the 1990s.
C) Large numbers of people moved from metropolitan areas to nonmetropolitan areas in the 1990s.
D) The US population as a whole grew more in the 1990s than in the 1980s.

Reading Comprehension

Varlam Shalamov, "Lend Lease," from his Kolyma Tales (1980)

The logging area was just ahead, the slope of the mountain had been laid bare, and the shallow snow had been blown away by the wind. The stumps had all been rooted out; a charge of ammonal was placed under the larger ones, and the stump would fly into the air. Smaller stumps were uprooted with long bars. The smallest were simply pulled out by hand like the shrubs of dwarf cedar….

The mountain had been laid bare and transformed into a gigantic stage for a camp mystery play.

A grave, a mass prisoner grave, a stone pit stuffed full with undecaying corpses from 1938 was sliding down the side of the hill, revealing the secret of Kolyma.

In Kolyma, bodies are not given over to earth, but to stone. Stone keeps secrets and reveals them. The permafrost keeps and reveals secrets. All of our loved ones who died in Kolyma, all those who were shot, beaten to death, sucked dry by starvation, can still be recognized even after tens of years. There were no gas furnaces in Kolyma. The corpses wait in stone, in the permafrost.

In 1938 entire work groups dug such graves, constantly drilling, exploding, deepening the enormous gray, hard, cold stone pits. Digging graves in 1938 was no "assignment", no "norm" calculated to kill a man with a fourteen-hour working day. It was easier to dig graves than to stand in rubber galoshes over bare feet in the icy waters where they mined gold — the "basic unit of production," the "first of all metals."

These graves, enormous stone pits, were filled to the brim with corpses. The bodies had not decayed; they were just bare skeletons over which had stretched dirty, scratched skin bitten all over by lice.

The north resisted with all its strength this work of man, not accepting the corpses into its bowels. Defeated, humbled, retreating, stone promised to forget nothing, to wait and preserve its secret. The earth opened, baring its subterranean storerooms containing not only gold and lead, tungsten and uranium, but also undecaying human bodies.

These human bodies slid down the slope, perhaps attempting to arise. From a distance, from the other side of the creek, I had previously seen these moving objects that caught up against branches and stones; I had seen them through the few trees left standing and I thought that they were logs that had not yet been hauled away.

Now the mountain had been laid bare, and its secret was revealed. The grave "opened", and the dead men slid down the stony slope. Near the tractor road an enormous new common grave was dug. Who had dug it? No one was taken from the barracks for this work. It was enormous, and I and my companions knew that if we were to freeze and die place would be found for us in this new grave, this house-warming for dead men.

The bulldozer scraped up the frozen bodies, thousands of bodies of thousands of skeleton-like corpses. Nothing had decayed; the twisted fingers, the pus-filled toes which were reduced to mere stumps after frostbite, the dry skin scratched bloody and eyes burning with a hungry gleam.

With my exhausted, tormented mind I tried to understand: how did there come to be such an enormous grave in the area? I am an old resident of Kolyma, and there hadn't been any gold-mine here as far as I knew. But then I realized that I

knew only a fragment of that world surrounded by a barbed-wire zone and guard towers that reminded one of the pages of tent-like Moscow architecture. Moscow's taller buildings are guard towers keeping watch over the city's prisoners. That's what those buildings look like. And what served as models for Moscow architecture — the watchful towers of the Moscow Kremlin or the guard towers of the camps? The guard towers of the camp "zone" represent the main concept advanced by their time and brilliantly expressed in the symbolism of architecture….

And then I remembered the greedy blaze of the fireweed, the furious blossoming of the taiga in summer when it tried to hide in the grass and foliage any deed of man — good or bad. And if I forget, the grass will forget. But the permafrost and stone will not forget.

Grinka Lebedev, parricide, was a good tractor-driver, and he controlled the well-oiled foreign tractor with ease. Grinka Lebedev carefully carried out his job, scooping the corpses toward the grave with the gleaming bulldozer knife-shield, pushing them into the pit and returning to pick up more.

