

SECTION 7 - SCHOLASTIC APTITUDE

HOW TO WORK IT OUT

1. **Aptitude Test**
 - **What is aptitude?** It is natural ability or skill at doing something. Its synonym is talent. (**Aptitude = talent**).
 - **What is aptitude Test?** It is one designed to show whether somebody has the natural skill or ability for a particular job or course of education.
 - **Aptitude Test** such as **Scholastic Aptitude Test** is a college university entrance examination that measure basic skills used in many different subject areas or **achievement tests** that measure knowledge of specific subject such as history or biology.
 - **Scholastic Aptitude Test** measure skills that are gained over a period of many years. Consequently, it is impossible to study for them in the usual sense. In other words, you can't simply sit down a few days before these exams and learn everything that you need to know for them. Instead, you must begin now to develop the skills that these tests measure, including **vocabulary**, your **reading** and **computational skills**; your **ability** to think **reasonably** and **critically**; and your **understanding** of the basic principles of English.
 - The **Scholastic Aptitude Test (SAT)** is divided into sections on **Verbal** and **Mathematical** ability.
 - The types of English items included in **scholastic aptitude test** are called **VERBAL REASONING**.
 - To prepare for this college entrance examination (SAT), familiarize yourself with the types of questions that the **verbal reasoning** contains.
- ☞ These include:
 1. Analogy
 2. Synonyms
 3. Antonyms
 4. Language usage
 5. Grammatical meaning
 6. Sentence completion
 7. Reading comprehension
 8. Logical reasoning
 9. Analytical reasoning

Analogy are words that are related to each other in some way. In an analogy question, you are given two words that are related, and you must determine what this relationship is. You then choose a second pair of words that are related in the same way. A typical analogy question looks like this.

Example: Analogies

SONG: REPERTOIRE

- | | |
|-----------------------|------------------------|
| A. Score: Melody | D. Suit: wardrobe |
| B. Solo: Chorus | E. Benediction: church |
| C. Instrument: artist | |

These are strategies to use in answering analogy questions.

1. First determine the relationship between containing **both of them**.
2. Then, find a second pair of words that you can substitute for the original pair.

Several **suits** make up a **wardrobe**.

Common relationships found in analogy questions include.

Types of analogy	Examples
Action to object	Play: clarinet
Cause to effect	Sun: sunburn
Item to category	Iguana: reptile
Object to its function	Pencil: writing
Object to its material	Curtains: cloth
Part to whole	Page: book
Time sequence	Recent: current
Word to antonym	Help: hinder
Word to synonym	Provisions: supplies
Worker and creation	Artist: sketch
Worker and tool	Lumberjack: saw
Type of characteristic	Dancer: agile

1.2 Synonyms (SYN)

- **Synonyms** are words that have similar to meanings. Most **synonyms** don't mean exactly the same thing knowing the small differences in meaning between two synonyms enables you to each word precisely.
- Learning **synonyms** will help you broaden your vocabulary, expanding the range of words available to you and enabling you to express your ideas with precision.

Examples: Sincere, unaffected, heartfelt

- ☞ Show, display, exhibit, expose
- ☞ Expect, anticipate, hope, await
- ☞ Contain, hold, accommodate
- ☞ Rational, reasonable, sensible
- ☞ are synonym words

1.3 Antonyms

- An **antonym** is a word that is opposite in meaning to another word. **Antonym questions** provide a single word and ask you to select from a list of words the one that is most opposite meaning.
- A typical antonym question looks like this:

Example: Antonyms

DEPRESS:

- | | | |
|----------|------------|-----------|
| A. Force | C. Clarify | E. Loosen |
| B. Allow | D. Elate | |

- To answer an antonym question, use the following strategies.
 1. Look for a word that is opposite in meaning. Don't be thrown off by any synonyms – words that are similar in meaning – that included among the choices.
 2. Before looking at the choices be sure that your know the meaning of the first word. Define it using any of the following methods:
 - a. Think of another word or group of words that means the same thing.
 - b. Think of a sentence or sentences that use the word, then try to arrive at an exact definition.
 - c. Try analyzing the parts of the word.
 3. Once you know the meaning of the first word, look at the choices. If none of these is obviously the correct antonym, try either or both of the following strategies.

