



College Admission Test Reviewer

A project of:
SENATOR WIN GATCHALIAN

Developed by:

MSA
ACADEMIC ADVANCEMENT INSTITUTE



College Admission Test Reviewer

Developed by:



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Sa mga minamahal kong magsisipagtapos ng high school,

Sa wakas, natupad na ang ating pangarap! Ang libreng tuition fee sa kolehiyo sa lahat ng state universities at colleges (SUCs) at local universities at colleges (LUCs) sa buong panig ng bansa ay naisakatuparan na sa pamamagitan ng Republic Act No. 10931 o Universal Access to Quality Tertiary Education Law.

Madalas kong sabihin na huwag tumigil o mapagod na mangarap. Maliit man ito o malaki, naniniwala akong darating ang panahon na ito rin ay ating makakamit. Tulad ninyo, pangarap ko na kayo ay makapagtapos ng kolehiyo, kaya naman bilang inyong Kuya sa larangan ng dekalidad na edukasyon, hinihikayat ko kayong mga mag-aaral na sipagan at galingan pa lalo sa inyong pag-aaral.

Ngayong abot-kamay na ang libreng edukasyon sa bansa, sulitin ninyo ang magagandang oportunidad na dala nito. Ipinapasa na namin sa inyong mga kamay ang disiplina at pangangalaga sa sariling kinabukasan sa pamamagitan ng pagpapahalaga sa inyong edukasyon.

*Hayaang magabayan at matuto sa pinaganda at pinadaling konsepto ng pag-review para sa bawat kabataang kakatapos lang ng high school, ‘tulad na lang ng ating proyektong **WIN SA EXAMS College Admission Test Reviewer** kasama ang MSA Academic Advancement Institute. Paglaanan ng sapat na oras na sagutan ang bawat paksang nakapaloob dito para mapaghandaang maigi ang entrance exam saan mang kolehiyo nais ninyong pumasok.*

Sa bawat kabataang magkokolehiyo, patuloy lang kayong magsumikap. Mahaba man ang daang tatahakin, panigurado, malayo naman ang mararating dahil sa pagpupursigi at determinasyon ng bawat isa na makapagtapos ng kolehiyo.

Ito ang inyong Kuya Win, kasamang tutuparin ang inyong mga pangarap.

Maligayang pag-aaral sa inyong lahat!

Senator Win Gatchalian



Mathematics

Directions: Answer each question carefully. Shade the oval that corresponds to the letter of the correct answer.

1. As part of its 25th anniversary, Johnny Bee offered a 25% discount on all its food items. Aling Julia ordered three chicken combo meals and paid Php 315.00. What is the original price of a chicken combo meal (in Php)?
a. 120.00 b. 140.00
c. 150.00 d. 175.00
2. Decreasing a number by 40% and then decreasing the result by 30% is the same as decreasing the original number by what percent?
a. 70 b. 58 c. 42 d. 35
3. Suppose that 48 workers can build a tower in 60 days. How many more workers should be hired so that the tower can be finished 24 days earlier?
a. 32 b. 54 c. 80 d. 120
4. Don Facundo decides to split his assets between his two sons; Egbert and Leonardo in the ratio 8 : 17. If Leonardo receives Php 144 000 000 more than Egbert, how much is Don Facundo's total assets?
a. Php 500 000 000 b. Php 480 000 000
c. Php 450 000 000 d. Php 400 000 000
5. If $A = \{1, 3, 5, 7, 9\}$, $B = \{5, 6, 7, 8, 9\}$, and $C = \{1, 2, 3, 5, 7\}$, find $A \cap B \cap C$.
a. {5, 7} b. {1, 2, 7, 9}
c. {1, 2, 3, 5, 6, 7, 8, 9} d. \emptyset
6. Simplify: $(x + x + x \cdot x) \cdot x$
a. $2x^4$ b. $3x^3$
c. $2x^2 + x^3$ d. $3x^2$
7. Simplify and write using positive exponents:
$$(-3x^{-2})(-3x)^2 \div 3 - x^0$$

a. -10 b. 13.5 c. -9x d. $-2x^{-4}$
8. Which of the following expressions is equivalent to $(2n)^n \div n^{2n}$?
a. $\left(\frac{2}{n}\right)^n$ b. $\frac{2^n}{n^2}$
c. $\frac{n^n}{2}$ d. n^{-n}
9. Simplify: $3(a - 2b)^2 - (3a - b)(a + 3b)$
a. $35ab^2$ b. $-5ab$
c. $15ab - 10b^2$ d. $-20ab + 15b^2$

10. What is the solution of the equation

$$-\frac{x+3}{2} = \frac{-x+2}{3}$$

- a. 5 b. 1 c. -13 d. 2

11. Rewrite the equation in terms of

$$w: S = 2(lw + lh + wh)$$

| | |
|----------------------------------|----------------------------------|
| a. $w = \frac{S - 2hl}{2h + 2l}$ | b. $w = \frac{S - h - l}{hl}$ |
| c. $w = \frac{S - hl}{h - l}$ | d. $w = \frac{S - 2l - 2h}{2hl}$ |

12. Find k such that $p = -3$ will be a solution of the equation $5k - p^2 = 1$.

- a. 0 b. 2 c. -2 d. 3

13. What is the solution set of the inequality $x + 2x \leq 4x$?

- | | |
|-----------------------|----------------|
| a. $x \in \mathbb{R}$ | b. $x \leq 0$ |
| c. $x \geq 0$ | d. \emptyset |

14. Find the solution set of $5 - |4 - x| > -3$.

- | | |
|------------------|------------------|
| a. $x < 4$ | b. $x > -4$ |
| c. $-12 < x < 4$ | d. $-4 < x < 12$ |

15. Uncle Lorenzo is 7 times as old as Pipo. In 4 years, he will be 5 times as old as Pipo. What will be Uncle Lorenzo's age next year?

- a. 56 b. 57 c. 60 d. 64

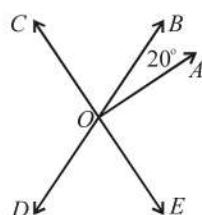
16. How many mL of a 10% brine solution is needed to mix with a 50% brine solution to produce an 800 mL solution that is 20% brine?

- | | |
|-----------|-----------|
| a. 200 mL | b. 300 mL |
| c. 500 mL | d. 600 mL |

17. The sum of two consecutive odd integers is less than 100. Find the biggest possible pair.

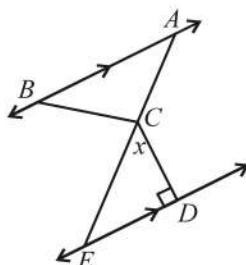
- | | |
|--------------|--------------|
| a. 47 and 49 | b. 48 and 50 |
| c. 49 and 51 | d. 51 and 53 |

18. In the figure below, $OA \perp OC$ and $m\angle DOE = (4x + 10)^\circ$. Find the value of x .



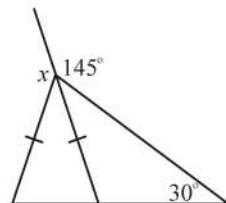
- a. 2.5 b. 7.5 c. 15 d. 20

19. In the figure below, \overline{AE} intersects \overline{BC} at C with $m\angle B = 48^\circ$ and $m\angle BCA = 88^\circ$. Find x .



- a. 54 b. 32 c. 64 d. 46

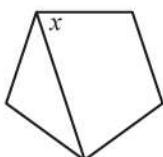
20. In the figure below, find the value of x .



- a. 120° b. 130° c. 145° d. 150°

21. The polygon below is a regular pentagon.

Find x .



- a. 60° b. 54° c. 72° d. 84°

22. Factor completely: $2m^4 - 16m$

- a. $2m(m - 2)(m^2 + 4m - 4)$
 b. $2(m - 2)(m^2 - 2m - 4)$
 c. $2m(m - 2)(m^2 + 2m + 4)$
 d. $(m^2 - 4m)(m^2 + 4m)$

23. Which of the following is a prime polynomial?

- a. $5x^2 + 45$ b. $x^2 + 8x - 18$
 c. $x^3 - 3x^2 + 3x - 9$ d. $x^6 + y^6$

24. Simplify:

$$\frac{x^2 - 2x}{x^2 - 6x + 9} \div 3x \cdot \frac{x^2 - x - 6}{x^2 - 4}$$

- a. $\frac{1}{3x - 9}$ b. $\frac{3}{x - 3}$
 c. $\frac{(x - 2)^2}{3(x - 3)^3}$ d. $\frac{3x^2}{x - 3}$

25. Simplify: $\frac{4}{x^2 - 2x} - \frac{2}{2 + x - x^2}$

- a. $\frac{2}{2x^2 - 3x - 2}$ b. $\frac{6}{2x^2 - 3x - 2}$
 c. $\frac{2x + 4}{x(x - 2)(x + 1)}$ d. $\frac{6x + 4}{x(x - 2)(x + 1)}$

26. Simplify: $\frac{x - 1}{\frac{1}{x^2}}$

- a. $\frac{1}{x} - \frac{1}{x^3}$ b. $x^3 - x$
 c. $1 - \frac{1}{x}$ d. $x^2 - 1$

27. If $\frac{1}{x} - \frac{1}{y} = \frac{3}{7}$ and $y - x = 24$, find the value of xy .

- a. 56 b. $\frac{72}{7}$ c. $-\frac{72}{7}$ d. -56

28. Judy went on a vacation, and drove her car to Abra. At first, her car contained 50 L of gasoline. After driving for 4 hours, she found out that she had already consumed 30 L of gasoline. Which function describes the amount of gasoline remaining in the car after driving for t hours?

- a. $f(t) = 50 - 5t$ b. $f(t) = 50 - \frac{15}{2}t$
 c. $f(t) = 5t - 50$ d. $f(t) = 50 - \frac{1}{5}t$

29. If $g(x) = 4 - x^2$ and $h(x) = \frac{x - 4}{2}$, evaluate $(g \circ h)(0)$.

- a. 0 b. 1 c. -2 d. 4

30. What is the slope of the line $x = -3$?

- a. 3 b. -3 c. 0 d. undefined

31. Which of the following lines is perpendicular to $y = -2x + 3$?
- $x + 2y = 5$
 - $2x - y = -2$
 - $x = -2y + 7$
 - $x = 2y$
32. The graph below shows the lines $2x + y = 10$ and $x + y = 6$ on the Cartesian Plane. Find the area of the shaded region (in square units).
-
- a. 8 b. 10 c. 12 d. 16
33. Which region below is the solution set of the system
- $$\begin{cases} y \geq \frac{1}{2}x \\ y < -3x \end{cases}$$
- ?
- a. A b. B c. C d. D
34. In $\triangle ABX$, if $m\angle A = 30^\circ$ and $m\angle C = 75^\circ$, which of the following is **true** about d , e and f ?
-
- a. $d < e < f$ b. $e < f < d$
c. $d = f < e$ d. $e < d = f$
35. Which of the following has the least value?
- $-4^{\frac{1}{2}}$
 - $-4^{-\frac{1}{2}}$
 - $\left(\frac{1}{4}\right)^{-\frac{1}{2}}$
 - $\left(-\frac{1}{4}\right)^2$
36. Simplify: $\frac{\sqrt{3}}{3 - \sqrt{3}}$
- $\frac{3\sqrt{3}}{2}$
 - $\frac{1 + \sqrt{3}}{2}$
 - $\frac{\sqrt{3} - 1}{2}$
 - $\frac{3 + \sqrt{3}}{3}$
37. Simplify: $(4\sqrt{5} - \sqrt{3})^2$
- $83 - 8\sqrt{15}$
 - $75\sqrt{15}$
 - 77
 - 32
38. Solve the equation: $x - 4\sqrt{x} = 5$
- 1 and 4
 - 1
 - 25
 - 1 and 25
39. According to Newton's Universal Law of Gravitation, the force of attraction between two objects with fixed mass is inversely proportional to the square of the distance between them. What happens to the force of attraction between the two objects if the distance between them is halved?
- the force is halved
 - the force is doubled
 - the force is quadrupled
 - the force is divided by 4

40. Solve the equation: $x(x + 5) = 27 - x$
- a. 3 only b. 3 and 9
c. -3 and -6 d. 3 and -9
41. Which of the following is a solution of the inequality $x^2 - 3 < 3 - x$?
- a. -4 b. -1 c. 2 d. 5
42. What are the x -intercept(s) of the function $f(x) = x^2 + 2x - 8$?
- a. 2 only b. 2 and 4
c. -2 and 4 d. -4 and 2
43. Find the value of a so that the graph of the function $f(x) = ax^2 + 8x - 5$ will be symmetric to the line $x = 2$.
- a. 4 b. -4 c. -2 d. 2
44. If the graphs of $f(x) = x^2 - 6$ and $g(x) = k - x^2$ do not intersect, which of the following is a possible value for k ?
- a. 6 b. 2 c. -6 d. -8

For numbers 45 - 46:

Consider the situation below.

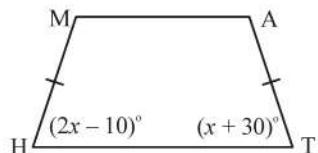
A company is manufacturing fidget spinners. Suppose that the company determined that the revenue in pesos gained from selling x fidget spinners follows the function $R(x) = 40x - x^2$ while the cost of manufacturing x units of fidget spinners follows the function $C(x) = 4x + 128$. Assume that all fidget spinners produced were sold eventually.

45. How many fidget spinners must be produced to maximize revenue?
- a. 20 b. 18 c. 15 d. 10

46. How many fidget spinners must be produced to break-even?
- a. 4 b. 12 c. 20 d. 4 or 32

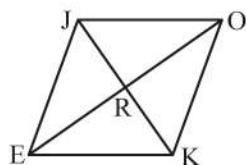
47. The diagonal of a rectangle is 26 cm long. If the length of the rectangle is 4 cm more than twice its width, find its perimeter.
- a. 34 cm b. 48 cm
c. 68 cm d. 80 cm

48. If $\square MATH$ is an isosceles trapezoid, find $m\angle A$.



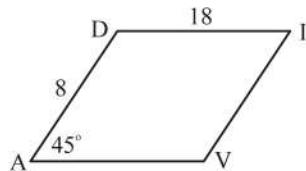
- a. 40° b. 70°
c. 110° d. 140°

49. If $JOKE$ is a rhombus and $m\angle JKE = 55^\circ$, find $m\angle JEK$.

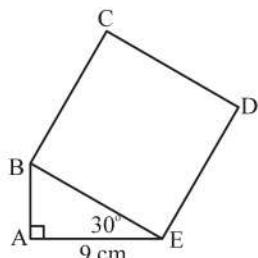


- a. 70 b. 80
c. 110 d. 125

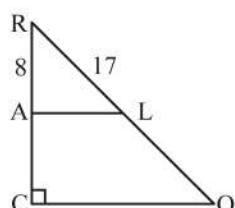
50. In the parallelogram below, find the length of the altitude to side \overline{AV} .



- a. $4\sqrt{2}$ b. $8\sqrt{2}$
 c. 12 d. $9\sqrt{3}$
51. In the given figure below, find the area of the square BCDE.



- a. $3\sqrt{3} \text{ cm}^2$ b. $6\sqrt{3} \text{ cm}^2$
 c. 36 cm^2 d. 108 cm^2
52. In the figure below, \overline{LA} is the midsegment of $\triangle RCO$. Find the length of \overline{OC} .

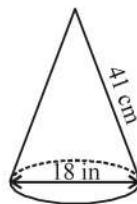


- a. 15 b. 24
 c. 30 d. 36

53. At a height $500\sqrt{3}$ m above the ground, a helicopter can see an island at 30° angle of depression. Two hours after flying towards the island without ascending or descending, the helicopter can now see the island at 60° angle of depression. How far did the helicopter travel during those two hours?
- a. 750 m b. 1 000 m
 c. $500\sqrt{3}$ m d. $750\sqrt{6}$ m

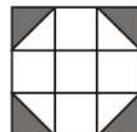
54. The ratio of the diameters of two spheres is $3 : 5$. What is the ratio of their surface areas?
- a. $5 : 8$ b. $3 : 5$
 c. $9 : 25$ d. $27 : 125$

55. What is the volume of the cone below?



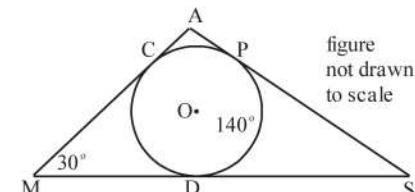
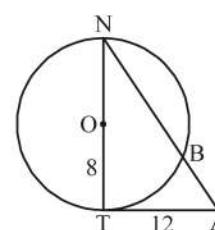
- a. $2214\pi \text{ cm}^3$ b. $1080\pi \text{ cm}^3$
 c. $4320\pi \text{ cm}^3$ d. $840\pi \text{ cm}^3$

56. If the quadrilateral below is a square, what is the ratio of the area of the shaded region to the area of the unshaded region?



- a. 1 : 6 b. 1 : 8
 c. 2 : 9 d. 2 : 7

57. Find k such that when the polynomial $x^3 - 4x^2 + 3x + k$ is divided by $x + 2$, the remainder is -13 .
- a. 25 b. 17 c. 3 d. -11

58. If -3 is a zero of the function $f(x) = 2x^3 - 7x^2 - 19x + 60$, what is/are the remaining zero(es) of the function?
- a. $\frac{5}{2}$ and -4 b. 4 only
 c. $\frac{5}{2}$ and 4 d. $\frac{5}{4}$ and 2
59. Evaluate the sum: $1 + 2 + 4 + 8 + \dots + 1024$
- a. 4096 b. 2048 c. 2047 d. 1039
60. A pyramid is being built as follows, 3800 bricks are needed to build the first floor, 3750 bricks are needed to build the second floor, 3700 bricks are needed to build the third floor, and so on. How many bricks are needed to build the 44th floor?
- a. 1650 b. 1600 c. 2150 d. 4400
61. A pendulum swings such that its next swing is $\frac{3}{4}$ that of its previous swing. A pendulum is made to swing an arc of length 10 inches initially. If the pendulum swings continuously, find the total distance swung by the pendulum.
- a. 18 in b. 24 in c. 30 in d. 40 in
62. Quadrilateral $\square MATH$ is inscribed on circle O such that $\overline{MA} \parallel \overline{TH}$ and $\overline{MH} \parallel \overline{TA}$. Which of the following best describes $MATH$?
- a. $MATH$ is a parallelogram
 b. $MATH$ is a rectangle
 c. $MATH$ is a rhombus
 d. $MATH$ is a square
63. In the figure below, $\triangle MSA$ is circumscribed about circle O . Find $m\angle A$.
- 
- a. 110° b. 100° c. 85° d. 55°
64. In the figure below, \overline{AT} is tangent to circle O at T . If the radius of circle O is 8, find BN .
- 
- a. 7.2 b. 9.6 c. 12.8 d. 15
65. A circle has center at $(5, -4)$ and passes through $(-3, 2)$. What is the circumference of the circle?
- a. 10π b. 20π c. 30π d. 40π
66. What is the coordinate of the center of the circle whose equation is $x^2 + y^2 - 6x + 2y - 54 = 0$?
- a. $(3, -9)$ b. $(-2, 6)$
 c. $(-3, 1)$ d. $(3, -1)$
67. Donkey Donuts has 7 different flavor of doughnuts. Romeo and Juliet went to Donkey Donuts to each buy a doughnut. In how many ways can they select the doughnuts to buy such that they will not pick doughnuts with the same flavor?
- a. 21 b. 42 c. 49 d. 56

68. A 4 member fact-finding committee is to be established by selecting members from a team consisting of 6 senators. In how many ways can the members of the committee be selected?
- a. 4 b. 15 c. 24 d. 360
69. Two dice were rolled. What is the probability that the positive difference of the rolls is at least 3?
- a. $\frac{1}{3}$ b. $\frac{1}{6}$ c. $\frac{1}{4}$ d. $\frac{2}{3}$
70. What is the median of the following set of numbers:
3, 7, 5, 4, 8, 8, 2, 6, 9
- a. 5 b. 6 c. 7.5 d. 8
71. What is the domain of the function:
 $f(x) = \sqrt{x - 4}$?
- a. $x > 0$ b. $x \neq 4$ c. $x \geq 4$ d. $x \in \mathbb{R}$
72. If $f(x) = \begin{cases} x - 3 & \text{if } x > 3 \\ x^2 - 3 & \text{if } x \leq 3 \end{cases}$ evaluate $f(2)$.
- a. 3 b. 0 c. -1 d. 1
73. What is the horizontal asymptote of the function $f(x) = \frac{2x^2 - 1}{x^2 + 5x + 6}$?
- a. $y = 0$ b. $y = 1$ c. $y = -2$ d. $y = 2$
74. What is the solution set of the inequality
$$\frac{4}{x - 2} > 2$$
 ?
- a. $x > 0$ b. $x > 2$ c. $x < 4$ d. $2 < x < 4$
75. What is the range of the function:
 $f(x) = -2^x$?
- a. $y < 0$ b. $y > -2$ c. $y > 0$ d. $y < 2$
76. Solve for x : $8^{x-1} = 4^{x+2}$
- a. 7 b. 5 c. 3 d. 0
77. Evaluate: $\log_3 243$
- a. 5 b. 27 c. 48 d. 81
78. Simplify: $2 \log_{12} 4 + \log_{12} 9$
- a. 4 b. 3 c. 2 d. 1
79. Solve the equation: $\ln x + \ln(x + 4) = \ln 32$
- a. 4 only b. 14 only
c. -8 and 4 d. -4 and 8
80. Convert $\frac{5\pi}{3}$ radians to degrees.
- a. 320° b. 300° c. 240° d. 120°
81. The terminal side of θ in standard position passes through (-3, 4). What is the value of $\csc \theta$?
- a. $\frac{5}{4}$ b. $-\frac{5}{4}$ c. $-\frac{4}{3}$ d. $\frac{3}{5}$
82. Which of the following expressions is equivalent to $\frac{\cos A}{\sec A}$?
- a. 1 b. $\tan A$ c. $\cos^2 A$ d. $\sec^2 A$
83. If $\sin \theta = -\frac{2}{3}$, and θ is in Quadrant III, find the value of $\sin 2\theta$.
- a. $\frac{1}{9}$ b. $-\frac{4}{3}$
c. $-\frac{4\sqrt{5}}{9}$ d. $\frac{4\sqrt{5}}{9}$

84. Evaluate: $\frac{(i+2)^2}{i}$

- a. $3 + 4i$
b. -9
c. $-i$
d. $4 - 3i$

85. What are the vertices of the hyperbola:

$$\frac{(x-3)^2}{9} - \frac{y^2}{16} = 1$$

- a. $(-3, -4)$ and $(-3, 4)$
b. $(3, 4)$ and $(3, -4)$
c. $(0, 0)$ and $(-6, 0)$
d. $(0, 0)$ and $(6, 0)$

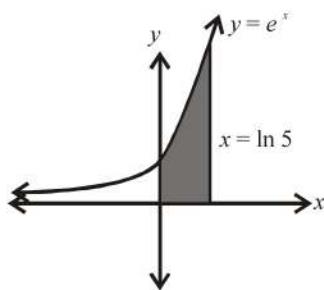
86. Evaluate: $\lim_{x \rightarrow 3} \left(\frac{x^2 - 9}{x^2 - 9x + 18} \right)$

- a. -2
b. 0
c. $-\frac{1}{2}$
d. undefined

87. A particle on a number line lies on the origin. Suppose that the acceleration of the particle at time t is given by the function $a(t) = 2t$. What is the position of the particle after 3 seconds given that the particle is initially at rest?

- a. 6
b. 8
c. 9
d. 10

88. The figure below shows the graph of the function $f(x) = e^x$ bounded by the y -axis, x -axis and the line $x = \ln 5$. Find the area of the shaded region.



- a. 4 sq. units
b. 5 sq. units
c. e sq. units
d. 7 sq. units

89. Since their last movie was a success, the director made a sequel named "Kitang-Kita Kita". The budget for the movie was Php 18 000 000. If the price of the ticket is Php 450, how many tickets must be sold to have a profit of Php 135 000 000?

- a. 260 000
b. 300 000
c. 340 000
d. 380 000

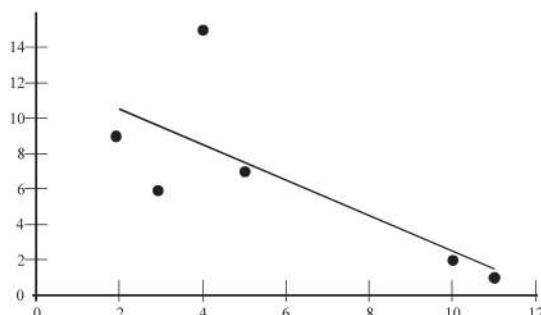
90. According to study, 40% of the students prefer to use a coin-operated washing machine. Given that six students were asked, what is the probability that exactly 4 of them prefer to use a coin-operated washing machine?

- a. ${}_6C_4 (0.4)^2 (0.6)^4$
b. ${}_6C_4 (0.4)^4 (0.6)^2$
c. $(0.4)^4 (0.6)^2$
d. $(0.4)^2 (0.6)^4$

91. Kristine has 15 pens, 8 of which are black. If she needs to pick 4 pens randomly for her to use in school, what is the probability that at least 3 of these are black?

- a. $\frac{8C_3 \cdot 7C_1}{15C_4} + \frac{8C_4 \cdot 7C_0}{15C_4}$
b. $\frac{8C_3 \cdot 7C_1}{15C_4}$
c. $\frac{8C_1 \cdot 7C_3}{15C_4} + \frac{8C_0 \cdot 7C_4}{15C_4}$
d. $\frac{8C_1 \cdot 7C_3}{15C_4}$

92. In the House of Just Teas, the average consumption of green tea of 81 customers is equal to 180 ml with a standard deviation of 45 ml. If data are normally distributed and the level of significance is 5%, determine the confidence interval for the population mean, μ .
- $170.2 < \mu < 189.8$
 - $179.75 < \mu < 180.25$
 - $179.5 < \mu < 180.5$
 - $178.91 < \mu < 181.09$
93. A certain review center claims that at least 90% of their reviewees pass the school of their choice. Four hundred reviewees of the center were asked and 368 of them pass their preferred school. Assume that the data are normally distributed, what will be the conclusion at $\alpha = 10\%$?
- The claim of the review center is true.
 - The number of reviewees that pass the school of their choice is not at least 90%.
 - The number of reviewees that will pass the school of their choice is not equal to 90%.
 - Cannot be decided using the given data.
94. Given the figure consisting of a scatter plot and a regression line below.



Which of the following **does not** describe the figure?

a. The slope of the regression line is negative.

b. It shows a negative correlation.

c. It suggests that as one variable increases, the other variable also increases.

d. Both a and b.

95. Discount Php 120 000 at 5% simple discount for 3 years.

a. Php 102 000

b. Php 60 000

c. Php 30 000

d. Php 18 000

96. At what effective rate equivalent to 14% compounded semi-annually?

a. 7%

b. 7.07%

c. 14%

d. 14.49%

97. Which of the following describes the payment when a person applies general ordinary annuity?

I. Payment is made at the beginning of every payment interval.

II. Payment is made at the end of every payment interval.

III. The number of interest being compounded is the same as the number of payment interval.

a. I only

b. II only

c. I and III

d. II and III

98. The credit card statement, with the amount in Php, is given below.

| Date | Details | Amount |
|--------|--------------------------|----------|
| Nov 1 | Previous Balance | 6 000.00 |
| Nov 5 | Restaurant Purchase | 2 400.00 |
| Nov 16 | Payment | 7 000.00 |
| Nov 22 | School Supplies Purchase | 1 200.00 |

100. A company has 160 shares with a dividend of Php 3 200 000. If it has a market value of Php 10 000, determine the dividend yield ratio.

a. 0.5 b. 1 c. 2 d. 4

For this credit card, the monthly interest rate is 5% and the billing cycle starts on the first day of the month. What is the finance charge, in Php?

- a. 247 b. 494
c. 2 470 d. 4 940

99. Michael wants to have a mini-laboratory in his house for his Biology experiments in school. For that to happen, he needs to invest Php 5 000 every month for 10 years. If money is worth 6% compounded monthly, how much should he have today, in Php, in order for him to fulfill his goal?

a. $5\ 000 \left[\frac{1 - (1.005)^{-120}}{0.005} \right]$

b. $5\ 000 \left[\frac{1 - (1.06)^{-10}}{0.06} \right]$

c. $5\ 000 \left[\frac{(1.005)^{120} - 1}{0.005} \right]$

d. $5\ 000 \left[\frac{(1.06)^{10} - 1}{0.06} \right]$

Science

Directions: Answer each question carefully. Shade the oval that corresponds to the letter of the correct answer.