The camp administration had decided that the first job for the bulldozer received from Lend-Lease should not be work in the forest, but something far more impressive.

The work was finished. The bulldozer heaped a mound of stones and gravel on the new grave, and the corpses were hidden under stone. But they did not disappear.

The bulldozer approached us. Grinka Lebedev, common criminal and parricide, did not look at us, prisoners of Article 58. Grinka had been entrusted with a task by the government, and he had fulfilled that task. On the stone face of Grinka Lebedev were hewn pride and a sense of having accomplished his duty.

The bulldozer roared past us; on the mirror-like blade there was no scratch, not a single spot.

53. What does Shalamov mean by the "'norm"' [33]?
A) A punitive work requirement that, it was expected, would kill a prisoner over time
B) A minimal food ration doled out to prisoners
C) The length of a typical Soviet workday
D) How long a prisoner could work every day and manage to survive

54. What is the closest meaning of "parricide" [107] and [126]?
A) Someone who has murdered his/her own child
B) A man who has murdered his own brother or sister
C) Someone found innocent of murder by reason of insanity
D) Someone who has murdered his/her own parent(s)

55. Where do you think Kolyma is located?
A) A few hundred miles north of Moscow
B) In the deserts of the Kazakh SSR
C) In far northeastern Siberia
D) In the Caucasus region

56. Where did the bulldozer come from?
A) A Soviet factory in Gorky
B) A Nazi factory during the Nazi-Soviet Alliance of 1939-41
C) The United States
D) Canada

57. What does "Article 58" [127] probably refer to?
A) An article of the Soviet Constitution of 1936
B) A list of "political" offenses posted on the gate of every Soviet labor camp
C) The official Soviet manual of psychiatric disorders
D) The Criminal Code of the RSFSR as of 1937

58. According to the text, the corpses did not decay because

A) The stone kept them from decomposing
B) Because they were recent corpses
C) Because of the manner in which they were buried
D) Because of the extreme cold

59. The lines which best support the answer to the previous question are

A) [23-28] "All...permafrost"
B) [Line] "A grave...Kolyma"
C) [46-47] "The north...bowels"
D) [20-21] "In Kolyma...stone"

60. The sentence on [21-22], "Stone keeps…them" is an example of

A) Anastrophe
B) Hyperbole
C) Anthropomorphism
D) Amplification

61. Based on the information in the passage, "ammonal" [5] is most likely

A) A tool used for digging
B) An explosive
C) A detonator
D) A torch

62. In [97], the word "brilliantly" most nearly means

A) Gleamingly
B) Intelligently
C) Vividly
D) Magnificently

Sentence Improvement

63. Should a college application essay be required, one should probably set aside a large block of time and avoid writing it at the last minute.
(A) Should a college application essay be required
(B) Should you need to write a college application essay
(C) If you need to write a college application essay
(D) In an event that one needs to write a college application essay

64. Few of us attempt to examine the sources of our most cherished convictions; indeed, there is a natural reluctance to this.
(A) there is a natural reluctance to this
(B) our reluctance for it is natural
(C) we are naturally reluctant to do so
(D) our being reluctant is a natural thing

65. The harmful effects of smoking on the vascular system is increasingly well documented.
(A) is increasingly well documented
(B) is more and more documented
(C) are increasingly well documented
(D) are increasing in better documentation

66. Pop artist Ed Ruscha was fascinated by words, and have consistently formed the principal subject matter of his paintings.
(A) words, and have consistently formed the principal subject matter
(B) words, and words have consistently former the principal subject matter
(C) words which have consistently formed the principal subject matter
(D) words, which have consistently formed the principal subject matter

67. Enzymes are among the oldest known chemical compounds as they actually are nonliving protein molecules.
(A) Enzymes are among the oldest known chemical compounds, as they actually are nonliving protein molecules.
(B) Among the oldest known chemical compounds, the nonliving protein molecules are actually called enzymes.
(C) Enzymes, among the oldest known chemical compounds, actually are nonliving protein molecules.
(D) Enzymes actually are nonliving protein molecules, being among the oldest known chemical compounds.