- a. Eliminate any odiously correct answers.
- b. Remember that many words have more than one meaning. If none of the choices seems to be opposite in meaning, think of other meanings of the first word.

Therefore, the answer to the sample question is (D).

1.4

Language usage questions (usage questions)

This kind of question can ask either the corresponding meaning or phrases or idioms or the grammatical error within the same sentence.

Idioms (especial meaning phrases) can be done through the contextual meaning they have in a sentence or we need to know the especial expressions they originally have.

Grammatical usage (seeking error) question require that you recognize wiring that is not standard written English. In usage questions, four words or phrases are underlined and lettered. You must either choose the underlined part the contains an error or mark the answer corresponding to no error.

Here is a typical usage question.

Example: Usage questions

He spoke blunty and angrily to we spectators. No

Use the following strategies to answer usage questions.

1. Read the sentences in its entirety.
2. Look for errors of the following kinds.
 - a. Incorrect word error
 - b. Errors in punctuation
 - c. Errors in capitalization
 - d. Errors in grammar
 - e. Improper, awkward, or unclear sentence structure
3. Common grammatical errors found in usage questions include the following: incorrect verb tenses, improper agreement of pronoun and antecedent or of subject and verb, improper form of the pronoun, and use of an adjective for an adverb or an adverb for an adjective. Common errors in sentence structure include fragments, dangling modifier, improper parallelism, and run – on caused by comma faults.
4. Remember that the error, if there is one, appears in one of the underlined sections of the sentence.

- Thus, the correct answer to the example question is (c). The object pronoun 'us' should follow the preposition.

1.5 Grammatical Meaning questions

This is the same as/ to mean language usage. This type of question is to ask you to choose a sentence that carries the closest/ nearest meaning to the given sentence (with original sentence).

1.6 Sentence completion questions

- **Sentence completion** questions measure both your vocabulary and your ability to recognize relationships between parts of a sentence. You are given a sentence from which one or two words have been removed. You must choose words that best fit the meaning of the rest of the sentence.
- A typical sentence completion question looks like this.

Example: Sentence completion

The author was determined to _____ his own conclusion, so he _____ any information that didn't support it.

- | | |
|---------------------------|------------------------------|
| A. Unhold . . . ignored | D. disprove . . . destroyed |
| B. Revise . . . destroyed | E. reverse . . . confiscated |
| C. Advance . . . devised | |

To answer sentence completion questions, use the following strategies.

1. Read the incomplete sentence carefully, noting any key words. Pay particular attention to words that indicate contrast (**but however, on the other hand**) or similarly (**and, another, the same as**).
2. Try each of the choices in the sentence, eliminating any that make no sense or that are grammatically incorrect.
3. Don't mislead by answers that contain only one word that fits well into the sentence. Incorrect answers often contain one word that makes sense and another one that doesn't. In the example, the first word in answer c makes sense, but the second word doesn't. Answer A is correct.
4. Look for grammatical clues in the sentence. Does the sentence call for a verb, an adverb, a noun? If a verb is required, what should its tense be? By asking such questions, you can sometimes eliminate incorrect answers.

1.7 Reading comprehension question

The reading comprehension questions measure your ability to understand various kinds of reading passages. The passages are taken from such fields as biological and physical sciences, the humanities and the social science.

To answer reading comprehension questions, use the following strategies.

1. Expect questions on the following:

- a. The central thought of the passage.
- b. Specific details in the passage.
- c. Conclusions that can be made based upon information provided in the passage.
- d. The meaning of words in the passage.
- e. The mood of the passage.
- f. Specific techniques used by the writer of the passage.
- g. Relationships between things in the passage.