1. The scientific method is a systematic way of solving a problem. Which stage in the scientific method uses background knowledge to provide a temporary explanation to a problem?
a. problem b. hypothesis
c. conclusion d. independent variable
2. Temperature is a measure of the average kinetic energy of the particles in a matter. What is the standard unit of measurement for temperature?
a. calories b. Celsius
c. Fahrenheit d. Kelvin
3. How many milligrams are there in 5.78 decigrams?
a. 0.0578 b. 0.578 c. 578 d. 57.8
4. Significant figures are important part of scientific and mathematical calculations because they deal with the accuracy and precision of numbers. How many significant figures are there in 507.000 m/s?
a. 2 b. 3 c. 6 d. 4
5. What is the standard form of 6.7×10^{-5} ?
a. 0.0067 c. 0.000067
b. 670 000 d. 670
6. What do you call the branch of Science that studies the Earth's interior and composition?
a. Biology b. Geology
c. Chemistry d. Physics
7. Gas-riched magma reached Pinatubo's surface on June 15, 1991. The volcano exploded in a violent eruption that ejected more than 1 cubic mile of material. What type of rock can possibly be the classification of the debris from the last eruption of Mt. Pinatubo classified?
a. Igneous b. Limestone
c. Metamorphic d. Sedimentary
8. An earthquake occurred in a city, with a reported strength of 5.7 magnitude. Which instrument is used to measure such earthquake movement?
a. Intensity b. Mercalli scale
c. Richter scale d. Seismograph
9. The atmosphere is an important part of what makes Earth liveable. In which layer of the atmosphere do weather disturbances probably occur?
a. thermosphere b. stratosphere
c. exosphere d. troposphere
10. DOST researchers are planning to set up a location that will measure the relative humidity of rural regions. What instrument should they use?
a. wind vane b. thermometer
c. hygrometer d. anemometer
11. Energy is broadly classified into two main groups: renewable and non-renewable. Which is **not** an example of non-renewable energy?
a. coal b. wind
c. fossil fuel d. oil

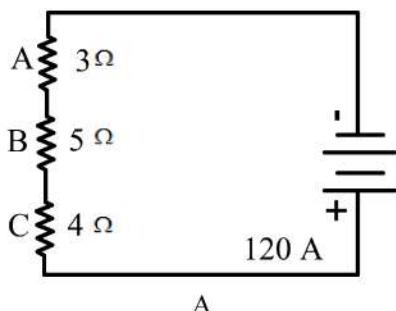
12. An eclipse occurs when an object or any celestial body hinders the light of another illuminating object or celestial body. What do you call the type of eclipse when the Moon is in between the Earth and Sun?
- solar
 - low tide
 - lunar
 - high tide
13. Which is ***not*** influenced by the Earth's revolution?
- occurrence of 365.25 days in a year
 - presence of different constellations within a year
 - different seasons throughout the globe
 - occurrence of day and night
14. What do you call the fragment of a comet or an asteroid that has entered the Earth's atmosphere?
- meteorite
 - meteor
 - meteoroid
 - asteroid belt
15. Many years ago, people liked to make up stories about constellations. These constellations are groups of stars that form a particular shape in the sky and have been given a name. The following analogies about constellations are correct ***except*** _____.
- Ursa Major: The Great Bear
 - Sagittarius : The Archer
 - Orion : The Hunter
 - Cygnus : The Dove
16. A plant cell is a eukaryotic cell that shares some characteristics with that of an animal cell. Which organelle is ***not*** included in a plant cell?
- chloroplast
 - nuclear membrane
 - centriole
 - lysosome
17. Muscle contraction is the generation of tension in muscle tissue, often resulting in a lengthening or shortening of muscles. Which organelle is needed in muscle contraction?
- mitochondrion
 - ribosome
 - nucleus
 - golgi body
18. Which cell transport explains the swelling of potato cells submerged in distilled water?
- diffusion
 - hypoosmosis
 - phagocytosis
 - hyperosmosis
19. A liver cell sample is obtained and mounted onto a microscope. Chromosomes are beginning to uncoil and the cytoplasm is starting to divide. Which stage of cell division is most probably described?
- telophase
 - prophase
 - metaphase
 - anaphase
20. Siblings, though they come from same parents, are not identical to each other. Which stage of cell division is mainly responsible for genetic variability?
- prophase
 - prophase I
 - metaphase I
 - anaphase II
21. Metabolism refers to the chemical reaction which occurs among living organisms to create and use energy needed to maintain life. It has two types, anabolism and catabolism which create and use energy, respectively. The following are examples of anabolic process ***except*** _____.
- photosynthesis
 - mineralization of bone
 - increase of muscle mass
 - cell respiration

22. The following are true about photosynthesis *except* _____.
a. glucose is a direct product of photosystem II
b. photosystem II has a lower amount of energy created than photosystem I
c. carbon dioxide is needed in dark reaction
d. water is used during light reaction
23. An organism is found in a pond. After a series of studies, it was found out that it contains a cell wall that is made up of chitin. Which kingdom does it most probably belong?
a. Animalia b. Plantae
c. Fungi d. Monera
24. A woman who has a heterozygous curly (C) hair marries a man that has a straight hair (c). What is their chance of having an offspring that has a genotype of homozygous curly hair?
a. 25 % b. 75 %
c. 50 % d. 0 %
25. In plants, tall (T) is dominant over short (t) while round (R) is dominant over wrinkled seed (r). If a plant with a genotype of ttRr is crossed with another plant with the genotype TTrr, how many out of 16 offspring are tall and have wrinkled seeds?
a. 4 b. 8 c. 12 d. 16
26. The following are examples of a phenotype *except* _____.
a. tall and short pea plants
b. pink and red flower petals
c. homozygous for hair type
d. round and wrinkled pea plants
27. If a DNA strand with a sequence of 5'...AAT GCG ATA...3' will undergo transcription, which is its correct mRNA complementary strand?
a. 3'...TTA CGC TAT...5'
b. 3'...UUA CGC UAU...5'
c. 3'...TTU CGC UAU...5'
d. 5'...UUA CGC UAU...3'
28. In a marine environment, a remora (a small fish) feeds on a shark's teeth. While able to get food, the shark's teeth are cleaned from parasites. What type of relationship is shown?
a. commensalism b. parasitism
c. mutualism d. predation
29. A flower is being studied by a group of Junior High School students. They have recorded that it has all the floral parts including the stamen and pistil. In which category can it be classified?
a. complete and imperfect
b. incomplete and perfect
c. incomplete and imperfect
d. complete and perfect
30. Which sequence is arranged from specific to general level of classification?
a. kingdom > class > phylum > order
b. kingdom > class > family > order
c. species < order < class < kingdom
d. order < family < class < phylum
31. All of the following scientists have contributed to the discovery of the subatomic particles of an atom *except* _____.
a. Eugene Goldstein
b. James Chadwick
c. Joseph John Thomson
d. Neils Bohr

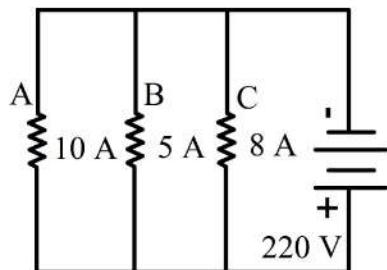
32. What is equal to the number of protons and neutrons in the nucleus of an atom?
- atomic symbol
 - atomic number
 - atomic mass
 - isotope number
33. If a particular element has an atomic number of 32 and an atomic mass of 54, how many protons does it have?
- 32
 - 54
 - 86
 - 22
34. What type of change is exhibited when dry ice turns into gas?
- physical change
 - chemical change
 - extrinsic change
 - intrinsic change
35. Matter is classified as pure substance or mixture. Which is **not** an example of a mixture?
- oil and water in a container
 - 70 percent isopropyl alcohol
 - dust particle scattered in the air
 - hydrochloric acid
- For numbers 36-39: Refer to the statement below.*
- Chlorine has an electron configuration of $1s^2 2s^2 2p^6 3s^2 3p^5$.
36. What group does chlorine belong to?
- VIIA
 - IVA
 - VIA
 - VIIIA
37. What period does chlorine belong to?
- 1
 - 2
 - 3
 - 4
38. How many valence electrons does chlorine have?
- 3
 - 7
 - 8
 - 10
39. Chlorine can readily gain 1 electron because it belongs to _____ group/family.
- alkali metal
 - alkaline earth metal
 - chalcogen
 - halogen
40. The following are examples of ionic bonding **except** _____.
- Ca_3N_2
 - BeF_2
 - PCl_3
 - MgCl_2
41. Which of the following compounds exhibits hydrogen bonding?
- CH_4
 - H_2S
 - N_2O_3
 - HF
42. What is the molar mass of Fe_2O_3 ? (Fe = 56 g/mol ; O = 16 g/mol)
- 160 g/mol
 - 200 g/mol
 - 72 g/mol
 - 40 g/mol
43. How many grams are present in 3.5 mol of aluminum? (Al = 27 g/mol)
- 80 g
 - 95 g
 - 100 g
 - 72 g
44. What is the empirical formula of a compound that contains 20% B, and 80% F? (B = 10 g/mol ; F = 19 g/mol)
- BF_3
 - BF
 - B_2F_3
 - BF_2
45. If 640-g of methane (CH_4) is released in a 150-mL container under 200 K, what is the pressure needed for this to be distributed evenly? (A.W.: C = 12 g/mol , H = 1 g/mol)
- 4000 atm
 - 400 atm
 - 40 atm
 - 0.4 atm
46. The following are vector quantities **except** _____.
- acceleration
 - speed
 - velocity
 - weight
47. A car travels east at a constant velocity of 60 kph for 3 hours. What is the total net force of the car?
- 1800
 - 2
 - 63
 - zero

48. A vehicle is moving with a constant velocity of 95 km/hr for 1.3 min. What is the vehicle's acceleration?
- a. 450 m/s^2 b. 9.8 m/s^2
c. 0.34 m/s^2 d. 0 m/s^2
49. A ball bounced on a trampoline and reached a maximum height. From the maximum height, how far is the ball from the trampoline if it will take 2 seconds to fall?
- a. 20 m b. 10 m c. 5 m d. 2 m
50. Isaac Newton developed the three laws of motion. The following are applications of the second law of motion *except* _____.
a. pushing a wall
b. towing a 4-wheeler car
c. a race between a 50-kg and a 70-kg man
d. pushing a 50-Newton box to a distance of 2 m
51. What is the mass of a fruit cart that is moving down a sloping road with a speed of 40 m/s if it contains 14 000 J of energy?
- a. $5.6 \times 10^5 \text{ kg}$ b. $2.24 \times 10^7 \text{ kg}$
c. 17.5 kg d. 10 kg
52. How much work is needed to push a 30-kg box to a distance of 3 meters?
- a. 90 N b. 900 N
c. 900 J d. 90 J
53. How much power is created by a 60-kg man that runs up a hill with a distance of 12 meters for 120 seconds?
- a. 60 Watts b. 600 Watts
c. 60 Joules d. 60 Newtons
54. How much pressure is exerted by a 4-kg object on a spring balance with an area of 4 m^2 ?
- a. 16 Pa b. 10 Pa c. 8 Pa d. 64 Pa
55. Which electromagnetic waves has the lowest and highest frequency, respectively?
- a. radiowave and gamma ray
b. infrared and radiowave
c. gamma ray and microwave
d. gamma ray and visible light
56. Starting from rest, a 0.200-kg ball rolls down a hill with a velocity of 1.5 m/s when it suddenly strikes a rock and changed its direction in 2.0 seconds. What is the total force needed by the ball to change its momentum?
- a. 1500 N b. 0.15 N
c. 1.50 N d. 200 N
57. What is the impulse of a 70-kg cart moving down a slope with a change of speed of 3.0 m/s? ($a = 10 \text{ m/s}^2$)
- a. 300 kg • m/s
b. 70 kg • m/s
c. 200 kg • m/s
d. 250 kg • m/s

For numbers 58-60: Refer to the circuits given.



A



B

58. What is the total resistance running across the series circuit?
- 23 ohms
 - 10 ohms
 - 12 ohms
 - 132 ohms
59. What is the voltage running in bulb B of the series circuit?
- 1100 V
 - 600 V
 - 220V
 - 1440 V
60. What is the total current flowing across the parallel circuit?
- 23 A
 - 12A
 - 10 A
 - 5060 A

Language Proficiency

Error Identification

Directions: Read and analyze each sentence. Then identify which of the underlined words/phrases is incorrect. Shade the oval of the letter that corresponds to the correct answer. If there is no error, choose e.

1. Joyce's salad is better than Janice.
a b c d
No error.
e

2. I painted this room ourselves. No error.
a b c d e

3. One must consider their strengths and
a b
weaknesses in dealing with difficult
c d
decisions. No error.
e

4. The lady asked me about a missing boy
a b c
in a fur hat. No error.
d e

5. The pilot wore a uniform to fly the plane
a b c
that was covered in gold buttons. No error.
d e

6. The informations he gave us was not
a b
advantageous so I consulted our professor
c
instead. No error.
d e

7. Despite of the many challenges he
a b
came across, Paul emerged victorious.
c d
No error.
e

8. Ignorant and illiterate people, living in the
a b
remote village, are usually afraid of
c
everything unfamiliar for them. No error.
d e

9. If I was president, I would make
a b
healthcare more affordable. No error.
c d e

10. The winners that the judges chose are
a b c
them. No error.
d e

11. The city school, where my cousins study,
a b
is besides the popular bookstore.
c d
No error.
e

12. Cris' car is the gift given by his parents
a b
for getting the highest score in the bar
c d
exam. No error.
e

13. His grandfather speaks Spanish
 a b
more fluently than her. No error.
 c d e
14. Mang Ben has droven for the Santos
 a b c
 family since 2001. No error.
 d e
15. Mr. Adams has accomplished many things
 a
in his career. He has finished his
 b
 Doctorate Degree, has worked in the
 c
 country's illustrious company, and
 a book he has written. No error.
 d e
16. The manager's decision is being questioned
 a b
 by the owner due to the tragic effect in
 c d
 the business. No error
 e
17. One-fourth of the books is delivered to
 a b
 the bookstore located near the school.
 c d
No error.
 e
18. Neither the participants nor the host
 a
notice the discrepancy in prizes given.
 b c d
No error.
 e
19. Mr. Hannigan had to take a train ride for
 a b
 six hours yesterday attending a conference.
 c d
No error.
 e
20. If she was the princess in the story, she
 a b
would have chosen a simpler life
 c d
 with her loved ones. No error.
 e
21. The admired councilor is known not only
 a
 for his remarkable intelligence but his
 b c
charming personality. No error.
 d e
22. Some of the philanthropist's properties
 a b
was given to the orphanage. No error.
 c d e
23. The audience was disappointed
 a
when the guest speaker arrived lately
 b c
 for the Commencement Exercises.
 d
No error.
 e
24. The reason they were disbanded is
 a
because the band members were arguing
 b c
about the goals they have. No error.
 d e
25. Everyone of the victims demands that he
 a b c
should be given immediate assistance by
 d
 the government. No error.
 e

Sentence Correction

Directions: Correct the underlined part of the sentence. If the underlined part is already correct, choose option a, if not, choose among the choices and shade the oval that gives the most effective sentence.

26. The number of participants in the poster making competition is higher than any division of the program.
- a. The number of participants in the poster making competition are higher than any division of the program.
 - b. The number of participants in the poster making competition is higher than those of any other division of the program.
 - c. The number of participants in the poster making competition are greater than all other division of the program.
 - d. The number of participants in the poster making competition is higher than any other division of the program.
 - e. The number of participants in the poster making competition is higher than that of any other division of the program.
27. I do not appreciate you trying to deceive the naïve woman.
- a. you trying to deceive the naïve woman.
 - b. your trying to deceive the naïve woman.
 - c. you're trying to deceive the naïve woman.
 - d. you're trying in deceiving the naïve woman.
 - e. your trying in deceiving the naïve woman.
28. That they were not invited to the couple's wedding was unknown to no one.
- a. to the couple's wedding was unknown to no one.
 - b. to the couple's wedding was unknown to everyone.
 - c. to the couple's wedding was unknown to every one.
 - d. to the couple's wedding was unknown to everything.
 - e. to the couple's wedding was unknown to every thing.
29. Located at the center of the business district, her close friend is assigned as the head chef of the restaurant.
- a. Located at the center of the business district, her close friend is assigned as the head chef of the restaurant.
 - b. Located in the center of the business district, the restaurant have assigned her close friends as the head chef.
 - c. Her close friend were assigned as the head chef of the restaurant located at the center of the business district.
 - d. Her close friend is assigned as the head chef of the restaurant located at the center of the business district.
 - e. The restaurant had assigned her close friend as the head chef, located at the center of the business district.

30. The internationally-renowned singer, together with the famous boy band, who are performing in the Grammy Awards next year.
- with the famous boy band, who are performing in the Grammy Awards next year.
 - with the famous boy band, who is performing in the Grammy Awards next year.
 - with the famous boy band, are performing in the Grammy Awards next year.
 - with the famous boy band, is performing in the Grammy Awards next year.
 - with the famous boy band, were performing in the Grammy Awards next year.
31. She often goes to the library and she wants a place where she can read quietly.
- goes to the library and she wants a place
 - goes to the library, and she wants a place
 - goes to the library, for she wants a place
 - goes to the library and she wants a place
 - goes to the library, she wants a place
32. If the student would have prepared his project immediately, he would have submitted it on time.
- If the student would have prepared his project immediately, he would have submitted it on time.
 - If the student have prepared his project immediately, he would have been submitting it on time.
33. The results of the examination is posted on the bulletin board beside the Dean's Office.
- is posted on the bulletin board beside the Dean's Office.
 - have posted on the bulletin board besides the Dean's Office.
 - are posted on the bulletin board beside the Dean's Office.
 - was posted on the bulletin board besides the Dean's Office.
 - is posted on the bulletin board besides the Dean's Office.
34. None of the proposals was accepted by the board of directors of Adams Construction, Inc. and Geller Real Estate Company.
- None of the proposals was accepted by the board of directors
 - None of the proposals have accepted by the board of directors
 - None of the proposals accepted by the board of directors
 - None of the proposals has been accepted by the board of directors
 - None of the proposals were accepted by the board of directors

35. We except that we need to research and to describe farther the topics assigned to us.
- We except that we need to research and to describe farther the topics assigned to us.
 - We accept that we need to research and to describe further the topics assigned to us.
 - We except that we need to research and to describe further the topics assigned to us.
 - We accept that we need to research and to describe farther the topics assigned to us.
 - We accepted that we need to research and to describe farther the topics were assigned to us.
36. Irregardless of the difficulty of the riddle, she can't help but solved it because of her curiosity.
- Irregardless of the difficulty of the riddle, she can't help but solved it
 - Regardless of the difficulty of the riddle, she can't help but solved it
 - Regarding of the difficulty of the riddle, she can't help solving it
 - Irregardless of the difficulty of the riddle, she can't help solving it
 - Regardless of the difficulty of the riddle, she can't help solving it
37. The astronomer who, we believe, leads the team has discovered another constellation.
- who, we believe, leads the team has discovered
 - who's we believe leads the team have discovered
 - whom we believe leads the team have discovered
38. I and my friends has observed that the every day schedule of the library hours is varrying.
- I and my friends has observed that the every day schedule of the library hours is varrying.
 - I and my friends have observed that the every day schedule of the library hours is varrying.
 - My friends and I have observed that the everyday schedule of the library hours is varying.
 - My friends and I has observed that the everyday schedule of the library hours is varying.
 - We have observed that the every day schedule of the library hours is varying.
39. Whom do you think is responsible for the questionnable report of the department?
- Whom do you think is responsible for the questionnable report
 - Who's do you think is responsible for the questionable report
 - Who do you think are responsible for the questionnable report
 - Whom, do you think, is responsible for the questionable report
 - Who, do you think, is responsible for the questionable report

40. The accused remained stationary after he heard the verdict given by the jury.
- The accused remained stationery after he heard the verdict given by the jury.
 - The accused remained stationary after he heard the verdict given by the jury.
- The accused remained stationery after he hears the verdict given by the jury.
 - The accused remained stationary after he hear the verdict given by the jury.
 - The accused remained stationery after he hear the verdict given by the jury.

Sentence Context

Directions: Read and analyze each sentence then using context clues, find out the meaning of the boldfaced word. Shade the oval that corresponds to the letter of the correct answer.

41. A good leader is someone who ensures that the **rappor**t of his team is always maintained so that they can achieve unity and coordination.
- harmony
 - cheerfulness
 - familiarity
 - communication
42. Vince's mother thought that it's time for him to finally learn how to organize and clean his room for she is now fed up seeing his **skimble-skambled** room full of used clothes, dust, and trash.
- chaotic
 - narrow
 - disorganized
 - smelly
43. Mae likes avant-garde art because of its uniqueness. Each piece she has adds to her growing **potpourri** of statues, figurines, paintings and sculptures.
- junk
 - litter
 - museum
 - collection
44. The art professor instructed his students to **scrutinize** every painting in the exhibit; he asked them to look at each painting for at least a minute.
- purchase
 - examine
 - copy
 - relinquish
45. Despite Czarina's shy and quiet attitude, she does not act **inertly** when brainstorming with the group.
- treacherously
 - conscientiously
 - robustly
 - inactively
46. A true philosopher is not molded through having a singular ideology; he is a product of a mind constantly emerging from **eclectic** knowledge of the universe.
- homogenous
 - diverse
 - diverse
 - different
47. Most Filipinos, as long as they are not directly affected, can still seem to continue a **cavalier** attitude despite all the injustices happening around the country.
- attentive
 - indifferent
 - emphatic
 - sympathetic
48. Humans go through crises all throughout their lives and question the mundanity of their **quotidian** lives.
- everyday
 - own
 - family
 - mortal

Sentence Completion

Directions: Read and analyze each sentence, look for context clues. Then, supply the most appropriate word/s in the sentence. Shade the oval of the correct answer.

56. Brittany was greatly saddened to see her long time friend _____ from cancer.
a. emaciated c. rectified
b. incited d. adroit

57. Tom has a/an _____ personality. He says things that can mislead other people.
a. aesthetic c. guileful
b. filial d. deleterious

58. The leader was annoyed by the _____ comments of the unthinking members.
a. aggregate c. plenary
b. inane d. nobby

59. Through her well-known speech, Donatella thanked her _____ who have shared her ups and downs since their school days.
a. adversary c. individual
b. clique d. entrant

60. Dr. Cristina felt _____ after conducting a whole day of surgery.
a. isolated c. secluded
b. braced d. enervated

61. Richard is a(an) _____ at Seattle-Grace Primary School who teaches Grade 1 students.

- a. pedagogue c. affluent
 b. virtuoso d. bravado
- c. deficient ... folkways
 d. tumultuous ... rituals
62. April cannot solve the _____ because the details are vague and the clues are blurred.
 a. heresy c. enigma
 b. allusion d. terse
63. Miranda is the _____ of a hospital nurse; most of the new nurses aspire to be like her.
 a. brief c. precis
 b. epitome d. conspectus
64. Jonathan, with his _____ personality, never fails to _____ his friends' mood no matter how gloomy the situation can be.
 a. jocular... uplift
 b. gay... drag
 c. mournful... enthuse
 d. perilous... turn
65. The encoders cannot _____ the message that the spy sent, for it contains inconsistent codes that translate to _____ language.
 a. understand... garbled
 b. read... explicit
 c. translate... comprehensible
 d. encode... lucid
66. Millennials are the _____ example of how technology can affect society cultures, traditions, and _____.
 a. quintessential ... praxes
 b. rigid ...practices
67. Experiencing 130 days of thunderstorm regularly, Florida's gulf coast has the most _____ weather in the United States.
 a. placid c. contemptuous
 b. tempestuous d. equable
68. The wealthy couple's wedding is just a _____ display of their fortune; they made sure that the media will write articles on how tremendously expensive the event was.
 a. impecunious c. pompous
 b. inferior d. modest
69. Claire has always had a great sense of self-assurance and deals with people with such _____.
 a. rudeness c. aversion
 b. indolence d. panache
70. When the issue of using harmful ingredients in their products was broadcasted in national television, Hermia Cosmetics was _____ with _____ and refund requests.
 a. swamped ... comments
 b. blitzed ... calls
 c. bombarded ... complaints
 d. attacked... praises

Synonyms

Directions: Find the word with the SAME meaning as the given. Shade the oval that corresponds to the letter of the correct answer.

- | | | | | | |
|----------------|-------------------------------|--------------------------------|-------------------------------|-----------------------------|------------------------------------|
| 71. SPLENETIC | a. irascible b. static | c. marvelous d. extravagant | 79. IGNOMINIOUS | a. disgraceful b. risk | c. happy d. unsatisfied |
| 72. EFFEMINATE | a. virile b. masculine | c. womanish d. manly | 80. NEBULOUS | a. warlike b. hard | c. hazy d. despicable |
| 73. PIQUANT | a. bland b. dull | c. boring d. fascinating | 81. to RATIFY the request | a. approve b. extreme | c. insight d. swing |
| 74. APHORISM | a. verb b. adages | c. act d. deed | 82. a TYRANNICAL attitude | a. distant b. hostile | c. sensitive d. surprising |
| 75. VACUOUS | a. shrewd b. clever | c. fanatic d. stupid | 83. UBIQUITOUS Christmas song | a. rare b. sporadic | c. ever-present d. upon-request |
| 76. PAUNCHY | a. minuscule b. stout | c. robust d. lean | 84. a personal GIBE | a. compliment b. jeer | c. aspersions d. ardor |
| 77. VISCID | a. watery b. sticky | c. sandy d. grainy | 85. a VENAL official | a. mercenary b. sardonic | c. scrupulous d. servile |
| 78. CACOPHONY | a. stillness b. discordant | c. harmony d. sound | | | |

Antonyms

Directions: Find the word with the OPPOSITE meaning as the given. Shade the oval that corresponds to the letter of the correct answer.

86. LANGUISH

- a. wilt
- c. drift
- b. enliven
- d. sag

94. FACILE

- a. elementary
- b. easy
- c. complex
- d. mediocre

87. ACRIMONIOUS

- a. genial
- c. rancorous
- b. acrid
- d. hard

95. WANE

- a. aggravate
- b. lessen
- c. diminish
- d. mitigate

88. CENSURE

- a. rebuke
- c. approve
- b. excoriation
- d. stricture

96. TIMOROUS

- a. timid
- b. diffident
- c. fearful
- d. brazen

89. SALUBRIOUS

- a. noxious
- c. wholesome
- b. medicinal
- d. salutiferous

97. NASCENCE

- a. advent
- b. omega
- c. birth
- d. genesis

90. GREGARIOUS

- a. clubbable
- c. sociable
- b. convivial
- d. reclusive

98. GARRULOUS

- a. reticent
- b. chatty
- c. voluble
- d. talkative

91. HALCYON

- a. chaotic
- c. euphoric
- b. blissful
- d. idyllic

99. LISSOM

- a. supple
- b. graceful
- c. light
- d. clumsy

92. MACABRE

- a. horrifying
- c. grim
- b. grotesque
- d. soothing

100. IMPIOUS

- a. sacrilegious
- b. profane
- c. reverent
- d. blasphemous

93. RAFFISH

- a. disreputable
- c. conservative
- b. unconventional
- d. affluent

Single Word Analogy

Directions: Shade the oval that corresponds to the letter of the word or pair of words that best completes the analogy.

101. persisting : quitting :: recreant : _____
 a. surrender c. daunted
 b. courageous d. weak
102. overlook : attend :: detention : _____
 a. prison c. control
 b. emancipation d. disenthral
103. Israel : Jerusalem :: Russia : _____
 a. Moscow c. Tehran
 b. Muscat d. St. Petersburg
104. Hammurabi : Code :: Nebuchadnezzar : _____
 a. Hanging Gardens c. Babylon
 b. Taj Mahal d. Lydian
105. Genetics : Gregor Mendel :: History : _____
 a. Socrates c. Pigafetta
 b. Herodotus d. Plato
106. elegy : death :: ode : _____
 a. lyric c. dramatic
 b. praise d. ballad
107. Pascal : pressure :: Hertz : _____
 a. temperature c. force
 b. power d. frequency
108. Animal Farm : 1984 :: War and Peace : _____
 a. Leo Tolstoy c. Pride and Prejudice
 b. Anna Karenina d. 869
109. five : penta :: eleven : _____
 a. hendeca c. deca
 b. icosa d. dodeca
110. sable : mammal :: raptor : _____
 a. bird c. plant
 b. flower d. tree
111. principal : teachers :: _____ : prisoner
 a. lawyer c. police
 b. marshal d. prosecutor
112. intrinsic : extrinsic :: transitory : _____
 a. permanent c. ambulatory
 b. clingy d. deluge
113. 992 : 248 :: 496 : _____
 a. 124 c. 124
 b. 248 d. 228
114. gumamela : malvaceae :: banana : _____
 a. ericaceae c. musaceae
 b. liliaceae d. violaceae
115. Honda : Civic :: _____ : Mirage
 a. Ford c. Mitsubishi
 b. Hyundai d. Suzuki
116. departure : arrival :: birth : _____
 a. human c. life
 b. vitality d. expiration
117. head : chapeau :: wrist : _____
 a. elbow c. dress
 b. sleeve d. cuff
118. brief : succinct :: ambivalent : _____
 a. equal c. astride
 b. equivocal d. equestrian
119. frigid : cold :: blistering : _____
 a. see c. hot
 b. manner d. humid
120. 30th : pearl :: 6th : _____
 a. ruby c. iron
 b. sapphire d. silver

Double Word Analogy

Directions: Shade the oval that corresponds to the letter of the word or pair of words that best completes the analogy.