68. A healthy economy can be measured not only by the growth of businesses but it has a psychological effect on people.
(A) it has a
(B) as well in the
(C) also by its
(D) also the

69. Our contention that is a body of common knowledge shared by literate Americans of the late twentieth century and that this knowledge can be defined.
(A) Our contention that is a body of common knowledge shared by
(B) To contend that a body of common knowledge is shared by
(D) We contend that we share a body of common knowledge in
(D) It is our contention that a body of common knowledge is shared by

70. Another of the common characteristics of bulimic is their dependence on the good opinion of others.
(A) of bulimic is their dependence on
(B) of bulimic is their reliability on
(C) of bulimia is her reliance on
(D) of bulimics is their dependence on

71. Many French farmers developed methods of preserving fresh produce <u>that resulted in their families being fed</u> over the long winters.
(A) that resulted in their families being fed
(B) that resulted in their feeding their families
(C) that enabled their families to feed
(D) that enabled them to feed their families

72. The letter was intended for <u>Betsy and him, but the actual recipients of the bad news were Peter and I</u>.
(A) Betsy and him, but the actual recipients of the bad news were Peter and I
(B) Betsy and I, but the actual recipients of the bad news were Peter and I
(B) Betsy and him, but Peter and me actually received the bad news
(D) Betsy and he, but the actual recipients of the bad news turned out to be Peter and me

Writing & Language

The Evolution of Slow Food

In 1986, McDonald's caused a stir in Italy when it opened a restaurant next to Rome's historic Spanish Steps. Young, on-the-go eaters were thrilled; [73] specifically, those who prized regional foods and Italy's convivial culture built on cooking and long meals feared that the restaurant signaled the death of a way of life. To counter the rise of fast food and fast [74] life, a cohort of chefs, journalists, and sociologists spearheaded a Slow Food movement, declaring loyalty to unhurried enjoyment. [75]

From its beginning, the movement [76] had opposed the standardization of taste that fast food chains promote. For example, a McDonald's hamburger made in Boston tastes more or less the same as one made in Beijing. This consistency is made possible by industrial mass production. Slow Food supporters, by contrast, back methods of growing and preparing food based on regional culinary traditions. When produced using traditional methods, goat cheese made in France tastes different from goat cheese made in Vermont. A goat ingests the vegetation particular to the meadow in which it grazes, which, along with other environmental [77] factors such as altitude and weather shapes the cheese's taste and texture. If all foods were produced under the industrial model, [78] we would have meals that are not very flavorful.

73. A) NO CHANGE
B) for example,
C) however,
D) in fact,

74. A) NO CHANGE
B) life; a
C) life: a
D) life. A

75. At this point, the writer is considering adding the following sentence.
The group's philosophy was connected to the tale of the hare and the tortoise, in which the tortoise wins the race.
Should the writer make this addition here?
A) Yes, because it explains the primary belief that led to the development of the Slow Food movement.
B) Yes, because it reinforces a claim that the writer makes earlier in the paragraph.
C) No, because it blurs the paragraph's focus by introducing a new idea that is not clearly explained.
D) No, because it distracts from the paragraph's emphasis on the Slow Food movement's origins and beliefs.

76. A) NO CHANGE
B) opposes
C) will oppose
D) has opposed

77. A) NO CHANGE
B) factors, such as altitude and weather,
C) factors such as, altitude and weather,
D) factors, such as altitude and weather

78. Which choice most effectively supports the central point of the paragraph?
A) NO CHANGE
B) the public would not be interested in learning about traditional foods.
C) people would not be able to determine how a particular food was made.
D) consumers would lose this diversity of flavors.