2. As you read the passage, identify the main idea and pay particular attention to transitional and other words that show relationships.

3. Read all the choices before you select an answer.

4. Answer the questions based on material in the passage, not on your own knowledge or opinions.

5. Don't choose an answer simply because it is true. Make certain that you answer the questions being asked.

6. Don't be misled by answers that are partially correct.

7. Budget your time. Set a time limit for reading each passage and answering questions on it. Don't waste time on impossibly difficult questions. Refer to your watch to make sure that you are not spending too much time.

1.8 Logical reasoning question

Logic is the study of reasoning (logical reasoning).

One of the most basic types of reasoning is known as induction.

A. Inductive reasoning

This is the process arriving at a general conclusion based up on specific facts.

A simple example of induction may be illustrated as follows.

1. First, you observe several specific facts. In the past, candidate smith has always voted in favor of federally – funded jobs programs. In a speech before the league of women voters, candidate smith expressed his support for federally – funded any

care centers. In a new conference, candidate – smith stated that he plans to introduce legislation that will provide federal assistance to pay the utility bills of people who need help.

2. Then, having noticed a similarity between these specific facts, you draw a conclusion.

☞ Candidate smith usually supports federally – funded social programs.

The conclusion that is drawn through inductive reasoning is called **generalization**. The group of specific on which the generalization is based is called a **sample**.

☞ [specific fact + specific fact → generalization]

B. **Deductive reasoning**

- In **deductive**, you start with a generalization and then derive a specific fact from it.

[Generalization + related fact → specific fact]

E.g.1 Snakes that have fangs are poisonous (generalization). The asp viper has fangs (**related facts**). Therefore, the asp viper is poisonous (specific fact).

Example 2: All ballads are poems (**Major premise**)

“Barbara Allen” is a ballad. (**Minor premise**)

Therefore, “Barbara Allen” is a poem. (**Conclusion**)

1.9 **Analytical Reasoning questions**

- **Analytical reasoning** is logic that is inferred through the virtue of the statement's own content, and it can be used to solve many types of problems in almost any discipline. This analytical aptitude test assesses inductive and deductive reasoning skills.

1. If the product of three consecutive positive integers is equal to their sum, what is the largest integer?
A. 3 B. 2 C. 1 D. 0

Solution: Let $2n - 1$, $2n$ and $2n + 1$, are consecutive positive integer for $n = 1, 2, 3, 4, \dots$

$$(2n - 1)(2n)(2n + 1) = (2n - 1) + 2n + (2n + 1)$$

$$\Rightarrow 8n^3 - 2n = 6n$$

$$\Rightarrow 8n^3 - 8n = 0 \Leftrightarrow 8n(n^2 - 1) = 0$$

$$\therefore n = 0 \text{ and } n^2 - 1 = 0, \text{ that is } n = 1, \text{ or } n = -1$$

However, we take only $n = 1$

Therefore 1, 2 and 3 are the number.

Answer: A

2. What is the missing value of b in the sequence 33, b , 19, 12, 5?

A. 25 B. 26 C. 27 D. 29

Answer: B

3. If $a + 3b = 13$ and $3a + 3b = 15$, what is the arithmetic mean of a and b ?

A. 3.5 B. 3 C. 2.5 D. 2

Solution: we have $3a + 3b = 15 \Rightarrow a + b = 5$

$$(a + 3b) - (a + b) = 13 - 5$$

$$2b = 8 \Rightarrow b = 4 \text{ and } a = 1$$

$$\therefore \text{A.M} = \frac{a + b}{2} = \frac{1 + 4}{2} = 2.5$$

Answer: C

4. If $7x + 17 = 49$, what is the value of $\sqrt{7x + 49}$?

A. 7 B. $4\sqrt{7}$ C. $8\sqrt{5}$ D. 9

Solution:

$$7x + 17 = 49 \text{ equivalent to}$$

$$7x + 17 + 32 = 49 + 32 \leftarrow \text{Adding 32 to both side}$$

$$7x + 49 = 81$$

$$\therefore \sqrt{7x + 49} = \sqrt{81} = 9$$

Answer: D

5. If $x = 16 \times 7$, which one of the following is NOT an integer?

A. $x \div 2$

C. $x \div 4$

B. $x \div 3$

D. $x \div 7$

Solution: $x = 16 \times 7 = 112$, therefore,

112 is visible by 2, 4 and 7

Answer: B

6. If the product of four integers is negative, how many of the integers can be negative at most?
 A. 1 B. 2 C. 3 D. 4

Solution:

$(+ve)(+ve)(+ve)(-ve) = -ve \leftarrow$ one negative and 3 positive.

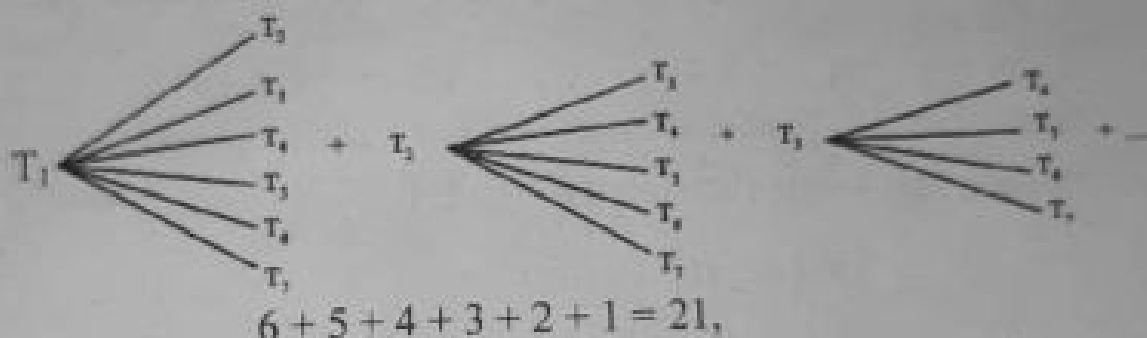
$(+ve)(-ve)(-ve)(-ve) = -ve \leftarrow$ 3 negative and 1 positive.

Answer: C

7. A team of seven teachers met for a discussion. Each teacher shook hands once with each other. How many handshakes took place?
 A. 36 B. 28 C. 21 D. 15

Explanation:

Let each of them are $T_1, T_2, T_3, T_4, T_5, T_6, T_7$



Answer: C

8. If x and y are integers such that $2x - 4 > 0$ and $2y + 4 < 0$, then which of the following must be true?
 A. xy is negative C. xy is odd
 B. xy is positive D. xy is even

Solution: Here

$$\rightarrow 2x - 4 > 0 \Rightarrow x > 2 = \{3, 4, 5, \dots\}$$

$$\rightarrow 2y + 4 < 0 \Rightarrow y < -2 = \{-6, -5, -4, \dots\}$$

$\therefore xy$ is negative,

Answer: A

9. What is the value of $\sqrt{2} \times \sqrt{15}$?

- A. 15 C. $\sqrt{30}$
 B. 30 D. $\sqrt{17}$

Solution: $\sqrt{2} \times \sqrt{15} = \sqrt{2 \times 15} = \sqrt{30}$

Answer: C

10. If a is 9 more than b , b is 4 more than c , and d is 3 more than c , then what is the positive difference between a and d ?

- A. 13 B. 12 C. 11 D. 10

Hint: $a = 9 + b$, $b = 4 + c$, and $d = 3 + c$

$$|a - d| = |9 + b - (3 + c)| = |9 - 3 + b - c| = |6 + b - c|$$

But we have $b = 4 + c$

$$\therefore |6 + 4 + c - c| = |10| = 10,$$

Answer: D

11. One ordering of the letters A, B, C and D from left to right is BACD. What is the total number of orderings of these letters from left to right, including BACD?