121. counsel : advise :: _____ : _____

- a.predict : future
- b.present : birthday
- c.fingers : hand
- d.remove : eliminate

128. alveolus : lungs :: _____ : _____

- a.pancake : egg
- b.ventricle : heart
- c.paper : printer
- d.pancreas : Islet of Langerhans

122. working : inoperative :: _____ : _____

- a.constant : loyal
- b.call : speak
- c. often : seldom
- d. worker : machine

129. playwright : writer :: _____ : _____

- a.gynecologist : doctor
- b.neurosurgeon : brain
- c.teacher : professor
- d.accountant : accounts

123. Lexicographer : dictionary ::

Cartographer : _____

- a.cartoon
- b.graph
- c. maps
- d. painting

130. caliber : quality :: _____ : _____

- a.antiquated : modern
- b.rudimentary : basic
- c.superficial : detailed
- d.vigorous : enervated

124. chrysalis : butterfly :: _____ : _____

- a. frog : tadpole
- b. test : review
- c. find : lost
- d. typing : printing

131. frivolous : seriousness :: _____ : _____

- a.facetious : humor
- b.impertinent : rudeness
- c.irreverent : respect
- d.pretentious : ostentatious

125. The Necklace : Maupassant :: _____ : _____

- a.The Road Not Taken : Frost
- b.Pride and Prejudice : Austen
- c.The Gift of the Magi : Henry
- d.The Iliad : Homer

132. Frittata : Italian :: _____ : _____

- a.Barfi : Taiwanese
- b.Japanese : Bibimbap
- c.Deokbukki : Korean
- d.Japanese : Sushi

126. Yin Yang : balance :: _____ : _____

- a.skull : poison
- b.red : sadness
- c. wisdom : laurel
- d. sword : pen

133. crepuscular : twilight :: _____ : _____

- a.diurnal : day
- b.nocturnal : dawn
- c.stellar : morning
- d.peculiar : night

127. dehydration : water :: _____ : _____

- a.obesity : fat
- b.La Niña : flood
- c.anemia : hemoglobin
- d.food : malnutrition

134. pamphleteer : pamphlet :: _____ :
a. astronomer : astronomy
b. dancer : dance
c. novelist : novel
d. song : singer
135. Rottweiler : German :: _____ :
a. Dachshund : French
b. Japanese : Hokkaido
c. Labrador : Canadian
d. Pomeranian : Philippines
136. Soledad : Angela Manalang Gloria ::
_____ :
a. Amado V. Hernandez : Luha ng
 Buwaya
b. Footnote to Youth : Carlos Garcia
c. Jose Rizal : El Filibusterismo
d. The Woman Who Had Two Navels :
 Nick Joaquin
137. Thai : Thailand :: _____ :
a. Korea : Hangul
b. Orlando : Florida
c. England : English
d. Spanish : Spain
138. Beefeater : Tower of London ::
_____ :
a. Swiss guard : Apostolic Palace
b. Old guard : Kremlin
c. guardian : kid
d. Secret Service : Pentagon
139. assiduity : success :: _____ :
a. nuclear : fusion
b. disjointed : cohesion
c. unity : progress
d. agnostic : belief
140. actor : rehearsal :: _____ :
a. teacher : demonstration
b. scientist : zoologist
c. troupe : play
d. baboon : monkeys

Reading Comprehension

Directions: The following passages will test your skills in noting details, analysis, interpretation, vocabularies etc. Read the passages carefully then answer the questions that follow. Shade the oval that corresponds to the letter of the correct answer.

For items 141 - 145:

"Advice to Youth" (1882)
(an excerpt)
by Mark Twain

Being told I would be expected to talk here, I inquired what sort of talk I ought to make. They said it should be something suitable to youth-something didactic, instructive, or something in the nature of good advice. Very well. I have a few things in my mind which I have often longed to say for the instruction of the young; for it is in one's tender early years that such things will best take root and be most enduring and most valuable.

First, then. I will say to you my young friends — and I say it beseechingly, urgently.

Always obey your parents, when they are present. This is the best policy in the long run, because if you don't, they will make you. Most parents think they know better than you do, and you can generally make more by humoring that superstition than you can by acting on your own better judgment.

Be respectful to your superiors, if you have any, also to strangers, and sometimes to others. If a person offend you, and you are in doubt as to whether it was intentional or not, do not resort to extreme measures; simply watch your chance and hit him with a brick. That will be sufficient. If you shall find that he had not intended any offense, come out frankly and confess yourself in the wrong when you struck him; acknowledge it like a man and say you didn't mean to. Yes, always avoid violence; in this age of charity and kindliness, the time has gone by for such things. Leave dynamite to the low and unrefined.

Go to bed early, get up early — this is wise. Some authorities say get up with the sun; some say get up with one thing, others with another. But a lark is really the best thing to get up with. It gives you a splendid reputation with everybody to know that you get up with the lark; and if you get the right kind of lark, and work at him right, you can easily train him to get up at half past nine, every time — it's no trick at all.

Now as to the matter of lying. You want to be very careful about lying; otherwise you are nearly sure to get caught. Once caught, you can never again be in the eyes to the good and the pure, what you were before.

There are many sorts of books; but good ones are the sort for the young to read. remember that. They are a great, an inestimable, and unspeakable means of improvement. Therefore be careful in your selection, my young friends; be very careful; confine yourselves exclusively to Robertson's Sermons, Baxter's Saints' Rest, The Innocents Abroad, and works of that kind.

*But I have said enough. I hope you will treasure up the instructions which I have given you, and make them a guide to your feet and a light to your understanding. Build your character thoughtfully and painstakingly upon these **precepts**, and by and by, when you have got it built, you will be surprised and gratified to see how nicely and sharply it resembles everybody else's.*

- | | |
|--|---|
| 141. All of the following are given as advice for the youth except _____. | 144. In the fourth paragraph, <i>Leave dynamite to the low and unrefined</i> means _____. |
| a. be very careful about lying | a. don't use firearms |
| b. be obedient to your parents | b. contain your anger |
| c. be choosy in what to read | c. give explosives to those who offend you |
| d. be respectful only to your superiors | d. always justify your emotions |
| 142. What is the tone of the speaker? | |
| a. sarcastic | 145. What type of prose is this paragraph? |
| b. persuading | a. sermon |
| c. serious | c. epistle |
| d. monotonous | b. editorial |
| 143. What word can best replace the word precepts in the last paragraph? | |
| a. principles | d. essay |
| b. doctrine | c. tenet |
| | |

For items 146 - 150:

French engineer, architect, and entrepreneur, Gustave Eiffel is known for the tower that bears his name. Gustave created different structures that paved the way to his prominence. During his life, he created many other impressive structures like churches, houses, and diverse works of architecture.

Eiffel was born in Dijon, France, in 1832. Eiffel was extremely clever but not studious when it came to school. Eventually, he found himself interested in the techniques of construction and studied at the Ecole Centrale des Arts et Manufactures in Paris, where he graduated and earned his Master of Science Degree in 1855.

Charles Nepveu provided Eiffel's first professional project. It was to build a railway bridge to span the Garonne River in Bordeaux. He designed and constructed numerous other bridges over the next few decades, including a 525-foot steel arch bridge in Oporto, Portugal, and a 540-foot version of the same design in Truyere, France. This was considered as the highest bridge in the world, at the time, crossing 400 feet over the stream. He pioneered the use of compressed air in the **caissons** of his bridges.

In 1867, Eiffel showed his love of tall, arched structures with his other creations like the Galerie des Machines for the Paris Exhibition. He also constructed the framework for the Statue of Liberty.

In 1889, to honor the one hundredth anniversary of the French Revolution, the committee announced a contest to design and build a monument commemorating the anniversary of the revolution. Eiffel **bewildered** the world with his winning entry, Eiffel Tower. Eiffel Tower is now the major tourist attraction in Paris, dominating the landscape and modern technology. It is now recognized as one of the most beautiful works of art in the world.

146. As used in the passage, the word **caissons** is closest in meaning to which of the following words?
- a. structure c. materials
b. piles d. workers
147. The tone of the author in the fifth paragraph is one of _____.
- a. challenge c. pompousness
b. delight d. confusion
148. Which is the **best** title for the passage
- a. The History of Eiffel Tower
b. Gustave and His Works
c. The Eminent Gustave Eiffel
d. Eiffel Tower: The Most Beautiful Work of Art
149. As used in the passage, the word **bewildered** is closest in meaning to which of the following words?
- a. shock c. stimulate
b. challenge d. beseech
150. This passage would most likely be found in a(an) _____.
- a. memoir c. magazine
b. editorial d. newspaper

For items 151 - 155:

Learning Different Languages

Learning different languages generates curiosity and cultural awareness. When people interact with others from different countries, they tend to be curious and want to know more about other people's culture. They also want to create a bridge so that there will be no miscommunication or misunderstanding among cultures.

*Most misunderstandings among cultures transpires when messages are misconstrued. In order to solve this, a foreigner would enroll in a language center and take formal lessons. Then he would try to communicate again with the native speaker. When a foreigner mingles with native speakers, he learns not only the others' language but also the culture. He becomes **enthralled** in the new language to the point that he would like to visit the native speaker's country.*

Students, on the other hand, acquire languages as part of their school prerequisites. Teachers help them learn the language by giving lectures on grammar, reading, speaking, listening, etc. Some of these students would be curious enough to go online and search about that new language. They then study its origin and history. Students sometimes become comfortable enough to learn the language by themselves. This produces awareness that would help them comprehend the new language.

Knowledge of languages does not really mean just being able to speak fluently but rather also means being able to inculcate information that would help people to converse better with others from around the globe.

151. According to the passage, what is the cause of misunderstanding between cultures?
- People misinterpret other people's messages.
 - People do not listen to what the other people are saying.
 - Speaking clearly and active listening are the key factors in communication.
 - None of the above
152. Which of the following words could be synonymous to the word **enthralled**?
- | | |
|------------|---------------|
| a. tripped | c. bored |
| b. gripped | d. controlled |
153. Where is the thesis statement in the passage?
- It is in the first paragraph.
 - It is in the second paragraph.
154. Which among these words could be the opposite of **acquire**?
- | | |
|------------|------------|
| a. obtain | c. develop |
| b. procure | d. lose |
155. Which among the sentences below would the author most likely agree with?
- Acquiring languages is significant so that people could better understand one another.
 - Languages would create more boundaries instead of bridges.
 - Understanding languages is better than learning how to speak them.
 - None of the above

For items 156 - 160:

KARIMLAN
ni Kristine Ann D. Pascual

Nilatag ko na ang banig. Kasabay nun, inilapag ko na rin ang mga unan. Sinindihan ko na rin ang katol na magsisilbing tagataboy ng mga lamok mamaya. Inilabas ko na rin ang pamaypay na gawa sa napulot kong karton.

Handa na ang lahat.

"Nene, matulog na tayo." tawag ko sa kapatid ko.

Nakaupo na naman siya sa may bintana. Tinatanaw ang mga ilaw sa labas.

"Ate..." sambit niya.

--Isang salita lang galing sa mga labi ng isang musmos pero sapat na para maintindihan ko ang nais niyang ipahiwatig.

"Alam ko..." --nagbabakasakali akong maipaparating ko ang simpatya ko.

Binuhat ko siya. Inihiga sa aming banig... At dali-dali kong hinipan ang kandila.

--Kadiliman. Sino nga bang makakaaninag sa dilim na bumabalot sa amin gayong nagliliwanag ang kapaligiran namin?

Pinikit ko ang aking mga mata.

--Katahimikan. Sa kabilang ingay sa labas, sino kaya ang makakapansin sa katahimikang bumabalot sa aming barong-barong?

"Ate..." --umalingawngaw ang boses ni Nene.

Minulat kong muli ang aking mga mata.

Niyakap niya ako. Ramdam ko ang pag-agos ng luha sa kanyang mga mata.

--Pinigilan ko yung akin. Kailangan magpakatatac ako.

"Nene, alam ko.." --wala akong ibang masabi.

Sabay naming pinakinggan ang tunog ng mga sasakyen sa labas, ang ingay at tawanan ng mga tao, at ang pagkalam ng aming mga siksikura na animo'y musikang nakagawian na naming pakinggan bago matulog --musikang tila humehele sa amin.

Bigla kong naisip sina inay at itay. Nasaan na kaya sila? Naririnig din kaya nila ang musikang ito bago sila matulog? --Sana oo. Para maalala nila kami.

Makalipas ang isang oras, nakatulog na si Nene. Naaminag ko ang mukha niya sa tulong ng mga ilaw na sumisiwang mula sa labas.

--Mapayapa. Walang bahid ng lungkot at kagutuman... Ano kaya kung ganito na lang palagi?

Naisip ko, mas makabubuti siguro kung patulugin ko na lang siya... habambahay.

"Hindi na siya mahihirapan..." nanginginig kong bulong.

Kaya dinampot ko ang unan sa tabi ko.

At saka ko inisip kung paano ako magsisimula...

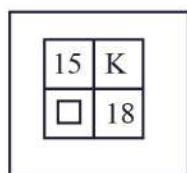
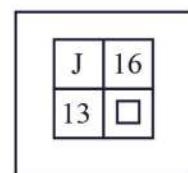
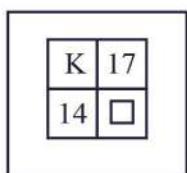
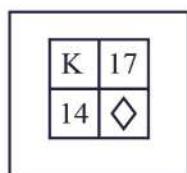
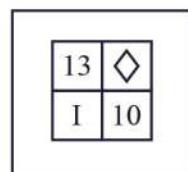
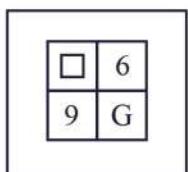
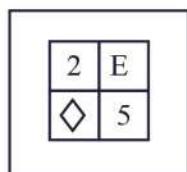
156. Anong isyung panlipunan ang ipinakita sa kabuuan ng kwento?
- kagutuman
 - kahirapan
 - edukasyon
 - pagiging ulila
157. Alin sa mga sumusunod ang hindi inilarawan sa kwento?
- ang mga magulang ng mga tauhan
 - ang tirahan ng mga tauhan
 - ang lipunang gingalawan ng mga tauhan
 - ang damdamin ng mga tauhan
158. Ano ang mahihinuha sa huling pahayag ng tauhan “*At saka ko inisip kung paano ako magsisimula...*” ?
- alam niya ang gagawin niya
 - masaya siya sa gagawin niya
 - nagdadalawang-isip siya sa gagawin niya
 - nag-iipon siya ng lakas para magawa niya ang balak niya
159. Ano kaya ang layunin ng may akda sa pagsulat ng kwentong ito?
- upang ipabatid sa mga mambabasa kung paano ba ang pamumuhay ng mahihirap
 - upang pag-isipin ang mga mambabasa kung bakit may mga mahihirap
 - upang ilarawan ang lipunang ginagalawan ng mga mahihirap
 - upang malaman ng mga mambabasa kung gaano kahirap ang maging mahirap
160. “*Ate... --umalingawngaw ang boses ni Nene.* Ano ang kahulugan ng salitang may salungguhit?
- pagnginig ng boses
 - pagtalbog ng boses
 - paglaki ng boses
 - paghina ng boses

Logical and Abstract Reasoning

Directions: Determine the next term in the sequence of numbers, letters, or figures. Shade the oval that corresponds to the letter of the correct answer.

1. 1, 12, 34, 67, 111, _____
a. 136 b. 146 c. 156 d. 166
2. $\frac{3}{8}, \frac{1}{2}, \frac{9}{16}, \frac{3}{5}, \frac{5}{8},$ _____
a. $\frac{7}{11}$ b. $\frac{9}{14}$ c. $\frac{11}{16}$ d. $\frac{5}{8}$
3. 19, 6, 28, 17, 37, 28, _____
a. 46 b. 39 c. 50 d. 56
4. 1, $\sqrt{22}$, $\sqrt{43}$, 8, $\sqrt{85}$, $\sqrt{106}$, $\sqrt{127}$, $\sqrt{148}$, _____
a. 13 b. 15 c. $\sqrt{159}$ d. $\sqrt{160}$
5. VAL, WEK, XIJ, YOI, _____
a. ZUG b. ZUH c. AUG d. AUH
6. A4, C16, F49, J121, _____
a. N225 b. O256 c. P289 d. Q324
7. Op, Mr, Ju, Fy, _____
a. Ac b. Bc c. Ad d. Bd
8. N, PqR, UvwX, BcdeF, _____
a. KlmnoP b. KlmnopQ
c. JklmnO d. JklmnoP
9. D8h, g11K, J15n, m20Q, _____
a. R26v b. p25T c. p26T d. P26t
10. apple, banana, cantaloupe, dragon fruit, _____
a. elderberry b. lychee
c. grapefruit d. blueberry
11. four, X, 16, twenty-two, XXVIII, _____
a. XXXIV b. 34 c. XXXVI d. thirty-four
12. AAA, AAB, ABA, ABB, BAA, _____
a. BBB b. BBA
c. BAB d. ABA
13. December, November, September, June, _____
a. April b. March
c. February d. January
14. north, north-east, south-east, west, _____
a. north-east b. east
c. south-east d. south

15.



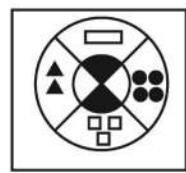
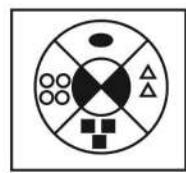
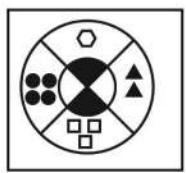
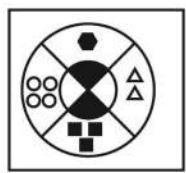
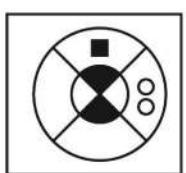
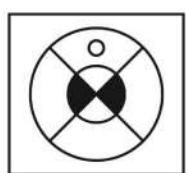
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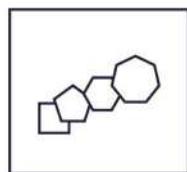
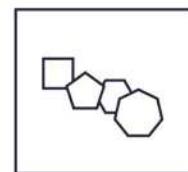
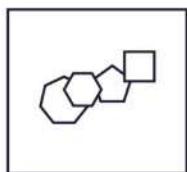
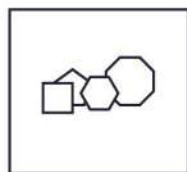
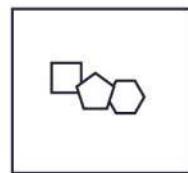
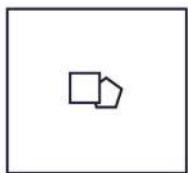
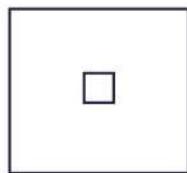
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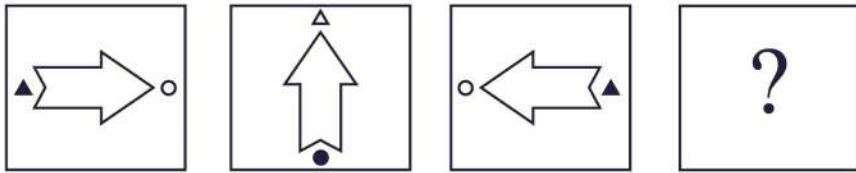
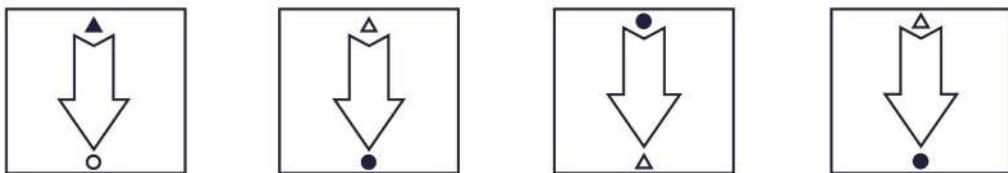
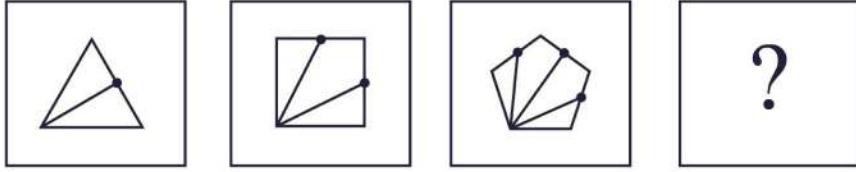
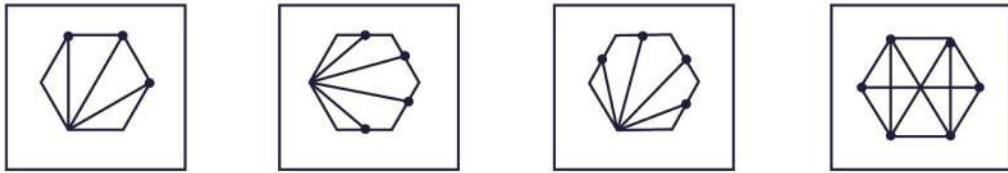


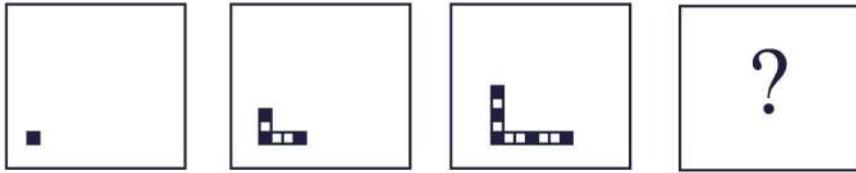
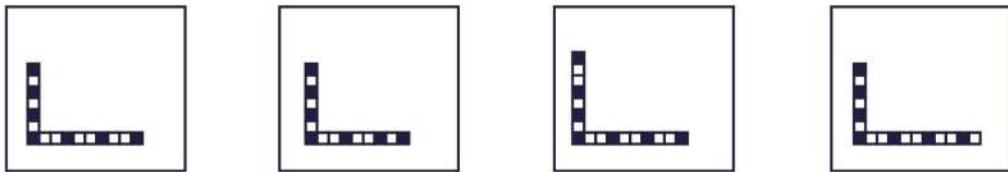
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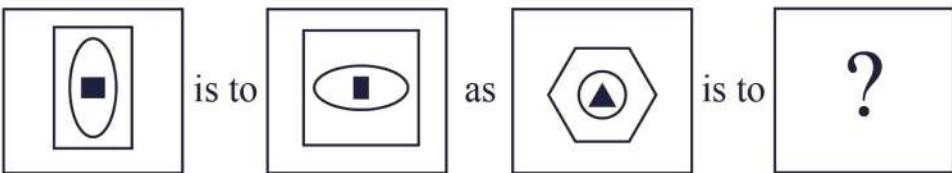
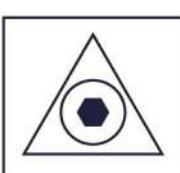
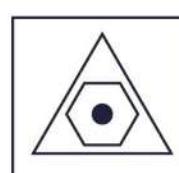
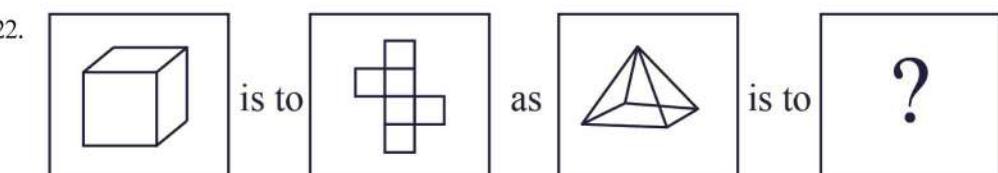
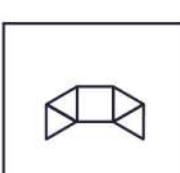
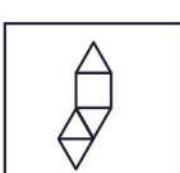
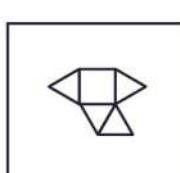
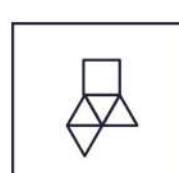
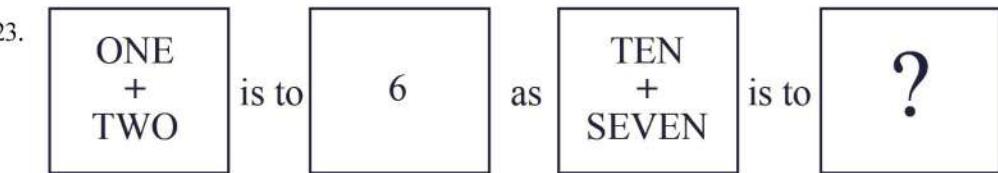
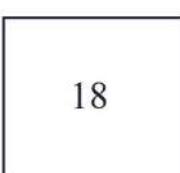
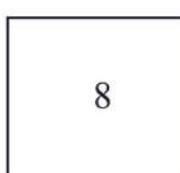
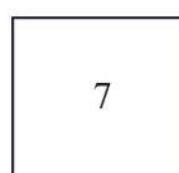
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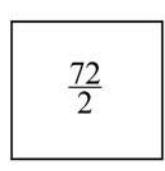
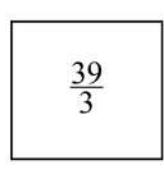
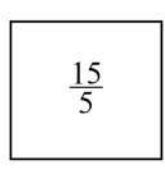
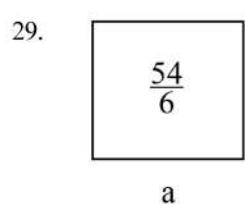
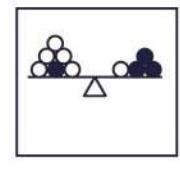
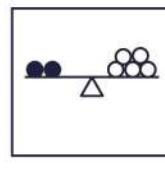
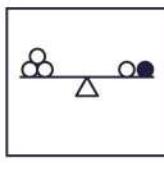
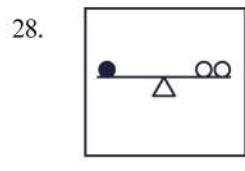
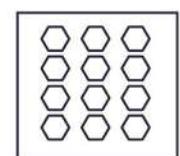
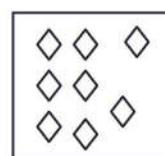
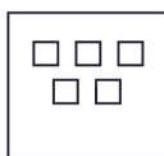
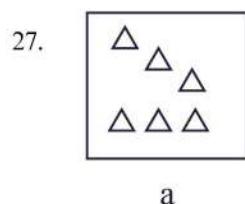
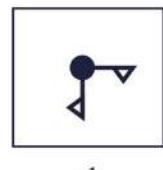
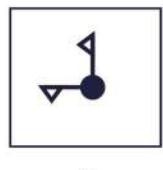
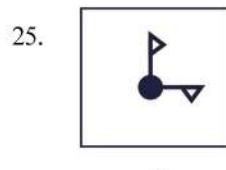
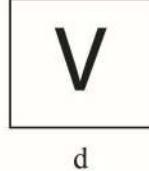
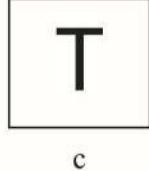
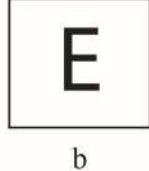
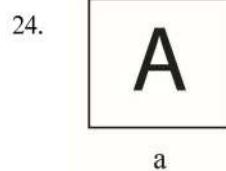
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- 20.
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21.  is to as is to
- a  b  c  d 
22.  is to as is to
- a  b  c  d 
23. 
- a  b  c  d 

Directions: Select the letter of the figure that does not belong to the group.



30. If the function is differentiable at a certain value, then it is continuous. If the function is continuous at the same value, then its limit exists. Therefore, _____.
- The limit exist at a certain value.
 - If the limit exists at a certain value, then the function is continuous.
 - The function is differentiable.
 - If the function is differentiable at a certain value, then its limit exists.
31. If Josephine asks Arianne for money, then Josephine will able be to buy the latest smartphone. If Josephine buys the latest smartphone, then she can post a picture of her birthday celebration on social media. Josephine was not able to post any pictures of her birthday celebration on social media. Therefore, _____.
- Josephine did not celebrate her party.
 - Arianne went to see Josephine's birthday party.
 - Arianne denied Josephine's request.
 - Josephine did not ask Arianne for money.
32. Either Brittany frequently goes to the gym or to the restaurant. If she frequently goes to the gym, then she will lose weight in less than a week. If she frequently goes to the restaurant, then she will have no money left in her savings. She does not frequently go to the gym.
Therefore, _____.
- Brittany will gain weight in less than a month.
 - Brittany does not want to lose weight.
 - Brittany does not have money left in her savings.
 - Brittany does not have time to go to the gym.
33. All squares are parallelograms.
All parallelograms are polygons.
- Therefore, _____.
- Some polygons are squares.
 - All polygons are squares.
 - Some, but not all, squares are polygons.
 - No squares are polygons.
34. Some businessmen are philanthropists. All businessmen are taxpayers. All philanthropists donate their money to charity. Therefore, _____.
- All philanthropists are taxpayers
 - Some taxpayers donate their money to charity.
 - All people who donate their money to charity are taxpayers.
 - Some businessmen does not like to donate their money to charity.
35. Arwen wants to go to the amusement park. She needs a red ticket and a blue card to enter the amusement park. She can get a red ticket if she has a yellow purse and a black umbrella. She can get a blue card if she has a yellow hat or a brown umbrella. If she has a green bag, she can have a yellow hat, a yellow purse and a yellow umbrella. Which pair of items will help her enter the amusement park?
- yellow purse and brown umbrella
 - green bag and brown umbrella
 - yellow umbrella and blue card
 - green bag and black umbrella
36. Grace is taller than Dianne but shorter than Samantha. Samantha is shorter than Stephanie, and Dianne is taller than Gwyneth. Which of them is the tallest?
- | | |
|------------|--------------|
| a. Dianne | c. Samantha |
| b. Gwyneth | d. Stephanie |
37. Lance is either a philosopher, an author, or a doctor. If he is a philosopher, he will think outside the box. If he is an author, his

- novels will be known all over the country. If he is a doctor, he will be relocated to a health center in Mindanao. Lance does not think outside the box and he is not a doctor. What will be the conclusion?
- Lance will not be relocated in a health center in Mindanao.
 - Lance's novels will be known all over the country.
 - Lance is a philosopher.
 - Lance is not an author.
38. If pigs fly, then cats swim. If cats swim, then dogs hate mice.
If dogs hate mice, then birds crawl.
Therefore, pigs do not fly.
Which statement could be an assumption to make the conclusion **true**?
- Dogs swim.
 - Cats hates mice.
 - Birds do not crawl.
 - Cats do not hate mice.
39. Kat is a student of ABC University. All students of ABC University are hardworking. Therefore, Kat will be successful in life. Which is a **best** assumption that will make the conclusion true?
- All hardworking people are successful in life.
 - If a person is successful in life, then he was a student of ABC University.
 - All people who are successful in life are hardworking.
 - If a person is hardworking, then he was a student of ABC University.
40. A number is divisible by 15 if it is both divisible by 5 and 3.
1 935 is divisible by both 5 and 3.
Therefore, 1 935 is divisible by 15.
- Certainly true
 - More likely to be true
 - More likely to be false
 - Certainly false
41. The first 6 numbers in the sequence are 8, 13, 19, 26, 34, and 43. The next number in the sequence is 53.
- Certainly true
 - More likely to be true
 - More likely to be false
 - Certainly false
42. No givers are takers. No takers are receivers. Therefore, no receivers are givers.
- Certainly true
 - More likely to be true
 - More likely to be false
 - Certainly false
43. If Bill will study Law at Harvard University, then Steve will graduate with a bachelor's degree. Bill did not study Law at Harvard University. Therefore, Steve did not graduate with a bachelor's degree.
- Certainly true
 - More likely to be true
 - More likely to be false
 - Certainly false
44. All graphic artists are adventurers. All adventurers are always cheerful. Maja is a graphic artist. Therefore, Maja is always cheerful.
- Certainly true
 - More likely to be true
 - More likely to be false
 - Certainly false
45. Every month of December, my godfather gives me presents. Therefore, my godfather will not give me a present this coming December.
- Certainly true
 - More likely to be true
 - More likely to be false
 - Certainly false



Answers and Explanations

Mathematics - Solutions

1. b. 140.00

$$\begin{aligned}\text{regular price} &= \frac{\text{discounted price}}{1 - \text{discount rate}} \\ &= \frac{315.00}{1 - 0.25} = \frac{315.00}{0.75} \\ &= 420\end{aligned}$$

The original price of a chicken combo meal is $420 \div 3 = \text{Php } 140$.