During [79] their early years, the movement also focused on the value of [80] spending lots of time with friends and family during long meals. It emphasized the importance of preserving these "easygoing, slow pleasures." As the movement grew beyond Italy's borders—today Slow Food International boasts more than 100,000 members in 150 countries—this emphasis on pleasure [81] pictured criticism for being elitist. Critics have also asked if growing food using traditional methods, as opposed to mass production, [82] can adequately and affordably feed the world? Given the hectic pace of modern life, who among us has the time and resources for elaborate meals? Such questions, in addition to environmental concerns, are at the heart of perennial debates about food production.

Over time, Slow Food has broadened its mission to focus on food that is good, clean, and fair for all. Members assert that food should be flavorful, carrying the properties of a particular region; it should be raised using environmentally sustainable practices that preserve biodiversity; and it should be accessible to all without exploiting the labors of those who produced it. [83] In short, Slow Food runs programs that support small-scale producers in marketing regional foods in a world where food corporations threaten to drive them out of the marketplace and homogenize food choices.

79. A) NO CHANGE
B) there
C) its
D) it's

80. A) NO CHANGE
B) leisurely meals with friends and family.
C) eating slowly and in the company of loved ones such as friends and family.
D) joining friends as well as family for time-consuming meals.

81. A) NO CHANGE
B) portrayed
C) drew
D) sketched

82. A) NO CHANGE
B) adequately and affordably can feed the world?
C) can adequately and affordably feed the world.
D) adequately and affordably can feed the world.

83. A) NO CHANGE
B) Nonetheless,
C) To these ends,
D) By the same token,

Writing & Language

DNA Analysis in a Day

Jane Saunders, a forensic DNA specialist, arrives at work and finds a request waiting for her: she needs to determine if the DNA of a fingernail with a few skin cells on it [84] match any records in the criminal database. "Human DNA is a long, double-stranded [85] molecule; each strand consists of a complementary set of nucleotides," she explains. "DNA has four nucleotides: [86] adenine (A), thymine (T), guanine (G), and cytosine (C). on each strand is a sequence of nucleotides that match or pair up with the nucleotides on the other, or complementary, strand. [87] As a result, when there is an adenine on one strand, there is a thymine on the complementary strand, and where there is guanine on one strand, there is cytosine on the complementary strand."

She begins by [88] moving the DNA from the rest of the sample, transferring it to a [89] reaction tube. She adds a solution of primers, DNA polymerase, and nucleotides, Her goal is to separate the two strands of the DNA molecules and then make complementary copies of each strand.

After mixing the primers, DNA polymerase, and nucleotides with the evidence DNA, Saunders closes the reaction tube and puts it in a thermocycler. It is programmed to raise the temperature to 94°C to separate the double strands into single strands, and then lower the temperature to 59°C to attach the primers to the single strands. Finally, it raises the temperature to 72°C for the DNA polymerase to build the complementary strands. The thermocycler holds each temperature for one minute and repeats the cycle of three temperatures for at least 30 cycles. At the end of each cycle, the number of DNA segments containing the sequence marked by the primers doubles. If the original sample contains only 100 DNA strands, the [90] absolute final solution will have billions of segments. [91]

84. A) NO CHANGE
B) matches
C) has matched
D) will be matching

85. A) NO CHANGE
B) molecule, each strand consists
C) molecule each strand consists
D) molecule but each strand consists

86. A) NO CHANGE
B) adenine (A), thymine (T), guanine (G), and cytosine (C)
C) adenine (A), thymine (T) guanine (G) and cytosine (C)
D) adenine (A) thymine (T), guanine (G) and cytosine (C)

87. A) NO CHANGE
B) Specifically,
C) However,
D) Similarly,

88. A) NO CHANGE
B) reviewing
C) changing
D) detaching

89. Which choice most effectively combines the sentences at the underlined portion?
A) reaction tube since she adds
B) reaction tube, however, she adds
C) reaction tube, and adding
D) reaction tube, she adds

90. A) NO CHANGE
B) absolutely the final solution
C) the final solution
D) the most final solution

91. Which sentence could be added to the beginning of the paragraph to most effectively establish the central idea?
A) The process of testing the DNA includes several steps and many changes in temperature.
B) The object of testing the DNA is to recreate many strands of the DNA in question.
C) Saunders uses a variety of machines in order to analyze the DNA.
D) Saunders would be unable to identify the DNA without the thermocycler.