2. b. 58

Assume that the number is 100.

decreasing the number by 40%
 $100 - 40 = 60$

decreasing the result by 30%
 $60 - 0.30(60) = 42$

Hence, $100 - 42 = 58$.

3. a. 32

This problem involves indirect variation.
Use the formula

$$(\text{worker}_1)(\text{time}_1) = (\text{worker}_2)(\text{time}_2)$$

$$(48)(60) = (x)(60 - 24)$$

$$\frac{(48)(60)^{10}}{36^6} = \frac{(x)(36)}{36}$$

$$\cancel{8} \frac{(48)(10)}{\cancel{6}} = x$$

$$80 = x$$

It would take $80 - 48 = 32$ more workers.

4. d. Php 400 000 000

$8x$ - amount received by Egbert

$17x$ - amount received by Leonardo

Leonardo's share - Egbert's share = 144 000 000

$$17x - 8x = 144 000 000$$

$$9x = 144 000 000$$

$$x = 16 000 000$$

Therefore, Don Facundo's asset is

$17x + 8x = 25x$, which is equivalent to
 $25(16 000 000) = \text{Php } 400 000 000$.

5. a. $\{5, 7\}$

$A \cap B \cap C$ means the intersection of sets A , B , and C . Hence, get the elements that are common to A , B , and C .

$$A \cap B \cap C = \{5, 7\}$$

6. c. $2x^2 + x^3$

$$\begin{aligned}(x + x + x \cdot x) \cdot x &= (2x + x^2)(x) \\ &= 2x^2 + x^3\end{aligned}$$

7. a. -10

$$\text{Recall: } a^{-n} = \frac{1}{a^n}$$

$$\begin{aligned}&\left(-3 \underbrace{x^{-2}}_{\downarrow}\right) (-3x)^2 \div 3 - x^0 \\ &\left(-3 \cdot \frac{1}{x^2}\right)\end{aligned}$$

Recall: $(ab)^m = a^m b^m$

$$\left(-3 \cdot \frac{1}{x^2}\right) \underbrace{\left(-3x\right)^2}_{\downarrow} \div 3 - x^0$$

$$\left(-3 \cdot \frac{1}{x^2}\right) \left(9x^2\right)$$

Follow PEMDAS,

$$\begin{aligned} & \left(\frac{-3}{x^2}\right) \left(9x^2\right) \div 3 - x^0 \\ & \quad \downarrow \\ & \overbrace{-27 \quad \div 3 - x^0}^{\downarrow} \\ & \quad \downarrow \\ & \overbrace{-9 \quad - 1}^{\downarrow} \\ & \quad \downarrow \\ & -10 \end{aligned}$$

8. a. $\left(\frac{2}{n}\right)^n$

Recall: $\frac{a^m}{a^n} = a^{m-n}$

$$\frac{2^n n^n}{n^{2n}} = 2^n n^{n-2n}$$

$$= 2^n n^{-n}$$

$$= \frac{2^n}{n^n}$$

$$= \left(\frac{2}{n}\right)^n$$

9. d. $-20ab + 15b^2$

Recall:

Square of a binomial: $(a+b)^2 = a^2 + 2ab + b^2$

FOIL Method $(a+b)(c+d) = ac + ad + bc + db$

$$3 \underbrace{(a-2b)^2}_{\downarrow} - \underbrace{(3a-b)(a+3b)}_{\downarrow}$$

$$3[a^2 - 2(a)(2b) + (2b)^2] - [(3a)(a) + (3a)(3b) + (-b)(a) + (-b)(3b)]$$

Simplify.

$$\begin{aligned} & 3(a^2 - 4ab + 4b^2) - (3a^2 + 9ab - ab - 3b^2) \\ & 3a^2 - 12ab + 12b^2 - 3a^2 - 9ab + ab + 3b^2 \\ & -20ab + 15b^2 \end{aligned}$$

10. c. -13

Cross-multiply

$$\begin{aligned} 3[-(x+3)] &= 2(-x+2) \\ -3x - 9 &= -2x + 4 \\ -9 - 4 &= -2x + 3x \\ -13 &= x \end{aligned}$$

11. a. $w = \frac{S - 2hl}{2h + 2l}$

$$S = 2(lw + lh + wh)$$

$$S = 2lw + 2lh + 2wh$$

$$S - 2lh = 2lw + 2wh$$

$$S - 2lh = w(2l + 2h)$$

$$\frac{S - 2lh}{2l + 2h} = w$$

12. b. 2

Substitute $p = -3$ then solve for k .

$$5k - p^2 = 1$$

$$5k - (-3)^2 = 1$$

$$5k - 9 = 1$$

$$5k = 10$$

$$k = 2$$

13. c. $x \geq 0$

$$\begin{aligned}x + 2x &\leq 4x \\3x &\leq 4x \\-x &\leq 0 \\x &\geq 0\end{aligned}$$

14. d. $-4 < x < 12$

Isolate the term containing absolute value.

$$\begin{aligned}5 - |4 - x| &> -3 \\-|4 - x| &> -3 - 5 \\-|4 - x| &> -8 \\|4 - x| &< 8\end{aligned}$$

Recall that $|a| < b, b > 0 \rightarrow -b < a < b$.

Hence, $-8 < 4 - x < 8$

$$\begin{aligned}-12 &< -x < 4 \\12 &> x > -4 \\-4 &< x < 12\end{aligned}$$

15. b. 57

| | Now | in 4 years |
|---------------|------|------------|
| Uncle Lorenzo | $7x$ | $7x + 4$ |
| Pipo | x | $x + 4$ |

In 4 years,

$$\text{age of Uncle Lorenzo} = 5(\text{age of Pipo})$$

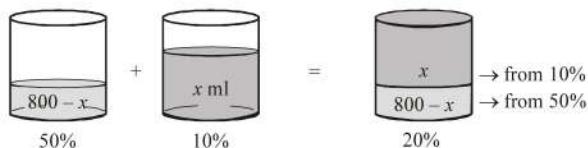
$$\begin{aligned}7x + 4 &= 5(x + 4) \\7x + 4 &= 5x + 20 \\7x - 5x &= 20 - 4 \\2x &= 16 \\x &= 8\end{aligned}$$

Hence, the age of Uncle Lorenzo next year will be

$$7x + 1 = 7(8) + 1 = 56 + 1 = 57.$$

16. d. 600 mL

Let x - volume of 10% brine solution used



| | percent concentration | number of ml | amount of brine |
|-------------------|-----------------------|--------------|-----------------|
| solution 1 | 50% | $800 - x$ | $50(800 - x)$ |
| solution 2 | 10% | x | $10x$ |
| resulting mixture | 20% | 800 | 20(800) |

$$\begin{aligned}50(800 - x) + 10x &= 20(800) \\40000 - 50x + 10x &= 16000 \\-40x + 40000 &= 16000 \\-40x &= -24000 \\x &= 600\end{aligned}$$

17. a. 47 and 49

Let x - first odd integer
 $x + 2$ - second odd integer

$$x + (x + 2) < 100$$

$$2x + 2 < 100$$

$$2x < 98$$

$$x < 49$$

Among the choices, only choice (a) 47 and 49 satisfies the given condition.

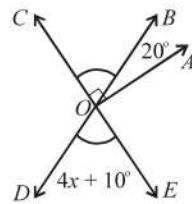
18. c. 15

Since $OA \perp OC$, then $\angle COA$ is a right angle. Hence,

$$m\angle COB = 90 - 20 = 70^\circ.$$

Then, $\angle COB$ and $\angle DOE$ are vertical angles.

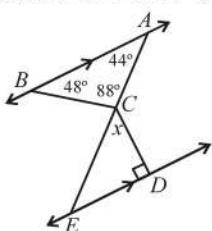
$$\begin{aligned}m\angle DOE &= m\angle COB \\4x + 10 &= 70 \\4x &= 60 \\x &= 15\end{aligned}$$



19. d. 46

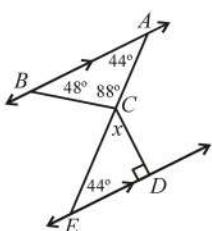
The sum of the interior angles of a triangle is 180.

Hence, in $\triangle ABC$, the measure of $\angle BAC$ is $180 - 48 - 88 = 44^\circ$.



In parallel lines cut by a transversal, alternate interior angles are congruent. Since $\overline{BA} \parallel \overline{ED}$,

then $m\angle DEC = 44^\circ$.

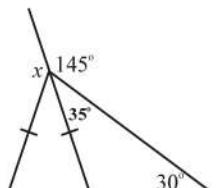


Therefore,

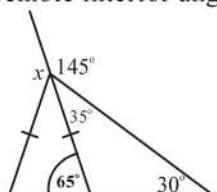
$$x = m\angle DCE = 180 - 90 - 44 = 46^\circ$$

 20. b. 130°

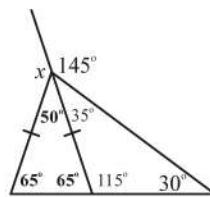
In a straight line, the angle formed is 180° . Hence,



The measure of the exterior angle of a triangle is equal to the sum of the measure of the two remote interior angles. Hence,



The base angles of an isosceles triangle are congruent and the sum of the measure of the interior angles is 180° .



Therefore, the value of x is $180 - 50 = 130^\circ$.

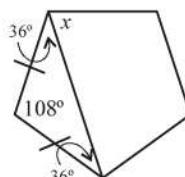
 21. c. 72°

The sum of the interior angles of a regular polygon is given by the formula $(n - 2) \times 180^\circ$.

Hence, for a pentagon ($n = 5$),

$$\text{sum} = (5 - 2) \times 180^\circ = (3)(180^\circ) = 540^\circ.$$

Each angle of the regular pentagon measures $540^\circ \div 5 = 108^\circ$.



Therefore, $x = 108^\circ - 36^\circ = 72^\circ$.

 22. c. $2m(m - 2)(m^2 + 2m + 4)$

$$2m^4 - 16m$$

$$\text{Factor out the GCF, } 2m \quad 2m(m^3 - 8)$$

Factor using Difference of Two Cubes

$$2m(m - 2)(m^2 + 2m + 4)$$

 23. b. $x^2 + 8x - 18$

A prime polynomial is a polynomial that cannot be factored.

$$\text{a. } 5x^2 + 45 = 5(x^2 + 9)$$

$$\text{b. } x^2 + 8x - 18 \rightarrow \text{prime}$$

$$\begin{aligned}
 \text{c. } x^3 - 3x^2 + 3x - 9 &= (x^3 - 3x^2) + (3x - 9) \\
 &= x^2(x - 3) + 3(x - 3) \\
 &= (x - 3)(x^2 + 3)
 \end{aligned}$$

$$\text{d. } x^6 + y^6 = (x^2 + y^2)(x^4 - x^2y^2 + y^4)$$

$$24. \text{ a. } \frac{1}{3x - 9}$$

In dividing fractions, recall that

$$\frac{a}{b} \div \frac{c}{d} \rightarrow \frac{a}{b} \cdot \frac{d}{c}.$$

Hence,

$$\frac{x^2 - 2x}{x^2 - 6x + 9} \cdot \frac{1}{3x} \cdot \frac{x^2 - x - 6}{x^2 - 4}$$

Factor the numerators and the denominators.

$$\frac{x(x - 2)}{(x - 3)(x - 3)} \cdot \frac{1}{3x} \cdot \frac{(x - 3)(x + 2)}{(x - 2)(x + 2)}$$

Cancel all common factors.

$$\cancel{\frac{x(x - 2)}{(x - 3)(x - 3)}} \cdot \frac{1}{3\cancel{x}} \cdot \cancel{\frac{(x - 3)(x + 2)}{(x - 2)(x + 2)}}$$

Therefore,

$$\frac{1}{3(x - 3)} = \frac{1}{3x - 9}$$

$$25. \text{ d. } \frac{6x + 4}{x(x - 2)(x + 1)}$$

$$\begin{aligned}
 \frac{4}{x^2 - 2x} - \frac{2}{2 + x - x^2} &= \frac{4}{x^2 - 2x} - \frac{2}{-(x^2 - x - 2)} \\
 &= \frac{4}{x^2 - 2x} + \frac{2}{x^2 - x - 2}
 \end{aligned}$$

Factor the denominators.

$$\frac{4}{x(x - 2)} + \frac{2}{(x - 2)(x + 1)}$$

Rewrite each fraction in terms of the LCD, $x(x - 2)(x + 1)$

$$\frac{4(x + 1)}{x(x - 2)(x + 1)} + \frac{2x}{x(x - 2)(x + 1)}$$

Add and simplify

$$\frac{4x + 4 + 2x}{x(x - 2)(x + 1)} = \frac{6x + 4}{x(x - 2)(x + 1)}$$

$$26. \text{ b. } x^3 - x$$

Multiply both the numerator and the denominator of the complex fraction by the LCD of all the denominators, which is x^2 .

$$\frac{x - \frac{1}{x}}{\frac{1}{x^2}} \cdot \frac{x^2}{x^2} = \frac{\left(x - \frac{1}{x}\right)(x^2)}{\left(\frac{1}{x^2}\right)(x^2)} = \frac{x^3 - x}{1} = x^3 - x$$

$$27. \text{ a. } 56$$

Multiply both sides of the equation by the LCD, $7xy$.

$$7xy \left(\frac{1}{x} - \frac{1}{y} \right) = 7xy \left(\frac{3}{7} \right)$$

$$\frac{7xy}{x} - \frac{7xy}{y} = \frac{(7xy)(3)}{7}$$

$$7y - 7x = 3xy$$

$$7(y - x) = 3xy$$

Since $y - x = 24$, then

$$7(y - x) = 3xy$$

$$7(24) = 3xy$$

$$\cancel{\frac{7(24)}{3}} = \frac{3xy}{3}$$

$$7(8) = xy$$

$$xy = 56$$

28. b. $f(t) = 50 - \frac{15}{2}t$

The car consumes 30 L of gasoline for 4 hours or $\frac{30\text{L}}{4\text{ hrs}} = \frac{15}{2}$ L/h. For t hours, the car consumes $\frac{15}{2}t$ liters of gasoline.

Thus, the amount of gasoline remaining in the car after driving for t hours is $50 - \frac{15}{2}t$.

29. a. 0

$$(g \circ h)(0) = g(h(0))$$

Evaluate $h(0)$:

$$h(0) = \frac{0-4}{2} = \frac{-4}{2} = -2$$

Hence,

$$\begin{aligned} g(h(0)) &= g(-2) \\ &= 4 - (-2)^2 = 4 - 4 = 0 \end{aligned}$$

30. d. undefined

The line $x = -3$ is a vertical line. Hence, the slope is undefined.

For horizontal line, the equation is of the form $y = b$ and the slope is 0.

31. d. $x = 2y$

Two lines are perpendicular if $m_1 \cdot m_2 = -1$

$$\text{or } m_1 = -\frac{1}{m_2}.$$

The slope of the given line $y = -2x + 3$ is $m_1 = -2$. Hence, the required slope for the perpendicular line is

$$m_2 = -\frac{1}{m_1} = -\frac{1}{(-2)} = \frac{1}{2}.$$

a. $x + 2y = 5$

$$2y = -x + 5$$

$$y = -\frac{x}{2} + \frac{5}{2} \rightarrow m = -\frac{1}{2}$$

b. $2x - y = -2$

$$-y = -2x - 2$$

$$y = 2x + 2 \rightarrow m = 2$$

c. $x = -2y + 7$

$$2y = -x + 7$$

$$y = -\frac{x}{2} + \frac{7}{2} \rightarrow m = -\frac{1}{2}$$

d. $x = 2y$

$$2y = x$$

$$y = \frac{x}{2} \rightarrow m = \frac{1}{2}$$

32. a. 8

Determine the point of intersection of the two lines.

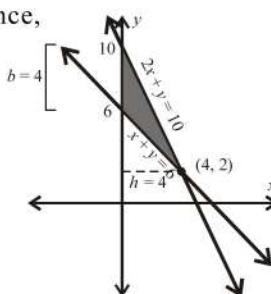
$$\begin{array}{rcl} 2x + y = 10 & & x + y = 6 \\ -x + y = 6 & & \\ \hline x & = 4 & y = 2 \end{array}$$

The y -intercept of the given lines are

$$\begin{array}{rcl} 2x + y = 10 & & x + y = 6 \\ 2(0) + y = 10 & & 0 + y = 6 \\ y = 10 & & y = 6 \end{array}$$

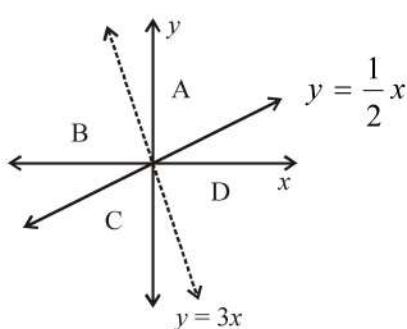
The shaded region is a triangle with base 4 and height 4. Hence,

$$\begin{aligned} \text{Area} &= \frac{1}{2}bh \\ &= \frac{1}{2}(4)(4) \\ &= 8 \end{aligned}$$



33. b. B

Get a test point in each region. Substitute each test point in the given system.



$$y \geq \frac{1}{2}x$$

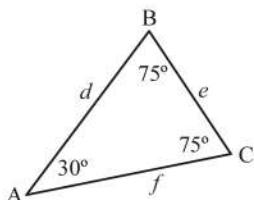
$$y < -3x$$

$$A(1, 1) \quad 1 \geq \frac{1}{2}(1) \rightarrow \text{true} \quad 1 < -3(1) \rightarrow \text{false}$$

$$B(-1, 1) \quad 1 \geq \frac{1}{2}(-1) \rightarrow \text{true} \quad 1 < -3(-1) \rightarrow \text{true}$$

$$C(-1, -1) \quad -1 \geq \frac{1}{2}(-1) \rightarrow \text{false} \quad -1 < -3(-1) \rightarrow \text{true}$$

$$D(1, -1) \quad -1 \geq \frac{1}{2}(1) \rightarrow \text{false} \quad -1 < -3(1) \rightarrow \text{false}$$

34. d. $e < d = f$ 

Since two angles of the triangle have equal measure, $m\angle B = m\angle C = 75^\circ$, the two sides opposite these two angles are also equal. Thus, $d = f$.

Theorem: If the measure of two angles of a triangle are unequal, then the sides opposite them are also unequal. The side opposite the angle with a larger measure is the longer angle.

Thus, $m\angle A < m\angle C \rightarrow e < d$.

35. a. $\frac{1}{-4^2}$

Solve for the value of each of the choices.

$$\text{a. } -4^{\frac{1}{2}} = -\sqrt{4} = -2$$

$$\text{b. } -4^{-\frac{1}{2}} = -\frac{1}{4^{\frac{1}{2}}} = -\frac{1}{\sqrt{4}} = -\frac{1}{2}$$

$$\text{c. } \left(\frac{1}{4}\right)^{\frac{1}{2}} = (4)^{\frac{1}{2}} = \sqrt{4} = 2$$

$$\text{d. } \left(-\frac{1}{4}\right)^2 = \frac{1}{16}$$

Among the choices, the smallest value is -2 . Thus, the answer is (a).

$$\text{36. b. } \frac{1+\sqrt{3}}{2}$$

Multiply the numerator and the denominator by $3 + \sqrt{3}$.

$$\begin{aligned} \frac{\sqrt{3}}{3-\sqrt{3}} \cdot \frac{3+\sqrt{3}}{3+\sqrt{3}} &= \frac{\sqrt{3}(3+\sqrt{3})}{(3)^2 - (\sqrt{3})^2} \\ &= \frac{3\sqrt{3}+3}{9-3} \\ &= \frac{3(\sqrt{3}+1)}{6} = \frac{\sqrt{3}+1}{2} \end{aligned}$$

37. a. $83 - 8\sqrt{15}$

Square of a Binomial:

$$\begin{aligned} (a+b)^2 &= a^2 + 2ab + b^2; (a-b)^2 \\ &= a^2 - 2ab + b^2 \end{aligned}$$

$$\begin{aligned} (4\sqrt{5} - \sqrt{3})^2 &= (4\sqrt{5})^2 - 2(4\sqrt{5})(\sqrt{3}) + (\sqrt{3})^2 \\ &= 16(5) - 8\sqrt{15} + 3 = 83 - 8\sqrt{15} \end{aligned}$$

38. c. 25

Isolate the term containing radical.

$$x - 4\sqrt{x} = 5$$

$$x - 5 = 4\sqrt{x}$$

Square both sides.

$$(x - 5)^2 = (4\sqrt{x})^2$$

$$x^2 - 10x + 25 = 16x$$

$$x^2 - 26x + 25 = 0$$

$$(x - 25)(x - 1) = 0$$

$$x - 25 = 0$$

$$x = 25$$

 Check: $x = 25$

$$25 - 4\sqrt{25} = 5$$

$$25 - 4(5) = 5$$

$$25 - 20 = 5$$

$$5 = 5$$

 $x = 1:$

$$1 - 4\sqrt{1} = 5$$

$$1 - 4 = 5$$

$$-3 \neq 5$$

Therefore, the answer is (c) 25.

39. c. the force is quadrupled

 Let F - force of attraction

 k - constant of variation

 d - distance between the two objects

$$F = \frac{k}{d^2}$$

If the distance is halved, then

$$F_{new} = \frac{k}{\left(\frac{1}{2}d\right)^2}$$

$$F_{new} = \frac{k}{\frac{1}{4}d^2}$$

$$= \frac{4k}{d^2} = 4\left(\frac{k}{d^2}\right)$$

$$F_{new} = 4 \cdot F$$

Hence, the new force is 4 times the original.

40. d. 3 and -9

$$x(x + 5) = 27 - x$$

$$x^2 + 5x = 27 - x$$

$$x^2 + 5x + x - 27 = 0$$

$$x^2 + 6x - 27 = 0$$

$$(x + 9)(x - 3) = 0$$

$$x + 9 = 0$$

$$x - 3 = 0$$

$$x = -9$$

$$x = 3$$

41. b. -1

$$x^2 - 3 < 3 - x$$

$$x^2 + x - 6 < 0$$

Substitute the choices to the given inequality.

$$\text{a. } -4 \quad x^2 + x - 6 < 0$$

$$(-4)^2 + (-4) - 6 < 0$$

$$16 - 10 < 0$$

$$6 < 0 \rightarrow \text{false}$$

$$\text{b. } -1 \quad x^2 + x - 6 < 0$$

$$(-1)^2 + (-1) - 6 < 0$$

$$1 - 7 < 0$$

$$-6 < 0 \rightarrow \text{true}$$

$$\text{c. } 2 \quad x^2 + x - 6 < 0$$

$$(2)^2 + (2) - 6 < 0$$

$$4 - 4 < 0$$

$$0 < 0 \rightarrow \text{false}$$

$$\text{d. } 5 \quad x^2 + x - 6 < 0$$

$$(5)^2 + (5) - 6 < 0$$

$$25 - 1 < 0$$

$$24 < 0 \rightarrow \text{false}$$

42. d. -4 and 2

To get the x -intercept, set $y = 0$.

$$x^2 + 2x - 8 = 0$$

$$(x + 4)(x - 2) = 0$$

$$\begin{array}{ll} x + 4 = 0 & x - 2 = 0 \\ x = -4 & x = 2 \end{array}$$

The x -intercepts are -4 and 2.

43. c. -2

In a quadratic function $f(x) = ax^2 + bx + c$,

the line of symmetry is $x = -\frac{b}{2a}$.

Thus,

$$x = -\frac{b}{2a}$$

$$2 = -\frac{8}{2a}$$

$$4a = -8$$

$$a = -2$$

44. d. -8

Consider the graph of both $f(x) = x^2 - 6$ and $g(x) = k - x^2$. f has a vertex at $(0, -6)$ and opens upward while g has a vertex at $(0, k)$ and opens downward.

For the two graphs not to intersect, $k < -6$ so that the parabola opening downward will be below the parabola opening upward.

Thus, only choice (d) satisfies the condition.

45. a. 20

$$R(x) = 40x - x^2 = -x^2 + 40x,$$

where $a = -1$, $b = 40$, $c = 0$.

Since the revenue function is quadratic, the maximum value occurs at the vertex.

$$x = -\frac{b}{2a} = -\frac{40}{2(-1)} = 20$$

46. d. 4 or 32

In order to achieve break-even, profit must be equal to 0. Hence,

$$\text{Profit} = \text{Revenue} - \text{Cost}$$

$$P(x) = R(x) - C(x)$$

$$= (40x - x^2) - (4x + 128)$$

$$0 = -x^2 + 36x - 128$$

$$x^2 - 36x + 128 = 0$$

$$(x - 32)(x - 4) = 0$$

$$x = 32 \text{ and } x = 4$$

47. c. 68 cm

Let x - width of the rectangle

$2x + 4$ - length of the rectangle

Using Pythagorean Theorem,

$$(\text{width})^2 + (\text{length})^2 = (\text{diagonal})^2$$

$$x^2 + (2x + 4)^2 = 26^2$$

$$x^2 + 4x^2 + 16x + 16 = 676$$

$$5x^2 + 16x - 660 = 0$$

$$(5x + 66)(x - 10) = 0$$

$$5x + 66 = 0 \qquad \qquad \qquad x - 10 = 0$$

$$5x = -66 \qquad \qquad \qquad x = 10$$

$$x = -\frac{66}{5}$$

Since measure cannot be negative, the width of the rectangle is 10 cm and the length is $2(10) + 4 = 24$. Hence, the perimeter of the rectangle is

$$P = 2(\text{length}) + 2(\text{width})$$

$$= 2(24) + 2(10)$$

$$= 48 + 20$$

$$= 68 \text{ cm}$$

48. c. 110°

The base angles of an isosceles trapezoid are congruent. Hence,

$$m\angle H = m\angle T$$

$$2x - 10 = x + 30$$

$$2x - x = 30 + 10$$

$$x = 40$$

Thus,

$$m\angle T = (x + 30)^\circ = (40 + 30)^\circ = 70^\circ.$$

Consecutive angles of an isosceles trapezoid are supplementary. Hence,

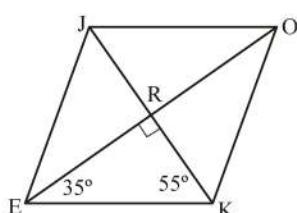
$$m\angle T + m\angle A = 180^\circ$$

$$m\angle A = 180^\circ - 70^\circ$$

$$m\angle A = 110^\circ$$

49. a. 70

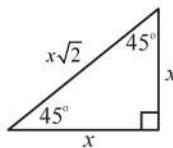
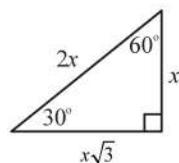
The diagonals of a rhombus are perpendicular. Since the sum of angles of a triangle is 180° , then $m\angle KER = 180^\circ - 90^\circ - 55^\circ = 35^\circ$.



Since the diagonal of a rhombus bisects the vertex angle, then $m\angle JEO = 35^\circ$. Thus, $m\angle JEK = 70^\circ$.

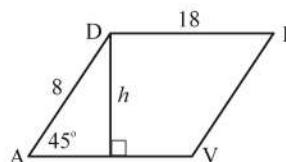
 50. a. $4\sqrt{2}$

Ratio of Sides of Special Right Triangles

 $30^\circ-60^\circ-90^\circ$
 $45^\circ-45^\circ-90^\circ$


Draw an altitude to \overline{AV} . Consider the triangle

formed.



Since the triangle is $45^\circ-45^\circ-90^\circ$, then

$$\text{hyp} = (\sqrt{2})(h)$$

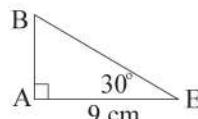
$$8 = (\sqrt{2})(h)$$

$$h = \frac{8}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{8\sqrt{2}}{2}$$

$$h = 4\sqrt{2}$$

 51. d. 108 cm^2

Consider $\triangle BAE$.



In a $30^\circ-60^\circ-90^\circ$,

$$AE = AB \cdot \sqrt{3}$$

$$9 = AB \cdot \sqrt{3}$$

$$AB = \frac{9}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{9\sqrt{3}}{3} = 3\sqrt{3}$$

$$BE = 2(AB) = 2(3\sqrt{3}) = 6\sqrt{3}$$

Thus, the side of the square has length $6\sqrt{3}$ cm. Therefore, the area is

$$\text{Area} = s^2 = (6\sqrt{3})^2 = 36(3) = 108 \text{ cm}^2$$

52. c. 30

Since \overline{LA} is a midsegment of $\triangle RCO$, $\overline{AL} \parallel \overline{CO}$ and $m\angle RAL = 90^\circ$.Using Pythagorean Theorem to find LA ,

$$AR^2 + AL^2 = RL^2$$

$$8^2 + AL^2 = 17^2$$

$$AL^2 = 289 - 64$$

$$AL^2 = 225$$

$$AL = 15$$

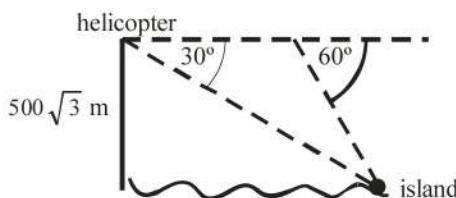
The length of the midsegment is half the length of the base. Since LA is the midsegment,

$$\text{midsegment} = \frac{1}{2}(\text{length of base})$$

$$LA = \frac{1}{2}CO$$

$$CO = 2LA = 2(15) = 30$$

53. b. 1 000 m

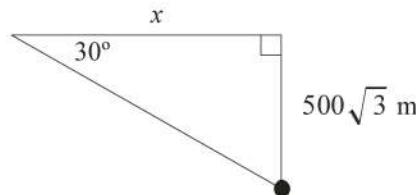


At the start,

$$\text{longer side} = (\text{shorter side})(\sqrt{3})$$

$$x = (500\sqrt{3})(\sqrt{3})$$

$$= 500(3) = 1500$$

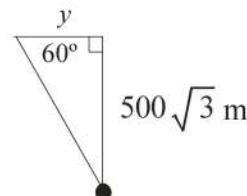


After 2 hours,

$$\text{longer side} = (\text{shorter side})(\sqrt{3})$$

$$500\sqrt{3} = (y)(\sqrt{3})$$

$$500 = y$$



Hence, the helicopter traveled a distance of $1500 - 500 = 1000$ m.

54. c. 9 : 25

Theorem: If two plane figures are similar, the ratio of their areas is equal to the square of the ratio of any two corresponding dimensions.

Thus,

$$\frac{\text{Surface area of 1st sphere}}{\text{Surface area of 2nd sphere}} = \left(\frac{d_1}{d_2}\right)^2 = \left(\frac{3}{5}\right)^2 = \frac{9}{25}$$

55. b. $1080\pi \text{ cm}^3$

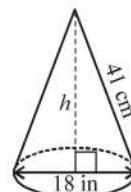
Determine the height of the cone using Pythagorean Theorem.

$$h^2 + 9^2 = 41^2$$

$$h^2 = 1681 - 81$$

$$h^2 = 1600$$

$$h = 40$$



Therefore, the volume of the cone is

$$\begin{aligned} V &= \frac{\pi r^2 h}{3} = \frac{\pi(9)^2(40)}{3} = \frac{\pi(81)(40)}{3} \\ &= \pi(27)(40) = 1080\pi \text{ cm}^3 \end{aligned}$$

56. d. 2 : 7



- counted as half square

shaded region = $4 \times$ half-square = 2 units

unshaded region

$$\begin{aligned} &= \text{area of square} - 4(\text{half square}) \\ &= 3^2 - 2 = 9 - 2 = 7 \end{aligned}$$

Hence, the ratio of the area of the shaded region to the area of the unshaded region is 2 : 7.

57. b. 17

Using Remainder Theorem,

$$\begin{aligned} (-2)^3 - 4(-2)^2 + 3(-2) + k &= -13 \\ -8 - 4(4) - 6 + k &= -13 \\ -30 + k &= -13 \\ k &= 17 \end{aligned}$$

 58. c. $\frac{5}{2}$ and 4

Since -3 is a zero of the function and using Synthetic Division,

$$\begin{array}{r} -3 \\ \hline 2 & -7 & -19 & 60 \\ & -6 & 39 & -60 \\ \hline 2 & -13 & 20 & 0 \end{array}$$

The function can be factored as follows:

$$\begin{aligned} f(x) &= 2x^3 - 7x^2 - 19x + 60 \\ &= (x + 3)(2x^2 - 13x + 20) \\ &= (x + 3)(2x - 5)(x - 4) \end{aligned}$$

Hence, the zeros of the functions

are -3 , $\frac{5}{2}$, and 4 .

59. c. 2047

The given series of numbers can be written as $2^0 + 2^1 + 2^2 + 2^3 + \dots + 2^{10}$, which is a geometric series with $r = 2$. The

sum is given by $S_n = \frac{a_1(1 - r^n)}{1 - r}$. Hence,

$$\begin{aligned} S_{11} &= \frac{(1)(1 - (2)^{11})}{1 - 2} \\ &= \frac{1 - 2048}{-1} = 2047 \end{aligned}$$

60. a. 1650

Let $a_1 = 3800$ bricks (first floor)

$a_2 = 3750$ bricks (second floor)

$a_3 = 3700$ bricks (third floor)

$$d = a_2 - a_1 = 3750 - 3800 = -50$$

The formula for the nth term of an arithmetic sequence is

$$a_n = a_1 + (n - 1)d.$$

Hence,

$$\begin{aligned} a_{44} &= 3800 + (44 - 1)(-50) \\ &= 3800 + (43)(-50) \\ &= 3800 - 2150 \\ &= 1650 \end{aligned}$$

61. d. 40 in

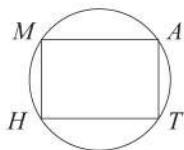
$$a_1 = 10 \text{ inches}; a_2 = \frac{3}{4}(10) = \frac{15}{2}; r = \frac{3}{4}$$

For infinite geometric series, the sum is

$$\text{given by } S_\infty = \frac{a_1}{1 - r}. \text{ Thus,}$$

$$S_\infty = \frac{10}{1 - \frac{3}{4}} = \frac{10}{\frac{1}{4}} = 40$$

62. b. $MATH$ is a rectangle



Since $\square MATH$ is inscribed in circle O , opposite angles are supplementary. At the same time $\overline{MA} \parallel \overline{TH}$ and $\overline{MH} \parallel \overline{TA}$.

Hence, $\square MATH$ is a parallelogram. Thus, opposite angles are congruent. Thus,

$$m\angle M + m\angle T = 180^\circ$$

$$m\angle M + m\angle M = 180^\circ$$

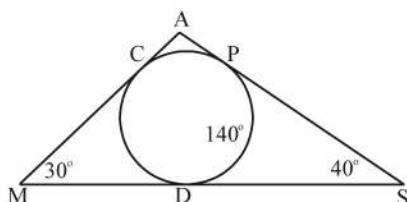
$$2m\angle M = 180^\circ$$

$$m\angle M = 90^\circ$$

Hence, $\angle M$ is a right angle. However, \overline{MA} and \overline{MT} are not necessarily congruent. Hence, $\square MATH$ is not necessarily a square.

63. a. 110°

The measure of an angle formed by two tangents of a circle intersecting at a point in the exterior of the circle is one-half the absolute value of the difference of the measures of the intercepted arcs.



$$\begin{aligned} m\angle S &= \frac{m\widehat{PCD} - m\widehat{DP}}{2} \\ &= \frac{220^\circ - 140^\circ}{2} = \frac{80^\circ}{2} \\ &= 40^\circ \end{aligned}$$

Hence in $\triangle MSA$,

$$m\angle M + m\angle S + m\angle A = 180^\circ$$

$$30^\circ + 40^\circ + m\angle A = 180^\circ$$

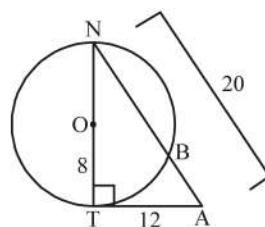
$$m\angle A = 180^\circ - 70^\circ$$

$$m\angle A = 110^\circ$$

64. c. 12.8

The diameter of a circle is perpendicular to a tangent segment at the point of tangency. Hence,

$$\begin{aligned} (NA)^2 &= (TN)^2 + (TA)^2 \\ &= 16^2 + 12^2 = 256 + 144 \\ &= 400 \\ NA &= 20 \end{aligned}$$



Theorem: If a tangent and a secant segment are drawn to a circle from the same exterior point, then the square of the length of a tangent segment is equal to the product of the lengths of one secant segment and its external segment.

$$AB \cdot AN = TA^2$$

$$AB + BN = AB$$

$$AB(20) = (12)^2$$

$$BN = 20 - 7.2$$

$$AB = \frac{144}{20} = 7.2$$

$$BN = 12.8$$

65. b. 20π

The length of the radius, r , is the distance between the center of the circle $(5, -4)$ and a point on the circle $(-3, 2)$.

$$r = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

$$r = \sqrt{(5 - (-3))^2 + (-4 - 2)^2}$$

$$r = \sqrt{(8)^2 + (-6)^2}$$

$$r = \sqrt{64 + 36}$$

$$r = \sqrt{100} = 10$$

Therefore, the circumference of the circle is $C = 2\pi r = 2\pi(10) = 20\pi$.

66. d. $(3, -1)$

Given $Ax^2 + By^2 + Cx + Dy + E = 0$, the coordinates of the center (h, k) of a circle, ellipse, or hyperbola is given by

$$h = -\frac{C}{2A} \quad k = -\frac{D}{2B}$$

In the given equation of the circle, $A = 1$, $B = 1$, $C = -6$, $D = 2$. Thus, the coordinates of the center is at

$$h = -\frac{C}{2A} = -\frac{-6}{2(1)} = 3$$

$$k = -\frac{D}{2B} = -\frac{2}{2(1)} = -1$$

67. b. 42

Fundamental Principle of Counting (Multiplication Rule):

In a sequence of events in which the first one has m_1 possibilities, the second has m_2 , the third has m_3 , and so on, and the total number of possible outcomes will be

$$m_1 \cdot m_2 \cdot m_3 \cdot \dots \cdot m_n$$

The first person will have 7 flavors to choose from. The second person will only have $7 - 1 = 6$ flavors to choose from.

Thus, the number of ways that they can select the doughnuts with two different flavors is $7(6) = 42$.

68. b. 15

Combination is an arrangement of objects/things without reference to the order in which they are arranged. The number of possible combinations of r objects from a collection of n objects is given by

$${}_n C_r = \frac{n!}{(n-r)!r!}.$$

In the given problem, there are $n = 6$ senators and $r = 4$ is chosen for the fact-finding committee. Hence,

$${}_6 C_4 = \frac{6!}{(6-4)!4!} = \frac{6!}{2!4!} = \frac{\cancel{6} \cdot \cancel{5} \cdot \cancel{4} \cdot \cancel{3} \cdot \cancel{2} \cdot 1}{\cancel{2} \cdot 1 \cdot \cancel{4} \cdot \cancel{3} \cdot \cancel{2} \cdot 1} = 15$$

69. a. $\frac{1}{3}$

Pairs of numbers whose positive difference is 3 or more:

$$(1, 4) (2, 5) (3, 6) (4, 1) (5, 2) (6, 3) (1, 5) (2, 6) (5, 1) (6, 2) (1, 6) (6, 1)$$

There are 12 such pairs. Since there are $6 \times 6 = 36$ possible outcomes when rolling a pair of dice, then the probability is

$$\begin{aligned} P(E) &= \frac{n(\text{positive difference is at least 3})}{n(\text{Sample Space})} \\ &= \frac{12}{36} = \frac{1}{3} \end{aligned}$$

70. b. 6

Arrange the numbers from least to greatest:

$$2, 3, 4, 5, 6, 7, 8, 8, 9$$

The median of a set of numbers is the middlemost number in the set. In this case, 6 is the median.

71. c. $x \geq 4$

The domain of a square root function

$$f(x) = a\sqrt{g(x)} + k \text{ is}$$

$$\text{domain} = \left\{ x \mid x \in \mathbb{R}, g(x) \geq 0 \right\}.$$

Hence,

$$\text{domain} = \left\{ x \mid x \in \mathbb{R}, x - 4 \geq 0 \right\} = \left\{ x \mid x \in \mathbb{R}, x \geq 4 \right\}$$

72. d. 1

Use $x^2 - 3$ since $2 \leq 3$.

$$f(x) = (2)^2 - 3 = 4 - 3 = 1$$

73. d. $y = 2$

For a rational function

$$f(x) = \frac{a_m x^m + a_{m-1} x^{m-1} + \dots + a_1 x + a_0}{b_n x^n + b_{n-1} x^{n-1} + \dots + b_1 x + b_0},$$

the horizontal asymptote is

i. $y = 0$ if $m < n$ ii. $y = \frac{a_m}{b_n}$ if $m = n$

In the given function $f(x) = \frac{2x^2 - 1}{x^2 + 5x + 6}$, $m = 2$

and $n = 2$. Hence, the horizontal asymptote is

$$y = \frac{2}{1} = 2.$$

74. d. $2 < x < 4$

$$\frac{4}{x-2} > 2$$

$$\frac{4}{x-2} - 2 > 0$$

$$\frac{4 - 2(x-2)}{x-2} > 0$$

$$\frac{4 - 2x + 4}{x-2} > 0$$

$$\frac{-2(x-4)}{x-2} > 0$$

$$\frac{2(x-4)}{x-2} < 0$$

Make a table of signs.

| | | 2 | 4 |
|---------|---|---|---|
| 2 | + | + | + |
| $x - 4$ | - | - | 0 |
| $x - 2$ | - | 0 | + |
| | + | - | + |

Therefore, the solution is $2 < x < 4$.

75. a. $y < 0$

The range of the exponential function

$f(x) = b^x$ where $b > 0$ is all positive real numbers. Hence, the range of the function $f(x) = -2^x$ is $y < 0$.

76. a. 7

Write both sides of the equation using the base 2.

$$8^{x-1} = 4^{x+2}$$

$$(2^3)^{x-1} = (2^2)^{x+2}$$

$$2^{3x-3} = 2^{2x+4}$$

If $b^u = b^v$, then $u = v$. Thus,

$$3x - 3 = 2x + 4$$

$$3x - 2x = 4 + 3$$

$$x = 7$$

77. a. 5

$$\log_3 243 = a$$

$$3^a = 243$$

$$3^a = 3^5$$

$$a = 5$$

78. c. 2

$$2 \log_{12} 4 + \log_{12} 9$$

$$= \log_{12} 4^2 + \log_{12} 9 \quad \text{Power rule for logarithms:}$$

$$\log_b M^r = r \log_b M$$

$$= \log_{12} 16 + \log_{12} 9$$

$$= \log_{12} (16)(9) \quad \text{Product rule for logarithms:}$$

$$\log_b M + \log_b N = \log_b MN$$

$$= \log_{12} 144$$

$$= \log_{12} (12)^2$$

$$= 2$$

$$\log_b b^r = r$$

79. a. 4 only

Use the product rule: $\ln M + \ln N = \ln MN$ to change the left side into a single logarithmic expression.

$$\ln x + \ln(x+4) = \ln 32$$

$$\ln(x)(x+4) = \ln 32$$

$$\ln(x^2 + 4x) = \ln 32$$

If $\ln M = \ln N$, then $M = N$. Hence,

$$x^2 + 4x = 32$$

Solve for the quadratic equation using factoring.

$$x^2 + 4x = 32$$

$$x^2 + 4x - 32 = 0$$

$$(x+8)(x-4) = 0$$

$$x = -8 \quad \text{or} \quad x = 4$$

Since the domain of the logarithmic function is all positive real numbers, the answer is 4 only.

80. b. 300°

To convert radians to degrees, multiply by

$$\frac{180}{\pi}. \quad \text{Hence,}$$

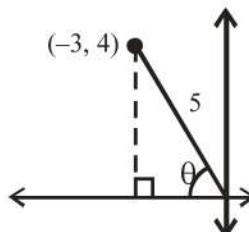
$$\frac{5\pi}{3} \cdot \frac{180}{\pi} = 300^\circ$$

81. a. $\frac{5}{4}$

Solve for the length of the hypotenuse.

$$r = \sqrt{(-3)^2 + (4)^2} = \sqrt{9+16} = \sqrt{25} = 5$$

$$\csc \theta = \frac{\text{hypotenuse}}{\text{opposite side of } \theta} = \frac{5}{4}$$



82. c. $\cos^2 A$

$$\frac{\cos A}{\sec A} = \frac{\cos A}{\frac{1}{\cos A}} = \cos A \cdot \frac{\cos A}{1} = \cos^2 A$$

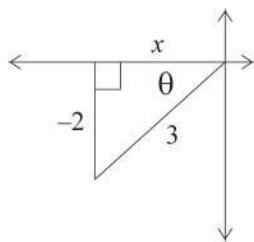
83. d. $\frac{4\sqrt{5}}{9}$

Since $\sin \theta = -\frac{2}{3} = \frac{\text{opposite side of } \theta}{\text{hypotenuse}}$, then

$$x^2 + (-2)^2 = (3)^2$$

$$x^2 = 9 - 4 = 5$$

$$x = \pm\sqrt{5}$$



Since θ is in Quadrant III, use $x = -\sqrt{5}$.

Hence,

$$\sin 2\theta = 2 \sin \theta \cos \theta$$

$$= 2 \left(-\frac{2}{3} \right) \left(\frac{-\sqrt{5}}{3} \right) = \frac{4\sqrt{5}}{9}$$

84. d. $4 - 3i$

$$\frac{(i+2)^2}{i} = \frac{i^2 + 4i + 4}{i} = \frac{(-1) + 4i + 4}{i} = \frac{3 + 4i}{i}$$

Rationalize the denominator.

$$\frac{3 + 4i}{i} \cdot \frac{i}{i} = \frac{3i + 4i^2}{i^2} = \frac{3i + 4(-1)}{-1} = \frac{3i - 4}{-1} = 4 - 3i$$

85. d. $(0, 0)$ and $(6, 0)$

$$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$$

Properties:

transverse axis is parallel to the x -axis

center (h, k)

vertices $(h-a, k)$ and $(h+a, k)$

$$\frac{(x-3)^2}{9} - \frac{y^2}{16} = 1$$

Center of hyperbola = $(3, 0)$

vertices: $(3-3, 0) = (0, 0)$

and $(3+3, 0) = (6, 0)$

86. a. -2

$$\begin{aligned} \lim_{x \rightarrow 3} \left(\frac{x^2 - 9}{x^2 - 9x + 18} \right) &= \lim_{x \rightarrow 3} \left(\frac{\cancel{(x-3)}(x+3)}{\cancel{(x-3)}(x-6)} \right) = \lim_{x \rightarrow 3} \left(\frac{x+3}{x-6} \right) \\ &= \frac{3+3}{3-6} = \frac{6}{-3} = -2 \end{aligned}$$

87. c. 9

Let $s(t)$ - position of particle at time t

$v(t)$ - velocity of particle at time t

$a(t)$ - acceleration of particle at time t

$$s'(t) = v(t)$$

$$v'(t) = a(t)$$

Since particle starts at origin, then

$s(0) = 0$. Since particle is initially at rest, $v(0) = 0$. Since $a(t) = 2t$, then $v(t)$ is antiderivative of $a(t)$.

Thus, $v(t) = t^2 + c$.

$$v(0) = 0^2 + c \rightarrow c = 0$$

$$v(t) = t^2$$

Also, $s(t)$ is the antiderivative of $v(t)$. Hence,

$$s(t) = \frac{1}{3}t^3 + c$$

$$s(0) = \frac{1}{3}(0)^3 + c \rightarrow c = 0$$

Hence, $s(t) = \frac{1}{3}t^3$. Thus, position of particle at time $t = 3$ is

$$s(3) = \frac{1}{3}(3)^3 = \frac{1}{3}(27) = 9$$

88. a. 4 sq. units

The area under the curve of $f(x)$ is given

by $\int_a^b f(x) dx$ if f is always above the x -axis in interval $[a, b]$. Thus, the area is the given figure is

$$\begin{aligned} \text{Area} &= \int_0^{\ln 5} e^x dx \\ &= e^x \Big|_0^{\ln 5} = e^{\ln 5} - e^0 \\ &= 5 - 1 = 4 \text{ square units} \end{aligned}$$

89. c. 340 000

Let x - number of tickets sold

$$\text{Revenue} = 450x$$

$$\text{Cost} = 18\,000\,000$$

$$\text{Profit} = \text{Revenue} - \text{Cost}$$

$$135\,000\,000 = 450x - 18\,000\,000$$

$$153\,000\,000 = 450x$$

$$x = 340\,000$$

90. b. ${}_6C_4(0.4)^4(0.6)^2$

The problem is a Binomial Distribution with $p = 0.40$, $q = 1 - 0.40 = 0.60$, $n = 6$, and $x = 4$. The probability is given by

$$P(X = x) = {}_nC_x p^x q^{n-x}$$

Using the formula,

$$\begin{aligned} P(X = 4) &= {}_6C_4(0.4)^4(0.6)^{6-4} \\ &= {}_6C_4(0.4)^4(0.6)^2 \end{aligned}$$

91. a. $\frac{{}_8C_3 \cdot {}_7C_1}{{}_{15}C_4} + \frac{{}_8C_4 \cdot {}_7C_0}{{}_{15}C_4}$

Use the formula for Hypergeometric Distribution,

$$P(X = x) = \frac{k C_x \cdot {}_{N-k}C_{n-x}}{N C_n}$$

with $N = 15$, $n = 4$, $k = 8$, and $x = 3$ and 4 (since it is at least 3).

$$P(X = 3) + P(X = 4) = \frac{{}_8C_3 \cdot {}_7C_1}{{}_{15}C_4} + \frac{{}_8C_4 \cdot {}_7C_0}{{}_{15}C_4}$$

92. a. $170.2 < \mu < 189.8$

Since $n = 81$ ($n > 30$), $\bar{x} = 180$, and $s = 45$, use the formula for the confidence interval for μ .

$$\bar{x} - z_{\alpha/2} \left(\frac{s}{\sqrt{n}} \right) < \mu < \bar{x} + z_{\alpha/2} \left(\frac{s}{\sqrt{n}} \right)$$

In the given problem, $\alpha = 0.05$ and $z_{\alpha/2} = 1.96$. Thus,

$$\bar{x} - z_{\alpha/2} \left(\frac{s}{\sqrt{n}} \right) < \mu < \bar{x} + z_{\alpha/2} \left(\frac{s}{\sqrt{n}} \right)$$

$$180 - 1.96 \left(\frac{45}{\sqrt{81}} \right) < \mu < 180 + 1.96 \left(\frac{45}{\sqrt{81}} \right)$$

$$180 - 1.96(5) < \mu < 180 + 1.96(5)$$

$$180 - 9.8 < \mu < 180 + 9.8$$

$$170.2 < \mu < 189.8$$

93. a. The claim of the review center is true. Since the data is in terms of proportions, this is a case of Hypothesis Testing with Proportions.

I. State the hypotheses

$$H_o: p \geq 0.90$$

$$H_a: p < 0.90$$

II. Level of Significance, critical value, and rejection region:

$$\alpha = 0.10 \rightarrow z_{\alpha} = -1.28 \text{ (a left-tailed test)}$$

$$\hat{p} = \frac{368}{400} = 0.92 ; p = 0.90 ; q = 0.10 ;$$

$$n = 400$$

III. Decision rule: Reject H_o if $z_c < -1.28$.

IV. Compute the test statistic:

$$z_c = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}} = \frac{0.92 - 0.90}{\sqrt{\frac{(0.90)(0.10)}{400}}} = \frac{0.02}{\frac{0.3}{20}} = \frac{4}{3} = 1.33$$

Since $z_c = 1.33$ is not in the rejection region, do not reject H_0 and conclude that the review center's claim is true.

94. d. Both a and b.

Given the regression line, it shows that it has a negative correlation and a negative slope. Since it has a negative correlation, as one variable increases, the other variable decreases. Only choice (c) does not describe the figure correctly.

95. a. Php 102 000

Use the formula $P = F(1 - dt)$ where

F - future amount

P - the discounted amount

d - discount rate

t - number of years.

Hence, given $F = 120\ 000$, $d = 0.05$, and $t = 3$

$$P = F(1 - dt) = 120\ 000(1 - (0.05)(3))$$

$$P = 120\ 000(1 - 0.15) = 120\ 000(0.85)$$

$$P = 102\ 000$$

96. d. 14.49%

Given a nominal rate $j = 0.14$ and $m = 2$ (semi-annually), the effective rate r is given by

$$r = \left(1 + \frac{j}{m}\right)^m - 1$$

$$r = \left(1 + \frac{0.14}{2}\right)^2 - 1$$

$$r = (1 + 0.07)^2 - 1$$

$$r = (1.07)^2 - 1 = 1.1449 - 1$$

$$r = 0.1449 = 14.49\%$$

97. b. II only

General ordinary annuity - an annuity where payment is made *at the end of every payment interval*. It is also where the number of compounding period is different from the number of payment interval.

98. a. 247

Step 1: To compute for the average daily balance, set up a chart that lists the activity in the account by date.

Step 2: Count the number of days for each transaction until the next transaction.

Step 3: List down the transaction and the corresponding amount.

Step 4: The Unpaid Balance is obtained by adding Previous Unpaid Balance and the next amount of transaction. For example, for November 5 - 15, the unpaid balance is $6000 + 2400 = 8400$.

Step 5: The Daily Balance is the product of the number of days and the unpaid balance. For November 5 - 15, the daily balances is $11 \text{ days} \times 8400 = 92400$.

| Date | No. of days | Amount | Unpaid Balance | Daily Balance |
|---------------------|-------------|------------------|----------------|---------------|
| Nov 1-4 | 4 | Previous Balance | 6000 | 24 000 |
| Nov 5-15 | 11 | 2 400 | 8 400 | 92 400 |
| Nov 16-21 | 6 | -7 000 | 1 400 | 8 400 |
| Nov 22-30 | 9 | 1 200 | 2 600 | 23 400 |
| Total Daily Balance | | | | 148 200 |

$$\begin{aligned} \text{Average Daily Balance} &= \frac{\text{Total Daily Balance}}{\text{Total number of days}} \\ &= \frac{148\ 200}{30} = 4\ 940 \end{aligned}$$

The finance charge with an interest rate of 5% is

Finance charge = Average daily balance \times interest rate

$$= (4\ 940)(0.05) = 247$$

99. a. $5000 \left[\frac{1 - (1.005)^{-120}}{0.005} \right]$

Use simple ordinary annuity since the payment interval is the same as the compounding period.

Given: $R = 5000, j = 0.06, i = \frac{j}{m} = \frac{0.06}{12} = 0.005,$

$m = 12, t = 10, n = mt = (12)(10) = 120$

Use the formula for the present value.

$$A = R \left[\frac{1 - (1 + i)^{-n}}{i} \right] = 5000 \left[\frac{1 - (1 + 0.005)^{-120}}{0.005} \right]$$

100. c. 2

Determine the dividends per share (DPS).

$$DPS = \frac{\text{total dividends}}{\text{total shares}} = \frac{3200000}{160} = 20000$$

Solve for the dividend yield ratio (DYR).

$$DYR = \frac{DPS}{\text{market value}} = \frac{20000}{10000} = 2$$

Science - Explanations

Earth and Formal Science

1. b. hypothesis

Scientific method has different stages.

1. Observation – anything that can be sensed in the environment

2. Problem – a question that is formed from observation

3. Hypothesis – a temporary answer to the problem based on observations and background knowledge

4. Experimentation – used to test the hypothesis

Variables - materials or factors that can be changed in the experiment

independent: manipulated variable

dependent: variable being observed

control: variable that is kept constant

5. Conclusion – a summarized interpretation of data based from the experiment

2. d. Kelvin

The standard unit of measurement is Kelvin. The following are used to convert different units of temperature:

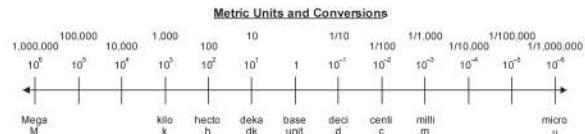
$${}^{\circ}\text{F} = \frac{9}{5}({}^{\circ}\text{C}) + 32 \quad {}^{\circ}\text{C} = \frac{5}{9}({}^{\circ}\text{F} - 32)$$

$$K = {}^{\circ}\text{C} + 273$$

3. c. 578

Number Line – a method used in converting units in the metric system

– a line with different intervals that each corresponds to a degree of ten higher or lower than a corresponding interval



Dimensional Analysis – method used in converting one unit to another through a series of multiplication

$$5 \text{ mi/hr} \longrightarrow \text{ m/s}$$

$$\left(\frac{5 \text{ mi}}{1 \text{ hr}} \right) \times \left(\frac{1.609 \text{ km}}{1 \text{ mi}} \right) \times \left(\frac{1000 \text{ m}}{1 \text{ km}} \right) \times \left(\frac{1 \text{ km}}{3600 \text{ s}} \right) = 2.23 \text{ m/s}$$

Hence from the given problem,

$$5.78 \text{ kg} \times \frac{100 \text{ mg}}{1 \text{ kg}} = 578 \text{ mg}$$

From decigram line measurement, move two places to the right to milligram.