① After a short lunch break, Saunders needs to separate and identify the copied DNA segments. ② She had used primers that bind to 13 specific sites in human DNA called short tandem repeats, or STRs. ③ The 13 STRs are segments of four nucleotides that repeat, such as GATAGATAGATA. ④ "Now here's where the real magic happens!" Saunders says excitedly. ⑤ "Most DNA is identical for all humans. ⑥ But STRs vary greatly. ⑦ The chances of any two humans—other than identical twins-having the same set of 13 STRs is less than one in one trillion." [92]

Saunders knows that the detectives will be [93] prepared to hear her findings, so she sits down at her desk to compare her results with the criminal database in the hopes of finding a match. [94] Is it possible that too much time is spent identifying DNA in cases that are relatively easy to solve?

92. Where should sentence i be placed to make the paragraph feel cohesive?
A) Where it is now
B) After sentence 2
C) After sentence 3
D) After sentence 4

93. A) NO CHANGE
B) eager
C) impatient
D) conditioned

94. Which choice most effectively establishes a concluding sentence for the paragraph and the passage?
A) NO CHANGE
B) It takes a good deal of work and expense to identify DNA in the world of modern forensics.
C) She takes pride in the fact that her scientific expertise plays such a key role in bringing criminals to justice.
D) She marvels at how far science has come in DNA analysis.

Answer Key

1. B
2. D
3. B
4. D
5. B
6. D
7. C
8. D
9. D
10. D
11. B
12. B
13. D
14. D
15. B
16. D
17. A
18. D
19. D
20. B
21. To preserve it against the intrusion of "inconsistencies" in the math (i.e. unwanted infinities)
22. The ability through an easily-grasped analogy to understand an otherwise opaque scientific proposition
23. N/A
24. Very close to the beginning of Space/Time and Matter/Energy, i.e. the Big Bang (10^{-35} s after the "Singularity")
25. Many scientists (Einstein, Dirac, etc.) have insisted that equations in physics must be aesthetically pleasing; if they're not, they must be wrong!
26. C
27. D
28. D
29. C
30. A
31. C
32. A
33. A
34. B
35. A
36. D
37. High square-footage tax rates, strict environmental regulations, expected high wages
38. It was long regarded as canonical
39. Newer infrastructure, mild winters, lower land, construction, and wage costs for employers
40. Many arrive with purchasing power that would enable that choice; available work in the suburbs themselves (business parks, professional buildings, parking)
41. It can be applied to cities of any size, including even rural areas
42. C
43. D
44. A
45. B
46. A
47. C
48. C
49. A
50. B
51. A
52. D
53. A
54. D
55. C
56. C
57. D
58. D
59. A
60. C
61. B
62. C
63. A
64. C
65. C
66. D
67. C
68. C
69. D (fragmDnt)
70. D
    (A) Pronoun-antecedent agreemnt. ***Their*** is plural; ***blumic*** is singular.
    (B) Reliability ⇒ Reliance
    (C) Pronoun reference. The pronoun ***her*** lacks a specific antecedent.
    (D) Pronoun reference. The pronoun ***their*** illogically refers to ***characteristics***.
71. D (passive)

72. A
    (A) Correct
    (B) Betsy and <u>me</u>, but the actual recipients of the bad news were Peter and I
    (B) Betsy and him, but Peter and <u>I</u> actually received the bad news
    (D) Betsy and <u>him</u>, but the actual recipients of the bad news turned out to be Peter and <u>I</u>
    (E) Betsy and I, but the bad news was actually received by Peter and <u>me</u>
73. C
74. A
75. C
76. D
77. B
78. D
79. C
80. B
81. C
82. C
83. C
84. B
85. A
86. B
87. B
88. D
89. C
90. C
91. A
92. A
93. B
94. C