4. c. 6

Rules on Significant Figures:

1. All non-zero digits (1-9) are always significant.

Examples:

854 783 – has 6 significant figures

1 450 – has 3 significant figures

2. Zeroes in between significant numbers are always significant.

Examples:

1 850 230 003 – has 10 significant figures

100 450 – has 5 significant figures

3. Zeroes at the beginning of a number are not significant; they only indicate the position of the decimal point.

Examples:

0.0953 – has 3 significant figures

0.004858 – has 4 significant figures

4. Zeroes at the right of a number and at the right of the decimal point are significant.
Examples:
0.04300 – has 4 significant figures
3.00500 – has 6 significant figures
5. When a number ends in zero but has no decimal point, placing a bar above the zeroes will make them significant.
Example:
28 $\overline{00}$ – has 5 significant figures (put a bar on top of three zeroes)
- Using scientific notation, the number of significant figure will vary depending on the value found on the base only.
- Examples:*
 2.800×10^5 – has 4 significant figures
 2.8×10^5 – has 2 significant figures
6. Exact numbers can be treated as having an infinite number of significant figures. These numbers result from equations, mathematical relationships, and counting indivisible things. Mathematical constants and numbers in defined conversions are also considered as exact numbers.
Example:
The number π is approximately equal to 3.141592; it can be treated as 3.14 (3 significant figures).
5. c. 0.000067
- Scientific Notation – a short-hand method used in writing very large or very small numbers in a simpler way
- The number is always written with only a number in the ones place and an accompanying decimal number multiplied by a power of 10.
Examples:
 $0.000035475 = 3.5475 \times 10^{-5}$
 $807348734 = 8.07348734 \times 10^8$
 $6.7 \times 10^{-5} = 0.000067$
(move to the left by 5 decimal places)
6. b. Geology
Biology – study of life
Chemistry – study of matter and its composition
Physics – study of matter and its behavior
7. a. Igneous
Igneous rocks – formed from magma or lava that cooled; classified as an either extrusive/volcanic or intrusive/plutonic rocks
Examples: granite, obsidian
- Sedimentary rocks – formed from the deposition of sediments; mostly found at the bottom of rivers or bodies of water*
Examples: limestone, shale
- Metamorphic rocks – formed from igneous, sedimentary, or other metamorphic rocks – a result of high pressure build up from an extreme elevation of temperature which chemically changed the composition of the rocks*
Examples: marble, gneiss
- * Limestone is an example of sedimentary rock but is not considered as a type of rock.
8. c. Richter scale
Magnitude – measures the strength of an earthquake by the amount of energy released; measured by the Richter scale
- Intensity – measures the amount of damage produced by an earthquake; measured by the modified Mercalli scale*
9. d. troposphere
Layers of the Atmosphere
1. *Troposphere – the innermost layer of the atmosphere; where atmospheric disturbances occur*
 2. *Stratosphere – the layer that contains the ozone layer that prevents harmful*

- radiations such as UV rays from reaching the Earth*
3. *Mesosphere – the middle and the coldest layer of the atmosphere*
 4. *Thermosphere – the layer of the atmosphere where a rapid change in temperature occurs*
 5. *Ionosphere – the layer of the atmosphere where charged particles are found*
 - it contains a high concentration of ions and free electrons and is able to reflect radio waves
 6. *Exosphere – the outermost layer of the atmosphere*
10. c. hygrometer
Weather instruments
1. *Thermometer – a device used to measure temperature*
 2. *Barometer – a device used to measure air pressure*
 3. *Anemometer – a device used to measure wind speed*
 4. *Wind vane – a device used to measure wind direction*
 5. *Psychrometer/Hygrometer – a device used to measure humidity*
 6. *Rain gauge – a device used to measure the amount of rainfall*
11. b. wind
Non-renewable energy – source that takes a lot of time to be replenished; demand is greater than supply
Examples: oil, coal petroleum, natural gas
Renewable energy – source generated from natural resources which can be replenished
Examples: biomass, wind energy, solar energy, hydropower energy, geothermal energy
12. a. solar
Lunar eclipse – happens when the Earth is in between the Sun and the Moon
Solar eclipse – happens when the Moon moves in between the Sun and the Earth
 13. d. occurrence of day and night
Day and night is caused by Earth's rotation.
 14. b. meteor
Meteoroid – a fragment of a planet, an asteroid, or a comet outside the Earth
Meteor – a fragment of a planet, an asteroid, or a comet that has entered the Earth's atmosphere and burns because of friction; meteors are falling stars
Meteorite – a fragment of a meteor that has landed on the Earth's surface
 15. d. Cygnus : The Dove
Cygnus is latin name for swan.
- ### Biological Science
16. c. centriole
Chloroplast – the site of photosynthesis
 – contains the green pigment chlorophyll
Nuclear membrane – the semi-permeable outer covering which regulates the substances that enter or leave the nucleus
Centriole – found only in animal cells
 – it forms the spindle fibers during cell division
Lysosome – contains hydrolytic enzymes that breakdowns molecules inside the cell
 17. a. mitochondrion
Mitochondrion – known as the powerhouse of the cell which produces energy in the form of ATP (adenosine triphosphate)

Ribosome – the protein factory of the cell which synthesize proteins

Nucleus – the control center of the cell that contains the genetic material

Golgi body – the packaging center of the cell

18. b. hypoosmosis

Cell Transport

– different ways by which substances are carried in or out of the cell

1. *Diffusion – a type of passive transport; movement of substances from higher to lower concentration*

2. *Osmosis – another type of passive transport*

– diffusion of water through a semi-permeable membrane

– movement of water is dictated by the solute concentration

– water generally moves from low to high solute concentration.

• *Hypotonic (hypoosmosis) – an environment that has lower solute concentration than the cell*

– animal cell (**burst**) and plant cell (**turgid**)

• *Hypertonic (hyperosmosis) – an environment that has higher solute concentration than the cell*

– both animal and plant cell (**shrink**)

• *Isotonic (isoosmosis) – when the inside of the cell and the environment has equal concentration*

– animal cell (**normal**) and plant cell (**flaccid**)

3. *Facilitated Diffusion – diffusion of substances via specific protein gates/channels*

4. *Active Transport – movement against a concentration gradient (low to high concentration)*

– requires energy

5. *Bulk Transport – movement of large-sized particles into and out of the cell*

- *Exocytosis – when a cell takes out a macromolecule*

- *Endocytosis – when a cell takes in a macromolecule or a whole cell; either by phagocytosis (cell “eating”/engulfing), pinocytosis (cell “drinking”), or receptor-mediated pinocytosis.*

19. a. telophase

Cell Cycle – an ordered sequence of events in the life of a dividing cell

1. *Interphase – when the cell is not dividing or inactive, but still performing important functions:*

- *Gap 1 or G₁ phase – growth phase*

– duplication of organelles, increase in cell size

- *Synthesis or S phase – where replication of DNA occurs in preparation for cell division*

- *Gap 2 or G₂ phase – synthesis of important proteins needed for cell division*

2. *Cell Division – the cell divides and distributes the genetic material to daughter cells*

Two Modes of Cell Division:

MITOSIS – produces two (2) identical daughter cells, each one contains the same chromosome number as parent cell

– as means of reproduction by unicellular organisms, for growth of multicellular organisms, and for replacement of worn-out tissues

– occurs in somatic and sex cells (in early stages of gamete formation).



Prophase



Metaphase



Anaphase



Telophase

Stages of Mitosis:

Prophase – chromatin condenses forming chromosomes and microtubules forming the spindle fiber, cytoplasm increases in size just outside the nuclear membrane. The end of prophase is signaled by the disruption of the nuclear membrane.

Metaphase – chromosomes line up at the center of the cell (equatorial plate or metaphase plate)

- microtubules attach to the kinetochores at the side of each sister chromatid
- a region of the chromosome where the kinetochores are located is called the centromere.

Anaphase – the connection between the sister chromatids is broken when the microtubules contract and move toward the poles

- separating the two sister chromatids (now the chromosomes)
- chromosomes are then dragged to the two opposite poles

Telophase – new nuclear membrane (nucleus) begins to form at the surface of each of the two separated sets of chromosomes

- chromosomes also uncoil and return to an extended (and diffused) interphase state

20. b. prophase I

MEIOSIS – produces four (4) daughter cells, each one contains half the chromosome number of the parent cells

- for the production of gametes or sex cells of sexually-reproducing organisms
- produces cells with variability

*Stages of Meiosis:**Meiosis I (Reductional Division)*

Prophase I – pairing of homologous chromosomes called synapsis;

- a four-chromosome structure called a tetrad is formed

- crossing-over may occur in segments called chiasmata

Metaphase I – spindle apparatus moves homologous chromosomes until they line up at the spindle equator

Anaphase I – each homologue is separated from its partner and the two are moved to opposite poles of the spindle

Telophase I – haploid number of chromosomes (still duplicated) ends up at each poles of the spindle

Meiosis II (Equational Division)

- proceeds like mitosis
- the most important event is the separation of two sister chromatids at anaphase II

- the two daughter cells produced during Meiosis I divide into two to form four daughter cells with each having half the chromosome number present in the parent cell

21. d. cell respiration

Cellular Metabolism

- a group of life-sustaining processes which defines the capacity of organisms to maintain life

Types of Metabolism:

Anabolism – a metabolic process by which simpler molecules are combined to form a complex structure; an energy-yielding process

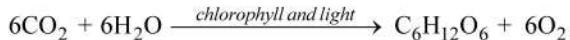
Example: photosynthesis

Catabolism – a metabolic process that breaks down a macromolecule to form simpler units; an energy-releasing process.

Example: cellular respiration

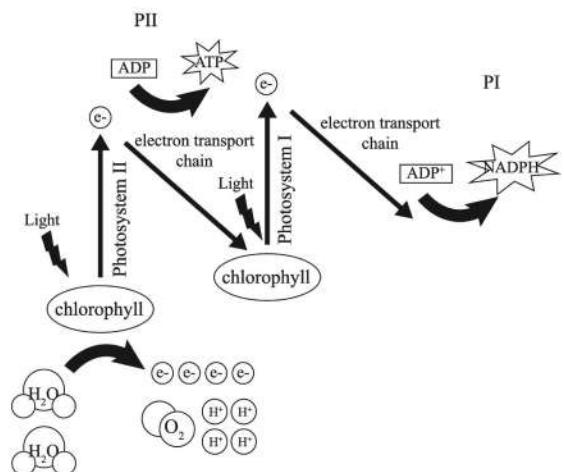
22. a. glucose is a direct product of photo system II

Photosynthesis – food manufacturing process in plants
 – involves the conversion of light energy to chemical energy
 – occurs in the chloroplast of plant cells

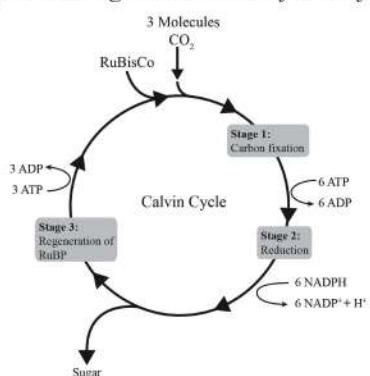


Stages:

- *Light Reaction* – requires sunlight
 - occurs in the thylakoid
 - photolysis occurs
 - produces energy needed in light reaction
- *Photosystem II (P680)* – produces ATP under photophosphorylation
- *Photosystem I (P700)* – produces NADPH



- *Dark Reaction* – does not require light but needs ATP and NADPH for the process to occur
 - occurs in the stroma of the chloroplast
 - produces glucose in the form of PGAL



23. c. Fungi

Hierarchy of Classifying Organisms

Domain - categorized into archaea, bacteria and eukarya

Kingdom - made up of several phyla

Phylum - consists of many classes

Class - composed of several orders

Order - many families

Family - several genera

Genus - composed of many species

Species - the most specific category

The 6 Kingdoms of Life

1. *Archaeabacteria* – with prokaryotic type of cell
 - the most primitive group of organisms considered as the ancestors of all present-day organisms
 - all unicellular
 - extremophiles living in a harsh environment.
2. *Eubacteria* – true bacteria
 - includes cyanobacteria (formerly known as blue-green algae)
3. *Protista* – with eukaryotic type of cell
 - various features (very diverse)
 - includes the unicellular protozoans, the multicellular algae, and the fungal-like slime molds
4. *Fungi* – with eukaryotic type of cell
 - heterotrophic (cannot manufacture their own food) with an absorptive mode of nutrition
 - with cell wall (made up of chitin); may be unicellular or multicellular
 - includes the unicellular yeasts (e.g. *Saccharomyces cerevisiae*, the baker's yeast), the multicellular mushrooms and molds (e.g. *Rhizopus stolonifer*, the common bread mold; *Penicillium notatum*, source of the antibiotic penicillin)
5. *Plantae* – with eukaryotic type of cell; all multicellular
 - with cell wall (made up of cellulose); photosynthetic autotrophic organisms (can manufacture own food via photosynthesis)
6. *Animalia* – with eukaryotic type of cell
 - all multicellular
 - without cell wall
 - heterotrophic with an ingestive mode of nutrition

24. d. 0 %

Genotype – genetic composition

- the complete set of alleles for a particular trait present in the individual
- may be classified as either

Phenotype – the observable trait of an individual; the outward manifestation of the genotype

Hence, based from the situation,

| | | |
|----------------|----------|----------|
| $Cc \times cc$ | C | c |
| | c | Cc |
| | c | cc |

GR: 50/50 (Homozygous dominant : 0%; Heterozygous dominant : 50%; Homozygous recessive: 50 %) or 0 CC : 2 Cc : 2 cc

PR: Curly: 50 % ; Straight: 50 % or 2 curly : 2 straight

Based from the result, there is no probability for the couple to have an offspring that has a genotype of a curly hair.

25. b. 8

| | | |
|--------------------|----------------|----------------|
| $ttRr \times TTrr$ | $TT \times tt$ | $Rr \times rr$ |
|--------------------|----------------|----------------|

| | | |
|---|----|----|
| | t | t |
| T | Tt | Tt |
| T | Tt | Tt |

4 Tt

| | | |
|---|----|----|
| | R | r |
| r | Rr | rr |
| r | Rr | rr |

2Rr : 2 rr

| | |
|-----|-------|
| | 4Tt |
| 2Rr | 8TtRr |
| 2rr | 8Ttrr |

GR: 8 TtRr : 8 Ttrr

PR: 8 (tall, round): 8 (tall, wrinkled)

26. c. homozygous for hair type

Genotype – genetic composition

- the complete set of alleles for a particular trait present in the individual

- homozygous (homozygote) – genes that are morphologically alike; described as either homozygous dominant (capital letters) or homozygous recessive (small letters)

- heterozygous (heterozygote) – genes that are morphologically different; represented by a big and a small letter

Phenotype – the observable trait of an individual; the outward manifestation of the genotype

Allele – genes of the same locus

- usually represented by a single letter

- maybe classified as either

- dominant – masks the effect of the “recessive” allele; indicated by a capital letter

- recessive – masked by the dominant allele; indicated by a small letter.

27. b. 3'...UUU CGC UAU...5'

Deoxyribonucleic acid (DNA) – double-stranded

Ribonucleic acid (RNA) – single-stranded

- in DNA, the purine bases are adenine (A) and guanine (G), while the pyrimidine bases are thymine (T) and cytosine (C); in RNA, the pyrimidine base thymine (T) is replaced by uracil (U)

- base pairing is highly specific: A pairs with T and C pairs with G in a DNA molecule; A pairs with U and C pairs with G in an RNA molecule

Protein synthesis has two major process:

- *Transcription* – a gene expression generally occurs in the nucleus where RNA strand makes a copy of DNA through 3' to 5' direction

- *Translation* – normally occurs on the ribosomes in the cytoplasm where production of amino acid is initiated by means of mRNA and tRNA.

28. c. mutualism

Nutritional relationship of organisms

1. *Competition – a relationship where two or more organisms fight against each other for food or territory*
 - a. *Interspecific competition – different species compete for the same resources*
 - b. *Intraspecific competition – same species compete for the same resources*
2. *Predation – one organism is eaten (prey) by another organism (predator)*
3. *Symbiosis – a relationship that develops between organisms that live together*
 - a. *Mutualism – a relationship wherein both organisms benefit from each other*
 - b. *Parasitism – a relationship in which an organism is benefited, while the other one is harmed*
 - *endoparasite – lives inside the host*
 - *ectoparasite – lives outside the host*
 - c. *Commensalism – a relationship where one is benefited and the other is neither harmed nor benefited*

29. d. complete and perfect

Floral Parts:

Non-reproductive parts of the flower

1. *Receptacle – holds the sepals together*
2. *Sepals – protect the flower bud of the plant*
– collectively called as calyx
3. *Petals – attract visual pollinators; collectively called as corolla*

Reproductive parts of the flower

1. *Stamen – the collective term for the male parts of the flower*
 - a. *anther – produces the pollen*
 - b. *filament – holds the anther*
2. *Pistil – the collective term for the female parts of the flower*
 - a. *stigma – sticky part of the pistil where pollen is received through pollination*
 - b. *style – connects the stigma to the ovary*
 - c. *ovary – holds the ovules*

Types of flowers according to:

1. *presence or absence of floral parts*
 - a. *complete flower – all the major floral parts are present*
 - b. *incomplete flower – one or more of the floral parts are missing*
2. *presence or absence of reproductive parts*
 - a. *perfect flower – both the male and female parts are present*
 - b. *imperfect flower – one of the reproductive parts is missing*

30. c. species < order < class < kingdom
Hierarchy of Classifying Organisms

Domain – categorized into archaea, bacteria and eukarya

Kingdom – made up of several phyla

Phylum – consists of many classes

Class – composed of several orders

Order – many families

Family – several genera

Genus – composed of many species

Species – the most specific category

Chemistry

31. d. Neils Bohr

Democritus – called the ultimate indivisible particle of matter atomos, meaning uncut, which is now known as atom

John Dalton – proposed the “Atomic Theory”

Atomic Theory:

1. *All matter is composed of very small particles called atoms.*
2. *All atoms of an element are the same in properties and different from the atoms of any other element.*
3. *Atoms unite and lose their properties when combination occurs in chemical change to form compounds.*
4. *The atom is not entirely altered in the formation of a compound, and its mass remains constant.*

Law of Conservation of Mass – matter can neither be created nor destroyed in a given chemical reaction

Law of Definite Proportions – different samples of the same compound always contain their constituent elements in the same proportion by mass

Law of Multiple Proportions – if two elements can be combined to form more than one compound, the masses of one element that combined with a fixed mass of another element are in ratios of small whole numbers

J.J. Thomson – proposed the “Plum Pudding Model”; the atom is composed of a positively charged material with the negatively charged electrons scattered through it

Eugen Goldstein – discovered the proton in 1886.

Ernest Rutherford – proposed the “Nuclear Model”; the atom is mostly empty space. There is a small, positive nucleus with the negative electrons scattered around it.

Niels Bohr – proposed the “Planetary Model”; electrons move in definite orbits around the nucleus, like planets moving around the Sun. He proposed that each electron moves in a specific energy level.

Sir James Chadwick – discovered the neutrally charged particles called neutrons

32. c. atomic mass

Atom – smallest indivisible particle of matter

Subatomic particles of an atom:

1. Proton (by Eugene Goldstein)
– a positively-charged particle
 2. Neutron (by James Chadwick)
– a neutral particle
 3. Electron (by J.J. Thomson)
– a negatively-charged particle

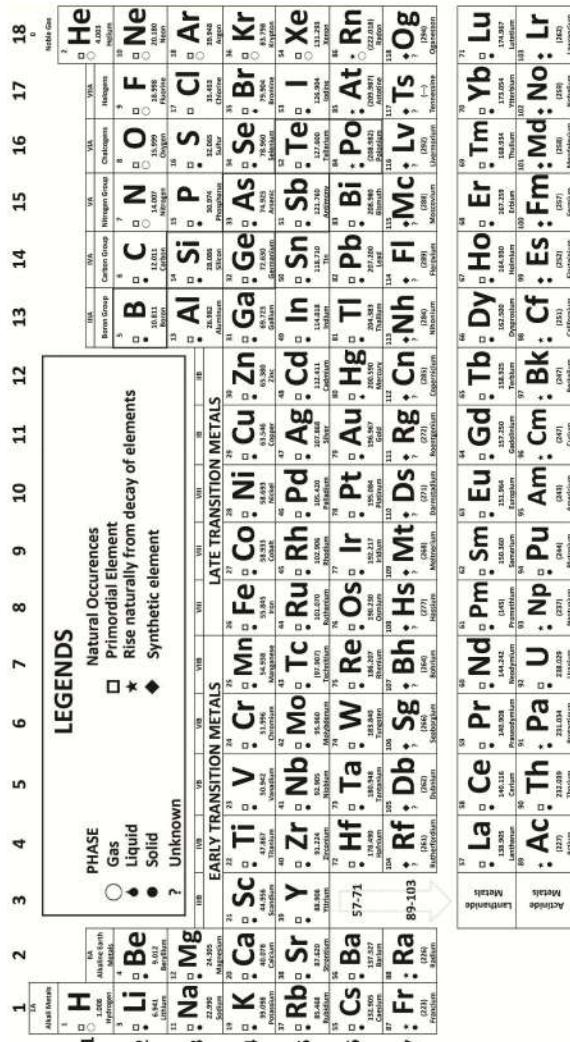
Atomic symbol ($\begin{smallmatrix} A \\ Z \end{smallmatrix} \mathbf{X}$) *Example:* $^{16}_8 O$

Atomic number (Z) – is equal to the number of protons in the nucleus of an atom – is also equal to the number of electrons in a neutral atom

Atomic mass (A) – equal to the number of protons and neutrons in the nucleus of an atom

Isotopes – atoms having the same atomic number but different atomic mass

Example: $\frac{12}{6} C$ and $\frac{13}{6} C$



33. a. 32

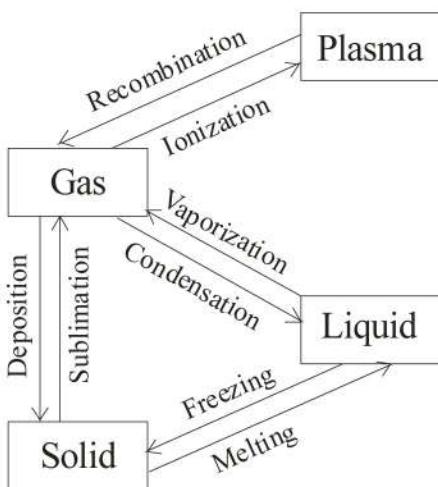
Based from the problem, atomic number is equal to number of protons in an atom, therefore there are 32 protons in the element.

34. a. physical change

Two types of changes:

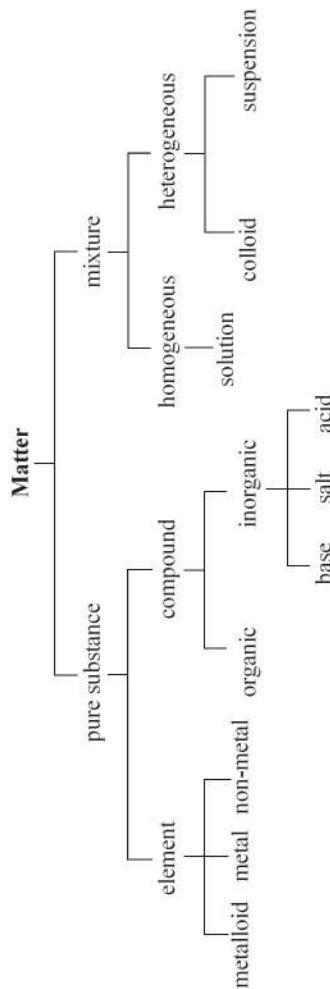
Physical change – involves a change in phase, size, shape, and other physical characteristics of matter without an alteration in its composition

Phase changes:



Chemical change – involves a change in composition of matter resulting to formation of a new substance with different physical and chemical characteristics

35. d. hydrochloric acid



Based from the problem,

– oil and water is a type of heterogeneous mixture

– 70 percent alcohol is a type of solution

– dust particle scattered in air manifest tyndall effect which is a type of heterogeneous mixture

– hydrochloric acid an example of compound with a formula of, HCl

For numbers 36-39: Refer to the statement below.

Chlorine has an electron configuration of $1s^2 2s^2 2p^6 3s^2 3p^5$

36. a. VIIA

The horizontal rows are called **periods** or **series**. There are seven periods that also correspond to the energy levels of the electron. Period 1 being the nearest to the nucleus and Period 7 the farthest.

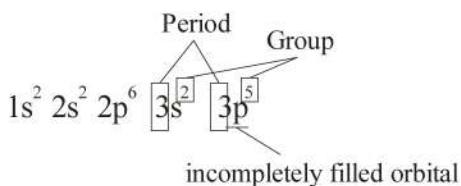
The vertical columns of elements are called **groups** or **families**. This also corresponds to the number of valence or outermost electrons of the elements in the group.

Elements belonging to the same family are most related to each other.

Representative Elements – elements in Groups 1A through 7A; elements in Groups 1A to 2A have incompletely filled s subshells, while elements in Groups 3A to 7A have incompletely filled p subshells.

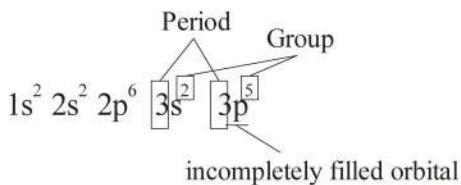
Transition Elements – Elements of Group B. early transition elements have incompletely filled d subshell, while the late transition elements have incompletely filled f subshells

Based from the problem,



37. c. 3

Based from the problem,



38. b. 7

Group number of an element corresponds to the number of valence or outermost electrons of the elements in the group. Since chlorine is under group number 7 therefore its valence electron is 7.

39. d. halogen

Anion (-) – gaining of electron (metals are good donors)

Cation (+) – losing of electron (non-metals are good recipients)

40. c. PCl₅

Chemical Bond – a strong attractive force that exists between atoms in a molecule

Valence electrons – electrons in the outermost energy level which are involved in chemical bonding

Types of Chemical Bond:

a. Ionic bond – a bond formed between oppositely charged ions by transferring one or more electrons
– bond between metallic and non-metallic elements

b. Covalent bond – a bond formed between two or more atoms by sharing of electrons
– bond between non-metallic elements

Types of covalent bond according to polarity:

a. Polar covalent bond – a covalent bond formed by unequal sharing of electrons
– creates a lone pair

b. Non-polar covalent bond – a covalent bond formed by equal sharing of electrons
– creates no lone pair

c. Metallic bond – a bond formed between metal atoms in which bonding electrons are free to move throughout a three-dimensional structure

Lewis Electron Dot Formula – consists of chemical symbol of an element surrounded by a number of dots representing the number of valence electrons

Octet Rule – states that atoms are stable if their outermost shell is completely filled with 8 electrons

Based from the problem, phosphorus is a non-metal element under group 5A, while chlorine is a halogen non-metal. Therefore, said elements portray covalent bonds.

41. c. N_2O_3

Intermolecular forces – attractive forces between molecules

Types of intermolecular forces

1. Hydrogen bonding – bonding force that exists between molecules containing hydrogen bonded to a highly electronegative element (N, O, or F)
2. Dipole-Dipole forces – forces that exist between polar molecules
3. London Dispersion Forces – forces that exist between non-polar molecules

Based from the problem, hydrogen bond exist when a hydrogen bonds with any of the atoms such a F, O or N.

42. a. 160 g/mol

Molar Mass – total mass of one mole of an element or a compound expressed in g/mol; equivalent to the statement that 1 mole of C atom has a mass of 12 grams (numerically equal to its atomic mass or atomic weight that can be found in the periodic table)

Example:

Calculate the molar mass of magnesium hydroxide, $\text{Mg}(\text{OH})_2$
(Mg = 24 g/mol; O = 16 g/mol ; H = 1 g/mol)

$$\begin{array}{rcl} \text{Mg} & 1 \times 24 & = 24 \\ \text{O} & 2 \times 16 & = 32 \\ \text{H} & 2 \times 1 & = 2 \\ & & 58 \text{ g/mol} \end{array}$$

Hence, for the given problem:

$$\begin{array}{rcl} \text{Fe} & 56 \times 2 & = 112 \\ \text{O} & 16 \times 3 & = 48 \\ & & 160 \text{ g/mol} \end{array}$$

43. b. 95 g

$$\text{mole} = \frac{\text{mass}}{\text{molar mass}}$$

$$\text{mass} = (\text{mole})(\text{molar mass})$$

$$= (3.5 \text{ mol})(27 \text{ g Al}) = 95 \text{ g Al}$$

or

$$\text{mass} = 3.5 \cancel{\text{ mol Al}} \times \frac{27 \text{ g Al}}{1 \cancel{\text{ mol Al}}} = 95 \text{ g Al}$$

44. d. BF_3

Empirical Formula – the simplest formula of a compound

Molecular Formula – the true formula of a compound which gives the actual number of atoms present in a compound

Determining the Empirical and Molecular Formula

Sample Problems:

1. What is the empirical formula of a compound that contains 27.38% Na, 1.19% H, 14.29% C, and 57.14% O? (AW: Na = 23; H = 1; S = 32; O = 64)

Solution:

$$27.38\% \text{ Na} = 27.38 \frac{\text{g Na}}{\text{g compound}} \times \frac{1 \text{ mol Na}}{23 \text{ g Na}} = 1.19 \text{ mol of Na}$$

$$1.19\% \text{ H} = 1.19 \frac{\text{g H}}{\text{g compound}} \times \frac{1 \text{ mol H}}{1 \text{ g H}} = 1.19 \text{ mol of H}$$

$$14.29\% \text{ C} = 14.29 \frac{\text{g C}}{\text{g compound}} \times \frac{1 \text{ mol C}}{12 \text{ g C}} = 1.19 \text{ mol of C}$$

$$57.14\% \text{ O} = 57.14 \frac{\text{g O}}{\text{g compound}} \times \frac{1 \text{ mol O}}{16 \text{ g O}} = 3.57 \text{ mol of O}$$

Since 1.19 mol is the smallest, divide everything by 1.19 mol.

$$\frac{1.19 \text{ mol Na}}{1.19 \text{ mol Na}} = 1 \text{ Na}, \quad \frac{1.19 \text{ mol H}}{1.19 \text{ mol H}} = 1 \text{ H},$$

$$\frac{1.19 \text{ mol C}}{1.19 \text{ mol C}} = 1 \text{ C}, \quad \frac{3.57 \text{ mol O}}{1.19 \text{ mol O}} = 3 \text{ O}$$

Therefore, the empirical formula is NaHCO_3 .

2. What is the molecular formula of baking soda (NaHCO_3) if it has a molecular mass of 168 g/mol?

Empirical mass = 84 g/mol

Solution:

$$\text{number of units} = \frac{\text{molecular mass}}{\text{empirical mass}} = \frac{168 \text{ g/mol}}{84 \text{ g/mol}} = 2$$

$$\text{Molecular Formula} = 2 \times \text{NaHCO}_3 = \text{Na}_2\text{H}_2\text{C}_2\text{O}_6$$

Hence for the given problem,

$$20\% \text{ B} = 20 \frac{\text{g B}}{\text{g compound}} \times \frac{1 \text{ mol B}}{10 \text{ g B}} = 2 \text{ mol of B}$$

$$80\% \text{ F} = 80 \frac{\text{g F}}{\text{g compound}} \times \frac{1 \text{ mol F}}{19 \text{ g F}} = 4 \text{ mol of F}$$

Since 2 mol is the smallest, divide everything by 2 mol.

$$\frac{2 \text{ mol B}}{2 \text{ mol}} = 1 \text{ B} \quad \frac{4 \text{ mol F}}{2 \text{ mol}} = 2 \text{ F}$$

Therefore, the empirical formula = BF_2

45. a. 4000 atm

GAS LAWS

1. Graham's Law

The rate of diffusion of gas is inversely related to the square root of its molecular mass. Mathematically,

$$\frac{\text{rate A}}{\text{rate B}} = \frac{\sqrt{\text{Molecular mass of B}}}{\sqrt{\text{Molecular mass of A}}}$$

2. Boyle's Law

At constant temperature, the volume of a gas is inversely proportional to pressure.

$$V \propto \frac{1}{P}$$

$$P_1 V_1 = P_2 V_2$$

3. Charles' Law

If pressure remains constant, the volume of a gas varies directly as the absolute temperature ($V \propto T$).

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

4. Gay-Lussac's Law

If the amount of gas and volume are kept constant, the pressure inside a fixed volume is proportional to the Kelvin temperature ($P \propto T$).

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

5. Combined Gas Law

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

Standard Temperature and Pressure (STP)

At STP: $T = 273.15\text{ K}$ and $P = 1\text{ atm}$

6. Avogadro's Law

At constant temperature and pressure, the volume of a gas is directly proportional to the mole of gas ($V \propto n$).

At STP: 1 mole = 22.4 L

7. Ideal Gas Equation

Combining all the gas laws, $V \propto nT/P$

$$V = \frac{RnT}{P} \quad \text{or} \quad PV = nRT$$

*where: R – is the universal gas constant
= 0.08205 atm-L/mol-K
= 62.36 mmHg-L/mol-K
= 8.314 Pa-m³/mol-K or J/mol-K*

For the given problem, find the number of moles (n) of CH_4 .

$$n = 640\text{ g } \text{CH}_4 \times \frac{1\text{ mol } \text{CH}_4}{16\text{ g } \text{CH}_4} = 40\text{ mol } \text{CH}_4$$

By applying the Ideal Gas Equation,

$$PV = nRT \rightarrow P = \frac{nRT}{V}$$

$$P = \frac{40\text{ mol} (0.08205\text{ atm} - \text{L / mol} - \text{K}) (200\text{ K})}{0.15\text{ L}} \\ = 4000\text{ atm}$$

Physics

46. b. speed

Scalars – quantities that only have the magnitude and do not specify direction

Examples: speed, temperature, mass, and distance

Vectors – quantities that specify both magnitude and direction

Examples: velocity, acceleration, and force

47. d. zero

The vehicle is in constant velocity, therefore acceleration is zero. When acceleration is zero, net force is also zero.

48. d. 0 m/s²

Acceleration (a) – the rate of change of an object's velocity per unit time

For the given formula,

The vehicle is in constant velocity therefore acceleration is zero.

| | Formula | Unit |
|--------------|--------------------------------------|--------------------|
| Speed | $s = \frac{d}{t}$ | m/s |
| Velocity | $v = \frac{d}{t} + \text{direction}$ | m/s with direction |
| Acceleration | $a = \frac{v_f - v_i}{t}$ | m/s ² |

Other derived formulas:

$$d = v_{ave} \cdot t \qquad \qquad d = \frac{v_f^2 - v_i^2}{2a}$$

$$v_{ave} = \frac{v_f + v_i}{2} \qquad \qquad d = v_i t + \frac{1}{2} a t^2$$

49. a. 20m

Free Fall – a vertical motion in which the only force acting on the object is gravity

Without air resistance, the acceleration of a freely falling object is constant due to gravity. On Earth, the acceleration due to gravity is 9.8 m/s² or 10m/s².

$$v_f = gt$$

$$d = v_i t + \frac{1}{2} g t^2 \Rightarrow \frac{1}{2} g t^2 \quad v_f = \sqrt{2gd}$$

Hence, for the given problem,

$$\begin{aligned} y &= \frac{gt^2}{2} = \frac{\left(10 \frac{m}{s^2}\right)(2s)^2}{2} \\ &= \frac{\left(10 \frac{m}{s^2}\right)(4s^2)}{2} = \frac{40m}{2} = 20m \end{aligned}$$

$$\begin{aligned} m &= \frac{(2)(14000J)}{\left(40 \frac{m}{s}\right)} = \frac{28000J}{1600 \frac{m^2}{s^2}} \\ &= \frac{70 \frac{kg \cdot m^2}{s^2}}{4 \frac{m^2}{s^2}} = \frac{35 \frac{kg}{s^2}}{2} = 17.5 \frac{kg}{s^2} \end{aligned}$$

50. a. pushing a wall

Newton's Laws of Motion

1. *First law of motion (Law of Inertia)*
– states that an object continues in its state of rest or of uniform motion unless acted upon by an external unbalanced force
2. *Second law of motion (Law of Acceleration)*
– the acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass
3. *Third law of motion (Law of Interaction)*
– that for every action (force) in nature there is an equal and opposite reaction.

Choice (a) shows the third law of motion.

51. c. 17.5 kg

Kinetic energy - energy in a moving object; unit in Joules (J) $KE = \frac{mv^2}{2}$

Potential energy- energy in an object at rest; unit in Joules (J) $PE = mgh$

Hence, for the given problem,

$$KE = \frac{mv^2}{2} \Rightarrow m = \frac{2KE}{v^2}$$

52. c. 900 J

Work – amount of force acting on a distance; unit in Joules (J)

$$W = Fd \cos\theta$$

$$\theta = 0$$

$$W = Fd = mgd$$

$$W = (30kg) \left(10 \frac{m}{s^2}\right) (3m) = 900J$$

53. a. 60 Watts

Power – amount of work done per unit of time; unit in Watts (W)

$$P = \frac{W}{t} = \frac{Fd}{t} = \frac{mgd}{t}$$

$$= \frac{(60kg) \left(10 \frac{m}{s^2}\right) (12m)}{120s} = 60W$$

54. b. 10 Pa

Pressure – amount of force applied per unit area

– unit is Pascal (Pa)

$$P = \frac{F}{A} = \frac{mg}{A} = \frac{(4kg) \left(10 \frac{m}{s^2}\right)}{4m^2} = 10Pa$$

55. a. radiowave and gamma ray

General Wave Characteristics:

a. *Amplitude (A)* – height of wave displacements; measured in meter (m)

b. *Frequency (f)* – number of wave cycles that can pass through a point in a period of time

– $f = \frac{1}{T}$ which is measured in Hertz or inverse second (Hz)

c. *Period (T)* – time it takes for one wave cycle to pass through a point

– $T = \frac{1}{f}$ which is measured in second (s)

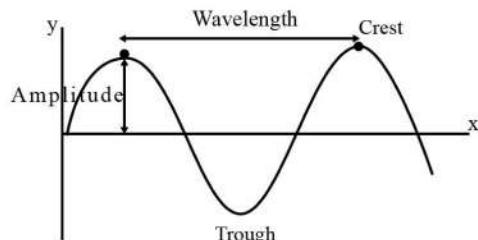
d. *Wavelength (λ)* – minimum distance between similar points in the wave – measured in meter (m)

e. *Wave speed (v)* – description of how fast the wave is travelling in space
– $v = \lambda f$, measured in meter per second (m/s)

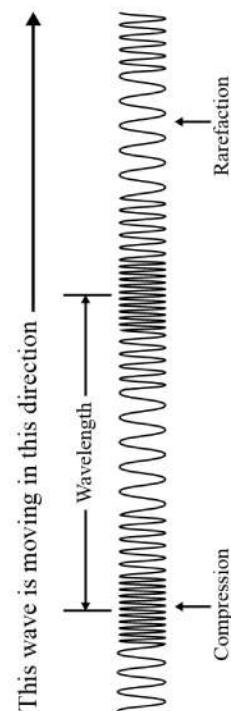
Types of Waves:

1. *Mechanical Waves* – type of waves that require a medium to propagate in space

a. *Transverse Waves* – mechanical waves with displacements perpendicular to their direction of propagation



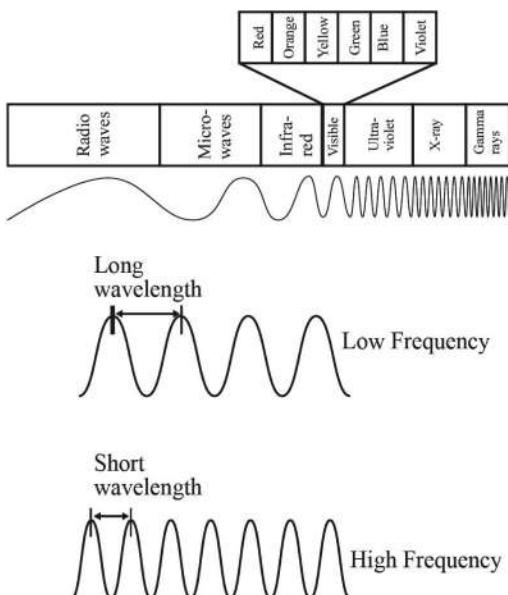
b. *Longitudinal Waves* – mechanical waves with displacements parallel to their direction of propagation



2. *Electromagnetic Waves* – type of waves that does not require a medium to propagate in space

– travel at a constant speed of 3×10^8 m/s in vacuum

Electromagnetic Spectrum



56. b. 0.15 N

| | Formula | Unit |
|--------------------------|---|---|
| Momentum | $p = mv$ | $\text{kg} \cdot \text{m/s}$ or $\text{N} \cdot \text{s}$ |
| Impulse | $I = Ft$ | $\text{kg} \cdot \text{m/s}$ or $\text{N} \cdot \text{s}$ |
| Conservation of Momentum | $m_1 v_1 + m_2 v_2 = m_1 v'_1 + m_2 v'_2$ | |

Hence, for the given problem,

$$m \cdot \Delta v = Ft \rightarrow F = \frac{m \cdot \Delta v}{t}$$

$$F = \frac{(0.200\text{ kg})(1.5\text{ m/s} - 0\text{ m/s})}{2\text{ s}} = 0.15\text{ N}$$

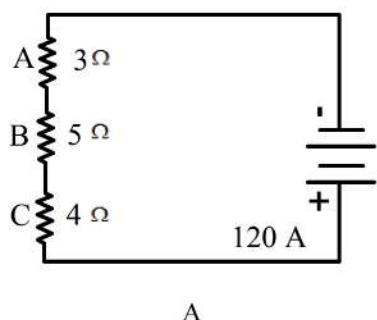
57. c. $200\text{ kg} \cdot \text{m/s}$ *Given $v_i = 0$,*

$$a = \frac{v_f - v_i}{t} = \frac{v}{t} \rightarrow t = \frac{v}{a} = \frac{3.0\text{ m/s}}{10\text{ m/s}^2} = 0.3\text{ s}$$

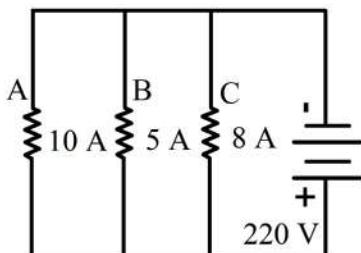
Thus,

$$I = Ft = mat$$

$$I = (70\text{ kg})(10\text{ m/s}^2)(0.3\text{ s}) = 210\text{ kg} \cdot \text{m/s}$$

For numbers 58-60: Refer to the circuits given.

A



B

Electricity

Ohm's Law – the current through a circuit is directly proportional to the potential difference across the circuit and inversely proportional to the total resistance of the circuit

$$I = \frac{V}{R}$$

I – current; the rate of flow of charges, measured in Amperes (A)

V – potential difference, also referred to as voltage, measured in volts (V)

R – resistance, the property of the conductor to resist current, measured in Ohms (Ω)

A circuit is a closed path through which charged particles flow. Circuits are classified depending on the connection of the components.

Types of Circuit

1. *Series Circuit – type of circuit where current is restricted to only one path*

- in a series circuit, the current flowing in the entire circuit is the same current that passes through every circuit component

2. *Parallel Circuit – type of circuit where current is able to take multiple paths*

- in a parallel circuit, the potential difference or voltage across the ends of each path are the same

Formula Comparison for Series and Parallel Circuits involving resistors:

| | Series Circuit | Parallel Circuit |
|------------------------------|---------------------------------|---|
| Current across each resistor | $I_T = I_1 = I_2 = \dots = I_n$ | $I_T = I_1 + I_2 + \dots + I_n$ |
| Voltage across each resistor | $V_T = V_1 + V_2 + \dots + V_n$ | $V_T = V_1 = V_2 = \dots = V_n$ |
| Total Resistance | $R_T = R_1 + R_2 + \dots + R_n$ | $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \dots + \frac{1}{R_n}$ |

58. c. 12 ohms

*Figure A is an example of a series circuit.
Therefore,*

$$\begin{aligned}R_T &= R_1 + R_2 + R_3 \\&= 3\Omega + 5\Omega + 4\Omega \\&= 12 \Omega\end{aligned}$$

59. b. 600 V

To compute the voltage of B,

$$I_T = I_1 + I_2 + I_3 = 120A ; R_B = 5\Omega$$

$$\begin{aligned}I &= \frac{V}{R} \Rightarrow V = IR \\&= (120A)(5\Omega) = 600V\end{aligned}$$

60. a. 23 A

Figure B is an example of a parallel circuit. Therefore,

$$\begin{aligned}I_T &= I_A + I_B + I_C \\&= 10A + 5A + 8A \\I_T &= 23A\end{aligned}$$

Language Proficiency - Explanations

Error Identification

1. (d) Janice's

Type of error: Illogical Comparison

The sentence is comparing the salad of Joyce to Janice hence is illogical in comparison since the ones to be compared are the salad of the girls.

2. (d) myself

Type of error: Pronoun Usage / Pronoun-Antecedent

The pronoun should agree with its antecedent (noun or pronoun before). The antecedent is I, therefore myself shall be used.

3. (b) his/her

Type of error: Pronoun Usage / Pronoun-Antecedent

The antecedent is one therefore the use of their is wrong since it is plural. Thus, use his or her.

4. (d) The lady **in a fur hat** asked me about a missing boy.

Type of error: Misplaced Modifier

The phrase "in a fur hat" is a modifier (description) of "the lady" and therefore should be placed directly after "the lady".

5. (c) The pilot **to fly the plane** wore a uniform that was covered in gold buttons.

Type of error: Misplaced Modifier

The phrase "to fly the plane" is a modifier of the subject "pilot" therefore shall be placed directly next to the word "pilot".

6. (a) information

Type of error: Noun Usage

Information is a mass noun; as a rule, mass nouns are not pluralized by adding s nor es instead by using quantifier phrases (pieces of furniture, bulk of mail, bits of information).

7. (a) Despite

Type of error: Preposition Usage

Although synonymous, **despite** and **in spite of** should be written according to their form (despite / in spite of).

8. (d) unfamiliar with them

Type of error: Idiomatic Phrase

The idiomatic phrase "unfamiliar with them" means something beyond one's knowledge. Idiomatic phrases are written as they are and may not be altered through changing the preposition.

9. (a) If I were president...I would make

Type of error: Subjunctive Mood

In stating hypothetical (untrue/ if statements) statements, if shall be followed by were regardless of the subject.

10. (d) they

Type of error: Pronoun Usage

Linking verbs (am, is, are, was, were, will be) are followed by nominative pronouns (I, he, she, it, they, we, you).

11. (c) beside the popular

Type of error: Preposition Usage

The preposition **besides** is a synonym of "aside from" while **beside** is to state location. The sentence speaks of the location of the city school hence, use beside.

12. (a) Cris's car
Type of error: Possessive Nouns
As a rule, when writing the possessive form of single syllable proper nouns ending in "s", one should use " 's ".
13. (d) she
Type of error: Pronoun Usage
Formal English writing rule states that in writing comparison, one should use nominative (subjective) pronouns.
(Technique: use nominative pronouns after the words **like, as, than**)
14. (b) driven for
Type of error: Verb Usage
The word **droven** is not a word in the English dictionary. The correct past participle of **drive** is **driven** (**drive - drove - driven**).
15. (d) has written a book
Type of error: Parallelism
The rule in parallelism states that tenses applied in the sentence should be consistent. The sentence used present perfect tense (**has + past participle**) followed by noun, choice (d) does not conform with the pattern.
16. (c) because of
Type of error: Correct Usage
Due to is used to state the cause and should be followed by a noun while **because of** should be followed by adjectives, verbs, or adverbs. The sentence used the word "**tragic**" which is an adjective. Therefore, **because of** shall be used.
17. (b) are delivered
Type of error: Subject-Verb Agreement
The rule in Subject-Verb agreement states that when **measurements** like fractions are used in the sentence as quantifiers, one should consider the form of the noun that the measurements quantify. In the sentence, one fourth quantifies **books** hence is plural.
18. (b) notices
Type of error: Subject-Verb Agreement
The rule in Subject-Verb agreement states that when subjects are connected by correlative conjunctions (either...or / neither...nor), one should consider the noun closer to the verb. In this case, the host is the subject. Hence it requires a singular verb.
19. (d) Mr. Hannigan, attending a conference, had to take a train ride for six hours yesterday.
Type of error: Misplaced Modifier
"attending a conference" is a modifier of Mr. Hannigan therefore should be written directly near to the subject Mr. Hannigan.
20. (a) were
Type of error: Subjunctive mood
In writing hypothetical statement (if statements), one must use **were** regardless of the subject.
21. (c) but also for his
Type of error: Connectors
Correlative conjunctions are conjunctions that are paired; they cannot be used without the other pairing. **Not only** is always paired with **but also**.
22. (c) were given
Type of error: Subject-Verb Agreement
The phrase "**some of**" quantifies properties. As a rule, one shall consider the noun quantified by the "**of**" phrase in determining the form of the verb to be used. In the sentence, the noun quantified is properties, hence is plural.
23. (c) late
Type of error: Adjective vs. Adverb usage
Late is an adjective or adverb which means not on time while lately means recently. The sentence speaks on **not on time** thus, late should be used.

24. (b) *that*

Type of error: Wordiness

The word **reason** is paired with **that** while **why** is paired with **because**. The sentence used “reason” therefore “that” should be used instead of “because”.

25. (a) *Every one*

Type of error: Correct Usage

The sentence connotes “each one” therefore “every one” shall be used. “Every one” and “any one” are paired with of.

Sentence Correction

26. The correct answer is (e). The expression “the number of” is singular, hence, “is”. Moreover, the one being compared is the number of participants of the division therefore, **that of** shall be used. Lastly, a division is also compared to the other divisions, thus the use of any other is crucial.
27. The correct answer is (b). As a rule, gerunds shall be preceded by possessive pronouns (his, her, their, our, its, your + -ing).
28. The correct answer is (b). This is double negatives – **unknown** and **no one**. Two negative words shall not be used together in a sentence.
29. The correct answer is (d). This is misplaced modifier. “Located at the center of the business district” is a modifier describing the restaurant thus, should be written directly before or after the word restaurant.
30. The correct answer is (d). The construction is a fragment since the thought is not clearly established. Furthermore, the phrase “together with the boy band” is just an intervening phrase that does not affect the number of the subject singer, thus is singular.
31. The correct answer is (c). The use of conjunction is erroneous. The sentence is stating a reason hence, **for** is the appropriate conjunction.

32. The correct answer is (e). The sentence is a past conditional clause thus shall follow the pattern:
if... had + past participle ... would have + past participle
33. The correct answer is (c). The subject of the sentence is “results” which is plural therefore “are” shall be used. In addition, preposition **besides** (by) is more appropriate than **besides** (except).
34. The correct answer is (e). As a rule, “of” phrases are used to quantify therefore the noun that they quantify are to be considered in determining the verbs to be used. The noun is **proposals** hence plural.
35. The correct answer is (e). Word usage: **except** is a word which means not included while **accept** is a word which means to consent or to agree. The sentence is denoting an act of consenting thus, **accept**.
36. The correct answer is (e). The word **irregardless** is a non-standard English word; the standard is **regardless**. Moreover, **can't help** is followed by an ‘-ing’ form of the word.
37. The correct answer is (a). The sentence is following the pattern:
who + embedded clause + verb

38. The correct answer is (c). The subject in the sentence are "My friends and I" therefore plural hence, use **have**.
39. The correct answer is (e). The sentence is following the pattern:
who + embedded clause + verb

Sentence Context

41. a. harmony
Context Clue: good leader... achieve unity and coordination
42. c. disorganized
Context Clue: room full of used clothes, dust, and trash
(a) chaotic means problem-filled
43. d. collection
Context Clue: Each piece she has adds up...
44. b. examine
Context Clue: look at each painting for at least a minute
Choice (d) relinquish means give up
45. d. inactively
Context Clue: Despite Czarina's shy and quiet attitude
Vigorously means actively or deliberately.
The sentence is looking for the opposite of vigorously hence inactively.
Choice (a) treacherously means deceitful or dishonest.
Choice (b) conscientiously means thoroughly.
Choice (c) robustly means strongly.
46. c. diverse
Context Clue: not molded through having a singular ideology
Choice (a) homogenous means uniform/alike.
Choice (b) monotonous means tedious/uninteresting.
40. The correct answer is (b). **Stationary** is an adjective which means not moving while **stationery** is a noun that is used for writing. The sentence needs a modifier for the linking verb **remained** thus use **stationary**.
47. c. emphatic
Context Clue: despite all the injustices happening around the country
Choice (c) emphatic means absolute.
Choice (d) sympathetic means compassionate.
48. a. everyday
Context Clue: go through crises all throughout their lives
Choice (d) mortal means fatal.
49. d. sweet-talking
Context Clue: casanova captured the naïve woman's heart
50. c. cultured
Context Clue: experience-enriching activities such as travelling
Choice (a) hostile means hateful.
Choice (b) naive means innocent.
51. a. insightful
Context Clue: can diagnose a patient in one look
Choice (b) cuddy means small.
Choice (c) rational means with reason.
Choice (d) affable means liking.
52. d. doubtful
Context Clue: after he lost her trust
Choice (b) steadfast means faithful.
Choice (c) sanguine means enthusiastic.
53. b. sullen
Context Clue: he gets easily angry
Choice (a) cordial means sociable.
Choice (c) gay means happy.
Choice (d) festive means joyous.

54. c. cryptic
Context Clue: only few can understand it
Choice (a), (b), and (d) means shallow or not deep.

55. b. bankrupt
Context Clue: After the robbery
Choice (c) rife means abundant.

Sentence Completion

56. The correct answer is (a) emaciated which means wasted.

Context Clue : from cancer
Choice (b) incited means provoked.
Choice (c) rectified means fixed.
Choice (d) adroit means skilled.

57. The correct answer is (c) guile which means trickery.

Context Clue : says things that can mislead
Choice (a) aesthetic means artistic.
Choice (b) filial means daughterly.
Choice (d) deleterious means harmful.

58. The correct answer is (b) inane which means empty.

Context Clue : unthinking members
Choice (a) aggregate means collective.
Choice (c) plenary means entire.
Choice (d) nobby means clean.

59. The correct answer is (b) clique which means group of friends.

Context Clue : who have shared her ups and downs since their school days

60. The correct answer is (d) enervated which means weakened.

Context Clue : after conducting a whole day of surgery
Choices (a) and (c) are synonymous.
Choice (b) braced means prepared.

61. The correct answer is (a) pedagogue which means teacher.

Context Clue : who teaches Grade 1 students
Choice (b) virtuoso means professional
Choice (c) affluent means wealthy
Choice (d) bravado means bragging

62. The correct answer is (c) enigma which means mystery.

Context Clue : details are vague and the clues are blurred
Choice (a) heresy means gossip.
Choice (b) allusion means reference.
Choice (d) terse means summary.

63. The correct answer is (b) epitome which means exemplar.

Context Clue : most of the new nurses aspire to be like her
Choices (a), (c), and (d) all mean summary

64. The correct answer is (a) jocular (humorous)... uplift.

Context Clue : no matter how gloomy the situation can be
Choice (b) gay (happy) ... drag (pull)
Choice (c) mournful (gloomy) ... enthuse (energize)
Choice (d) perilous (dangerous) ... turn

65. The correct answer is (a) understand ... garbled (misinterpreted).

Context Clue : it shows inconsistent codes

66. The correct answer is (a) quintessential (ultimate)... praxes (practices)

Context Clue : Millennials ... technology can affect societal...
Choice (b) rigid (solid) ... practices
Choice (c) deficient (lack) ... folkways
Choice (d) tumultuous (fierce) ... rituals

67. The correct answer is (b) tempestuous which means stormy.

Context Clue : Experiencing 130 days of thunderstorm
Choice (a) placid means silent.
Choice (c) contemptuous means arrogant.

68. The correct answer is (c) pompous which means bombastic.

Context Clue : made sure that media will write articles on how tremendously expensive

Choice (a) impecunious means lacking money.

69. The correct answer is (d) panache which means charisma.

*Context Clue : great sense of self-assurance
Choice (b) indolence means laziness.
Choice (c) aversion means hatred.*

70. The correct answer is (c) bombarded (assaulted) ... complaints.

Context Clue : issue of using harmful ingredients in their products

Choice (a) swamped (overwhelmed) ... comments

Synonyms

71. a. irascible

The words splenetic and irascible both mean hot-tempered. Choice (b) static means stable. Choice (d) extravagant means astonishment.

72. c. womanish

The root word "fem" relates to females. The words effeminate and womanish both mean feminine; choices (a), (b), and (d) are synonymous hence, cannot be the answer.

73. d. fascinating

The related word "pique" means to excite. The words piquant and fascinating both mean interesting; the rest are similar.

74. b. adages

The words aphorism and adages are nouns that both mean proverbs.

75. d. stupid

The root word "vacuous" means vacuum or empty. The words shrewd and clever are synonymous to wise while fanatic means passionate.

76. b. stout

The words paunchy and stout both mean obese while minuscule means small thus is opposite to lean; robust means healthy.

77. b. sticky

The related word viscous means sticky. Sandy and grainy have similar

characteristics therefore cannot be the answer. Sticky is a synonym of viscid.

78. b. discordant

The root word "cacophony" means bad or evil and "phon" means sound. The words cacophony and discordant both mean conflicting. Choice (a) stillness and choice (c) harmony are synonymous hence can be eliminated.

79. a. disgraceful

The words ignominious and disgraceful are synonyms of humiliating.

80. c. hazy

The related word "nebula" is an interstellar cloud. The word warlike means aggressive; despicable is hateful.

81. a. approve

The root word "ratus" means fixed by calculation. The word ratify is to approve. Extreme, insight, and swing have no relation to request.

82. b. hostile

The words tyrannical and hostile both mean heartless; distant means faraway.

83. c. ever-present

Rare and sporadic are synonymous thus not the answer. Upon-request is not usually an attribute of a Christmas song.

84. b. jeer
*The words *gibe* and *jeer* both mean sarcasm or joke; *aspersion* means criticism in a serious manner while *ardor* means passion.*
85. a. mercenary
*The words *venal* and *mercenary* both mean immoral; *sardonic* means offensive while *scrupulous* is precise and *servile* is humble.*

Antonyms

86. b. enliven
*The word *languish* is synonymous to *wilt*, *sag*, or *faint* so *enliven* is the antonym. *Drift* is not related to the word.*
87. a. genial
*The word *acrimonious* means bitter on the contrary, *genial* is pleasant; *acrid* and *rancorous* both mean sharp.*
88. c. approve
*The word *censure* means disapproval which is the antonym of *approve*; the rest are synonymous to the given.*
89. a. noxious
*The word *salubrious* means healthful, on the contrary *noxious* is toxic; the rest are synonymous to the given.*
90. d. reclusive
*The root word “*gregis*” relates to a flock. The word *gregarious* means sociable, on the contrary *reclusive* is isolated; the rest are synonymous to the given.*
91. a. chaotic
*The word *halcyon* means peaceful, on the contrary *chaotic* is lawless; the rest are synonymous to the given.*
92. d. soothing
*The word *macabre* means frightening, on the contrary *soothing* is relaxing; the rest are synonymous to the given.*
93. c. conservative
*The word *raffish* means liberal so *conservative* is the opposite; *disreputable* is dishonorable while *unconventional* is unique and *affluent* is wealthy.*
94. c. complex
*The related word “*facilitate*” means to make easy to do. The word *facile* means effortless so *complex* is the opposite. Choices (a) and (b) are the same while *mediocre* means middling.*
95. a. aggravate
*The word *wane* means to ease off on the contrary, *aggravate* is to irritate; the rest are synonymous to the given.*
96. d. brazen
*The word *timorous* means fearful on the contrary, *brazen* is to unashamed; the rest are synonymous*
97. b. omega
*The word *nascence* means beginning, on the contrary *omega* is outcome; the rest are synonymous to the given.*
98. a. reticent
*The word *garrulous* means talkative, on the contrary *reticent* is silent; the rest are synonymous to the given.*
99. d. clumsy
*The word *lissom* means graceful so *clumsy* is the opposite; the rest are synonymous to the given.*
100. c. reverent
*The prefix “*im*” means not. The word *impious* means godless, on the contrary *reverent* is devoted; the rest are synonymous to the given.*

Single Word Analogy

- 101.b. courageous

Persisting is the antonym of quitting as recreant is the antonym of courageous. Choice (c) daunted means frightened.

102. b. emancipation

Overlook is the antonym of attend as detention is the antonym of emancipation (rights). Choice (d) disenthral means uninterested.

103. a. Moscow

Israel is the country and its capital is Jerusalem as Russia is the country and its capital is Moscow.

104. a. Hanging Gardens *Hammurabi created Code of Hammurabi as Nebuchadnezzar created the Hanging Gardens.*

105. b. Herodotus

The father of genetics is Gregor Mendel as the father of history is Herodotus.

106. b. praise

An elegy is a poem about death as an ode is a poem about praise.

107. d. frequency

Pascal is a unit of pressure as Hertz is a unit of frequency

108. b. Anna Karenina

Animal Farm and 1984 are both written by George Orwell as War and Peace and Anna Karenina are both written by Leo Tolstoy.

109. a. hendeca

Penta is a prefix meaning five as hendeca is a prefix meaning eleven.

110. a. bird

Sable is a kind of mammal as raptor is a kind of bird.

111. b. marshal

A principal leads the teachers as a marshal leads the prisoners.

112. a. permanent

Intrinsic and extrinsic are antonyms. Transitory means temporary, hence opposite of permanent.

113. a. 124

992 divided by 4 is 248 as 496 divided by 4 is 124.

114. c. musaceae

Gumamela is part of malvaceae family as banana is part of musaceae family.

115. c. Mitsubishi

Civic is a model of Honda cars as Mirage is a model of Mitsubishi cars.

116. d. expiration

Departure comes first before arrival as birth happens first before expiration.

117. d. cuff

Chapeau is a French term for hat which is an accessory to the head as cuff to the wrist.

118. b. equivocal

Brief and succinct both mean concise as ambivalent and equivocal both mean uncertain.

119. c. hot

Frigid is extremely cold as blistering is extremely hot.

120. c. iron

Pearl is the traditional anniversary name for 30 years as iron is for 6 years.

Double Word Analogy

121. d.remove : eliminate
Counsel is synonymous to advise as remove is synonymous to eliminate.
122. c.often : seldom
Working is the antonym of inoperative as often is the antonym of seldom.
123. c.maps
A lexicographer creates dictionaries as a cartographer creates maps.
124. d.typing : printing
A chrysalis comes first before a butterfly as typing happens first before printing.
125. c.The Gift of the Magi : Henry
The Necklace is a short story written by Guy de Maupassant as The Gift of the Magi is a short story written by O. Henry. The Iliad is written by Homer but it is an epic poem as The Road not Taken by Frost is a poem.
126. a.skull : poison
Yin Yang is a symbol for balance as skull is a symbol for poison.
127. c.anemia : hemoglobin
Dehydration is caused by lack of water as anemia is caused by lack of hemoglobin.
128. b.ventricle : heart
Alveolus is a part of the lungs as ventricle is part of the heart.
129. a.gynecologist : doctor
Playwright is a writer as gynecologist is a doctor.
130. b.rudimentary : basic
Caliber and quality both mean capacity as rudimentary and basic both mean fundamental. Choices (c) and (d) are both opposite.
131. c.irreverent : respect
Frivolous means lack of seriousness as irreverent means lack of respect
132. c.Deokbukki : Korean
Frittata is an Italian dish as Deokbukki is a Korean dish.
133. a.diurnal : day
Crepuscular means active in the twilight as diurnal is active by day.
134. c.novelist : novel
A pamphleteer writes a pamphlet as a novelist writes a novel.
135. c.Labrador : Canadian
Rottweiler is a German dog as Labrador is a Canadian dog.
136. d.The Woman Who Had Two N navels : Nick Joaquin
Soledad is literary piece written by Angela Manalang Gloria as The Woman who had two N navels was written by Nick Joaquin.
137. d.Spanish : Spain
People of Thailand are called Thai as people of Spain are called Spanish
138. a.Swiss guard : Apostolic Palace
A Beefeater guards the Tower of London as a Swiss guard guards the Apostolic Palace.
139. c.unity : progress
Assiduity or diligence leads to success as unity leads to progress.
140. a.teacher : demonstration
Prior to the performance, actors do a rehearsal, as prior to teaching teachers do a demonstration.

Reading Comprehension

For items 141 - 145:

"Advice to Youth" (1882)
(an excerpt)
by Mark Twain

141. d. be respectful only to your superiors
Choice (a) is mentioned as advice in the 6th paragraph, choice (b) is also mentioned in the 3rd paragraph, and choice (c) is given in the seventh paragraph. The word "only" in choice (d) alters the statement of the author in the fourth paragraph.
142. a. sarcastic
Choice (b) persuades the readers to follow things but it lacks of moral responsibility. Choice (c) contradicts the statement in the third paragraph "and you can generally make more by humoring that superstition...". Choice (d) can not be the answer for the emotions applied are diverse. Choice (a) sarcastic is the author's tone because he uses the opposite perspective of what he intends to convey.
143. a. principles
Choice (b) can not be the answer for doctrine means a set of beliefs. Choice (c) is not the answer either for it means main principles of a religion. Choice (d) simply means acceptance of a statement.
144. b. contain your anger
Choice (a) opposes the definition of the statement. Choice (c) explains the literal meaning of the statement. Choice (d) does not mention to justify any emotion. Choice (b) is the answer for it provides the context clue "avoid violence"
145. d. essay
Choice (a) can not be the answer for it is not a lecture given by a religious clergy. Choice (b) is also wrong for it does not give opinion. Choice (c) means a series of letters. Choice (d) the best answer for the author elaborated the topic.

For items 146 - 150:

146. a. structure
Caisson means an enclosure to expel water to have access to underwater.
147. b. delight
The author stated a positive fact.
148. c. The Eminent Gustave Eiffel
Choice (c) speaks of Gustave Eiffel's formidability in his field.
149. a. shock
Bewilder means to mystify hence is close in meaning to shock.
150. c. magazine
The construction of the passage is one that is informative yet light in presentation. A characteristic of articles in magazines.

For items 151 - 155:

Learning Different Languages

151. a. People misinterpret other people's messages.
Choice (a) rephrases the statement of the author in the 1st line of the second paragraph.
152. b. gripped
Enthrall means to be bewitched, captivated, or held hence is synonymous to gripped.
153. a. It is in the first paragraph.
The thesis statement is the first line of the first paragraph. The thesis statement conveys the entire idea of the passage.
154. d. lose
Acquire means to get hence, its antonym is to lose.

155. a. Acquiring languages is significant so that people could better understand one another.

The passage is about the learning of language to understand cultures. Choice (a) conforms to the passage.

For items 156 - 160:

KARIMLAN

ni Kristine Ann D. Pascual

156. b. kahirapan

Ang (a) ay tumutukoy lamang sa nararamdaman ng mga tauhan. Ang (c) naman ay hindi nabanggit na isyung panlipunan. Ang (d) ay nagpapaliwanag ng kalagayan ng magkapatid pero hindi ito binigyang punto na isyu sa lipunan. Ang (b) ang tamang sagot dahil tumatalakay ito sa tema ng may akda sa buong kwento. Ipinapaliwanag nito ang estado at kapaligiran ng magkapatid.

157. a. ang mga magulang ng mga tauhan

Ang (b) ay inilarawan sa istorya "...katahimikang bumabalot sa aming barong-barong." Ang (c) ay inilarawan bilang "...ang tunog ng mga sasakyen sa labas, ang ingay at twanan ng mga tao..." Ang d ay ipinaliwanag sa bahaging "Niyakap niya ako. Ramdam ko ang pag-agos n luha sa kanyang mga mata..." A ay nabanggit lamang kung nasaan na ang kanilang mga magulang ngunit hindi ito inilarawan.

158. d. nag-iipon siya ng lakas para magawa niya ang balak niya

Hindi maaaring sagot ang (a) sapagkat tinatanong niya ang sarili niya kung paano siya magsisimula. Ang (b) ay hindi nagbanggit nang masaya niyang gagawin sa kanyang kapatid. Ang (c) ay kabaligtaran ng pahayag na "Hindi na siya mahihirapan..." Ang (d) ang sagot dahil ito ay sumasalamin sa damdamin ng tauhan, damdamin na gusto niya wakasan ang paghihirap ng kaniyang kapatid.

159. d. upang malaman ng mga mambabasa kung gaano kahirap ang maging mahirap
Ang (a) ay tumutukoy lamang sa kasalukuyang kalagayan ng mga tauhan. Ang (b) ay tumukoy sa kaisipang maiiwan sa mga mambabasa. Ang (c) ay naglalarawan lamang sa mundong o lipunang ginagalawan ng mga tauhan. Ang (d) ang tanging nagpapaliwanag sa antas o lebel ng kahirapan ng mga tauhan ng gustong iparating ng may akda.

160. b. pagtalbog ng boses

*Ang mga pinagpipiliang (a), (c), at (d) ay hindi tumutukoy sa salitang umalingawngaw. Ang salitang umalingawngaw o echoed ay ang pagtalbog o pagbanda ng tunog. Ginamit ang salitang **katahimikan** bilang pananda sa umalingawngaw.*

Logical and Abstract Reasoning - Explanations

1. d. 166

$$1, \underbrace{12,}_{+11} \underbrace{34,}_{+22} \underbrace{67,}_{+33} \underbrace{111,}_{+44} \underbrace{166,}_{+55}$$

2. b. $\frac{9}{14}$

The given fractions may be written as:

$$\begin{aligned} & \frac{3}{8}, \frac{1}{2}, \frac{9}{16}, \frac{3}{5}, \frac{5}{8}, \underline{\quad} \\ & \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow +3 \\ & \frac{3}{8}, \frac{6}{12}, \frac{9}{16}, \frac{12}{20}, \frac{15}{24}, \frac{18}{28} \\ & \qquad \qquad \qquad \downarrow +4 \end{aligned}$$

In lowest terms, $\frac{18}{28} = \frac{9}{14}$.

3. a. 46

Patterns can be observed in alternating numbers.

$$19, \underbrace{6,}_{+9} \underbrace{28,}_{+11} \underbrace{17,}_{+9} \underbrace{37,}_{+11} \underbrace{28,}_{+9} \underbrace{46,}_{+9}$$

4. a. 13

Each number inside the radical sign is increased by 21.

$$\begin{aligned} & 1, \sqrt{22}, \sqrt{43}, 8, \sqrt{85}, \sqrt{106}, \sqrt{127}, \sqrt{148}, \underline{\quad} \\ & \downarrow \\ & \sqrt{1}, \underbrace{\sqrt{22},}_{+21} \underbrace{\sqrt{43},}_{+21} \underbrace{\sqrt{64},}_{+21} \underbrace{\sqrt{85},}_{+21} \underbrace{\sqrt{106},}_{+21} \underbrace{\sqrt{127},}_{+21} \underbrace{\sqrt{148},}_{+21} \underbrace{\sqrt{169},}_{+21} \end{aligned}$$

Hence, $\sqrt{169} = 13$.

5. b. ZUH

First letters: V W X Y Z
 Second letters: A E I O U
 Third letters: L K J I H

6. b. 0256

For the letters:

A B C D E F G H I J K L M N O

For the numbers:

4, 16, 49, 121, 256

↓

$$2^2, \underbrace{4^2,}_{+3} \underbrace{7^2,}_{+4} \underbrace{11^2,}_{+5} \underbrace{16^2,}_{+5}$$

7. c. Ad

Identify the next capital letter by selecting every other letter in reverse alphabetical order. The skipping of letters is increasing by one.

O N M L K J H G F E D C B A

Identify the next small letter by selecting every other letter in alphabetical order. The skipping of letter is increasing by one.

p q r s t u v w x y z a b e d

8. a. KlmnoP

N ø PqR s t UvwX yza BcdeF ghij
KlmnoP

9. d. P26t

For each initial and terminating letter, change the letters from capital to small and vice versa.

First letter: D e f g h i J k l m n o P

number: 8 11 15 20 26
+3 +4 +5 +6

Last letter: h i j k l m n o p q r s t

10. a. elderberry

Notice that the first letters of the fruit names are in alphabetical order.

apple, banana, cantaloupe, dragon fruit

Hence, the next name of the fruit should start with letter e. Thus, the answer is choice (a) elderberry.

11. b. 34

The series may be written as:

4, 10, 16, 22, 28, .

Notice that the increase is by 6.

Hence, $28 + 6 = 34$.

12. c. BAB

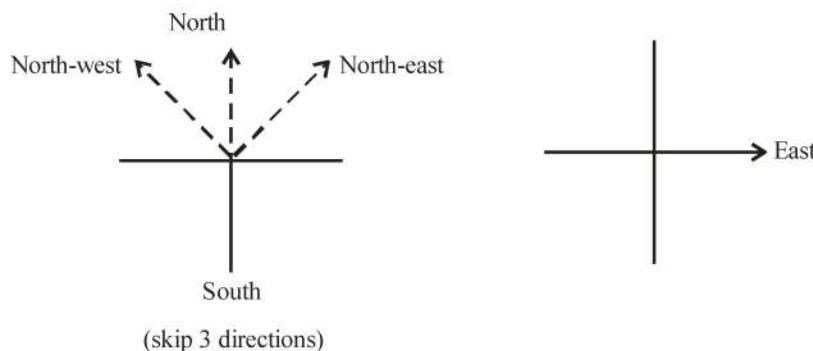
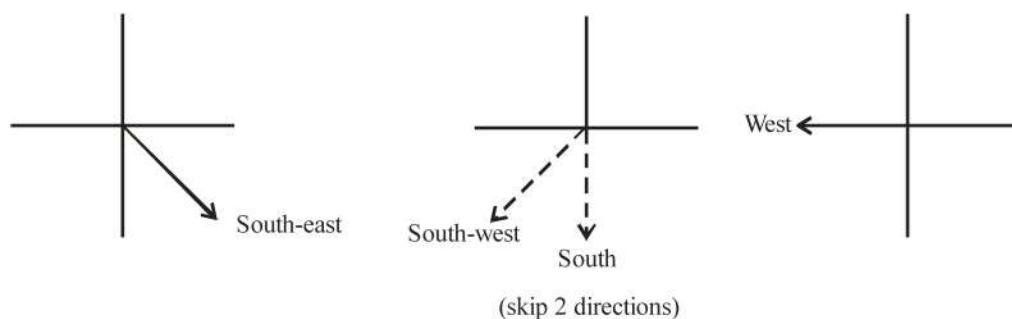
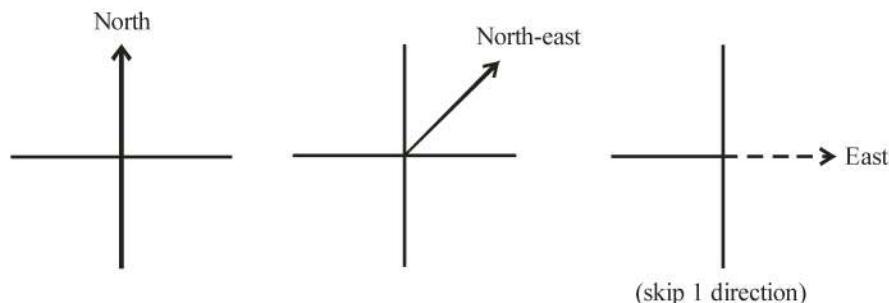
13. c. February

List the months starting with December going backwards while skipping an additional month each time.

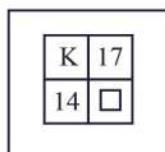
December, November, October, September, August, July, June, May, April, March, February

14. b. east

The direction moves clockwise, by 45° while skipping an additional step each time.

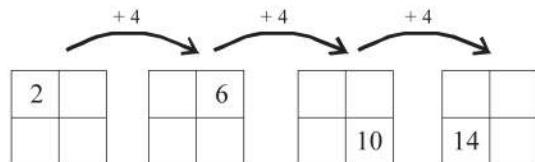


15.

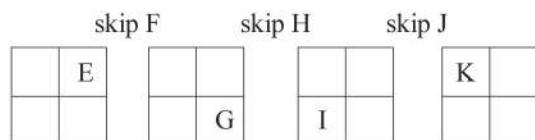


b

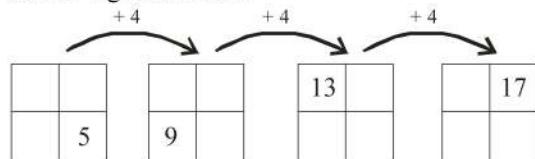
Each item inside the square rotates clockwise.
Upper left number:



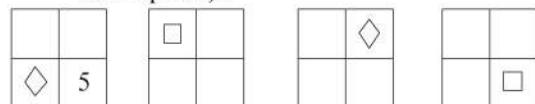
Upper right letter:



Lower right number:



Lower left symbol (alternate between diamond and square):



Thus, the answer is

| | |
|----|----|
| K | 17 |
| 14 | □ |

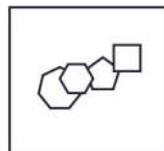
16.



a

Starting from north going clockwise, the figure increases by 2 and a new figure in alternate color is shaded. The inner circle changes/alternates shades.

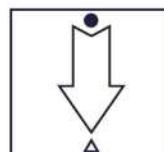
17.



b

- 1st box: square
2nd box: square (on top) pentagon
3rd box: square pentagon (on top) hexagon
4th box: square (on top) pentagon hexagon (on top) heptagon

18.



c

The large arrow moves in a counter-clockwise direction while the triangle and the circle move in a clockwise direction. The triangle and the square alternate in shade.

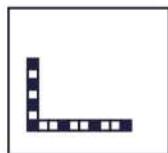
19.



c

A line is drawn from the lower left corner to the midpoint of the side of the polygon. The number of sides of each polygon increases by 1. Choices (b) and (d) do not conform with the pattern of the first three since the choices contain lines that do not start from the lower left corner.

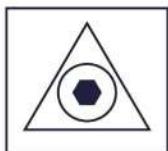
20.



a

The pattern of vertical from the bottom adds one white box and one black box while the pattern of horizontal left to right adds 2 white boxes and one black box. Hence choice (a).

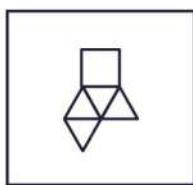
21.



a

The outermost and innermost figures change places while they alternate shades. The middle figure rotates 180°.

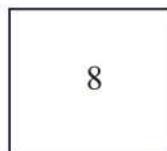
22.



d

The second figure shows the net of the first figure.

23.



c

The total letters in the first box is six while the total number of letters in the third box is eight.

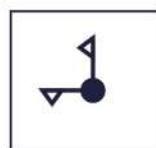
24.



a

The letter A in choice (a) has 3 segments (an odd number). The rest have even number of segments.

25.



c

Choice (c) does not follow the rotation pattern of the rest.

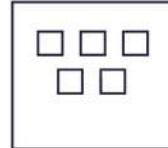
26.



c

Choice (c) does not follow the rotation pattern of the others

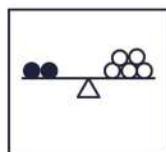
27.



b

Choices (a), (c), and (d) have an even number of shapes; 6, 8, and 12 respectively. Choice (b) has an odd number of shapes hence, the odd one out.

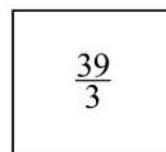
28.



c

The pattern is for every 2 white balls, there is a black one to balance. Only choice (c) does not conform with the pattern.

29.



c

The quotients in the choices are all divisible by 3 except for choice (c).

Rules of Inference in Logic:

Let p , q , and r be propositions

1. Modus Ponens

$$p \rightarrow q \quad (\text{If } p, \text{ then } q)$$

$$\frac{p}{}$$

$$\therefore p \quad (\therefore \text{ means therefore})$$

2. Modus Tollens $\quad p \rightarrow q$

$$\frac{\sim q}{\sim p}$$

3. Hypothetical Syllogism $\quad p \rightarrow q$

$$\frac{q \rightarrow r}{p \rightarrow r}$$

4. Disjunctive Syllogism $\quad p \vee q$

$$\frac{\sim p}{\therefore q}$$

30. d. If the function is differentiable at a certain value, then its limit exists.

Let D - the function is differentiable

C - the function is continuous

L - the limit exists at a certain value

Write the given statements in symbol form and determine if they follow the Rules of Inference.

If the function is differentiable at a certain value, then it is continuous.

$$D \rightarrow C$$

If the function is continuous at the same value, then its limit exists.

$$C \rightarrow L$$

By following Hypothetical Syllogism,

$$D \rightarrow L$$

$$\frac{C \rightarrow L}{}$$

$$\therefore D \rightarrow L$$

Therefore, if the function is differentiable at a certain value (D), then its limit exists (L).

31. d. Josephine did not ask Arianne for money.

Let A - Josephine asked Arianne for money

B - Josephine will be able to buy the latest smartphone

P - Josephine posts pictures about her birthday on social media

Write the given statements in symbols.

$$(1) \quad A \rightarrow B$$

$$(2) \quad B \rightarrow P$$

$$(3) \quad \sim P$$

Statements (2) and (3):

$$B \rightarrow P$$

$$\frac{\sim P}{}$$

$$\therefore \sim B \quad (4) \text{ Modus Tollens}$$

Statements (1) and (4):

$$A \rightarrow B$$

$$\frac{\sim B}{}$$

$$\therefore \sim A \quad \text{Modus Tollens}$$

Hence, Josephine did not ask Arianne for money.

32. c. Brittany does not have money left in her savings.

Let G - Brittany frequently goes to the gym
 R - Brittany frequently goes to the restaurant

L - Brittany will lose weight in less than a week

M - Brittany will have money left in her savings

Write the given statements in symbols.

$$(1) G \vee R \quad \vee - \text{ means or}$$

$$(2) G \rightarrow L$$

$$(3) R \rightarrow \sim M$$

$$(4) \sim G$$

Statements (1) and (4):

$$G \vee R$$

$$\sim G$$

$\therefore R$ (5) Disjunctive Syllogism

Statements (3) and (5):

$$R \rightarrow \sim M$$

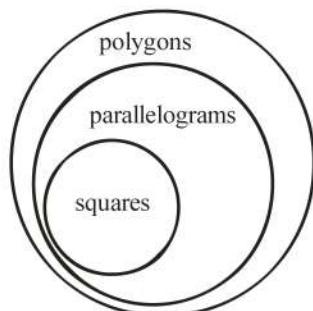
$$R$$

$\therefore \sim M$ Modus Ponens

Hence, Brittany does not have money left in her savings.

33. a. Some polygons are squares.

Use a Venn Diagram to represent the statements.



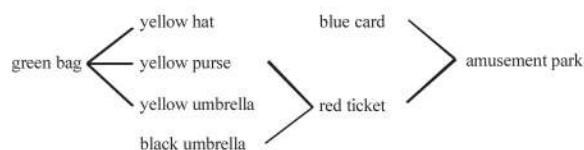
The set of squares is inside the set of polygon hence choices (b), (c), and (d) are false. Therefore, the correct conclusion is choice (a).

34. b. Some taxpayers donate their money to charity.



From the Venn diagram, choice (a) is false since not the whole set of philanthropists is inside the set of taxpayers. Choice (c) is false since only some taxpayers donate money to charity. Choice (d) is opinionated. Hence, the correct conclusion is choice (b).

35. d. green bag and black umbrella



36. d. Stephanie

$>$ means taller than

From the first sentence:

Samantha $>$ Grace $>$ Dianne $>$ Gwyneth

From the second sentence:

Stephanie $>$ Samantha

Dianne $>$ Gwyneth

Hence,

Stephanie $>$ Samantha $>$ Grace $>$ Dianne $>$ Gwyneth

Therefore, Stephanie is the tallest.

37. b. Lance's novels will be known all over the country.

Since Lance does not think outside the box, he is not a philosopher. Since he is not a doctor nor a philosopher, he is an author. Since Lance is an author, his novels will be known all over the country.

38. c. Birds do not crawl.

Let P - pigs fly

C - cats swim

D - dogs hate mice

B - birds crawl

Write the given statements in symbols.

$$(1) P \rightarrow C$$

$$(2) C \rightarrow D$$

$$(3) D \rightarrow B$$

Statements (1) and (2):

$$P \rightarrow C$$

$$\underline{C \rightarrow D}$$

$$\therefore P \rightarrow D \quad (4) \text{ Hypothetical Syllogism}$$

Statements (3) and (4):

$$P \rightarrow D$$

$$\underline{D \rightarrow B}$$

$$\therefore P \rightarrow B \quad (5) \text{ Hypothetical Syllogism}$$

If we use choice (c), birds do not crawl ($\sim B$), then by Modus Tollens

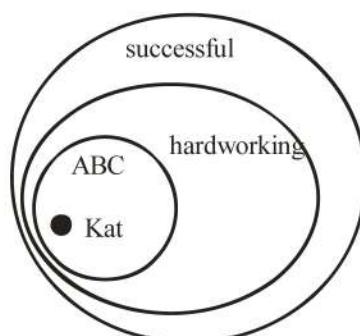
$$P \rightarrow B$$

$$\sim B$$

$$\therefore \sim P$$

The conclusion is true. Hence, the correct assumption is choice (c).

39. a. All hardworking people are successful in life.



From the Venn diagram, the conclusion that Kat will be successful in life is true.

40. a. Certainly true

Deductive Reasoning is a type of reasoning that goes from general statement to specific statements. Usually, this type of reasoning is answerable by certainly true or certainly false. If the statement is proven to be true, then the answer is "certainly true"; otherwise, "certainly false".

A - a number is divisible by both 5 and 3

B - a number is divisible by 15

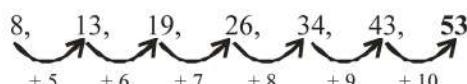
$$A \rightarrow B$$

$$\underline{A}$$

$$\therefore B$$

41. b. More likely to be true

Inductive Reasoning is a type of reasoning that goes from specific statement to general statements. Usually, this type of reasoning is answerable by most likely to be true or more likely to be false. If the statement is proven to be true, then the answer is "more likely to be true"; otherwise, "more likely to be false".



This is an example of inductive reasoning since the pattern was generalized based on the given sequence of numbers. Since the next number is 53 which is true based on the pattern, the answer is more likely to be true.

42. d. Certainly false

If there are two negative premises, there will be no conclusion drawn.

43. d. Certainly false

B - Bill will study law at Harvard University

S - Steve will graduate with a bachelor's degree

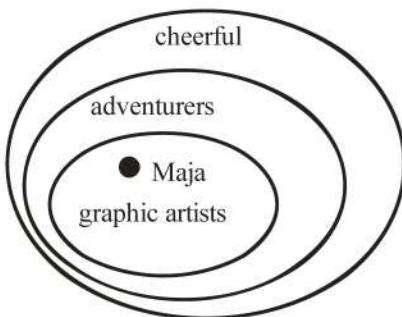
Write the statements in symbol.

$$B \rightarrow S$$

$$\begin{array}{c} \sim B \\ \hline \therefore \sim S \end{array}$$

This is invalid and does not follow any rule of inference. Hence, choice (d) certainly false.

44. a. Certainly true



Based on the Venn diagram, Maja is part of the set of cheerful. Hence, the conclusion is certainly true.

45. c. More likely to be false

Since this is by chance, this will be either choice (b) or choice (c). Also, the conclusion is contradicting the given assumption.

Hence, the answer is choice (c).



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