A. 12 B. 16 C. 20 D. 24

Solution: $4P_4 = \frac{4!}{(4-4)} = \frac{4!}{0!} = 4! = 4 \times 3 \times 2 \times 1 = 24$

Answer: D

12. In a group of 15 persons, 7 can speak Arabic, 8 can speak English, and 3 can speak neither, what fraction of the group can speak both English and Arabic?

A. $1/3$ B. $2/3$ C. $1/5$ D. $4/5$

Hint: Let A = Arabic speaker and E = English speaker

Recall: $n(A \cup E)' = \bigcup - n(A \cup E)$

$$3 = 15 - n(A \cup E)$$

$$\Rightarrow n(A \cup E) = 15 - 3 = 12$$

We know that $n(A) + n(E) = n(A \cap E) + n(A \cup E)$

$$7 + 8 = n(A \cap E) + 12$$

$$\therefore n(A \cap E) = 3 \leftarrow \text{both speakers}$$

$$\therefore \text{From group can speak both language is fraction of } \frac{3}{15} = \frac{1}{5}$$

Answer: C

13. Sixty bottle contain a total of 24 liters of mango juice. If each bottle contains the same amount of mango juice, how many liters of juice are in each bottle?

A. 0.2 B. 0.3 C. 0.4 D. 0.8

Hint: $60x = 24 \Rightarrow x = \frac{24}{60} = \frac{2}{5} = 0.4$

Answer: C

14. Halima wants to tile the floor of her bedroom. The floor is rectangular and measures 12 meter by 8 meter. If it costs 2.50 birr

per square meter for the materials, then what is the total cost of the materials in Birr for tiling the bedroom?

A. Birr 240

C. Birr 200

B. Birr 220

D. Birr 160

Explanation: Area = $12\text{m} \times 8\text{m} = 96\text{m}^2$

$$\left. \begin{array}{l} 1\text{m}^2 = 2.5\text{Birr} \\ 96\text{m}^2 = x \end{array} \right\} \Rightarrow x = 96 \times 2.5 = 240\text{Birr}$$

Answer: A

15. There are 27 students in a mathematic class and 22 students in an English class seven of these students take mathematics and English. What is the ratio of the number of students taking only English to those taking mathematics?

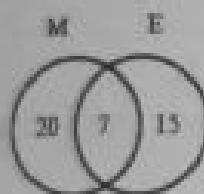
A. 2:5

C. 4:3

B. 3:4

D. 7:6

Solution: Let M = student in mathematics class
E = student in English class



✓ Number of student taking math's only = 20

✓ Number of student taking English only = 15

$$\text{Ratio} = \frac{15}{20} = 3:4$$

Answer: B

16. Compare the following two quantities.

Quantity A	Quantity B
$11 \times \sqrt{2}$	$9 \times \sqrt{3}$

- A. The two quantities are equal.
B. Quantity A is greater than quantity B
C. Quantity B is greater than quantity A
D. The two quantities cannot be compared.

Solution: comparing means ordering, $\leq$, $>$, $=$

- Quantity A = $11 \times \sqrt{2} = \sqrt{121} \times \sqrt{2} = \sqrt{121 \times 2} = \sqrt{242}$

- Quantity B = $9 \times \sqrt{3} = \sqrt{81} \times \sqrt{3} = \sqrt{81 \times 3} = \sqrt{243}$

Quantity B > Quantity A

Answer: C

17. Suppose that $a < b < c < 0$ and compare the following two quantities.

Quantity A	Quantity B
$\frac{c}{b}$	$\frac{c}{a}$

- A. The two quantities are equal
 B. Quantity B is greater than quantity A
 C. Quantity A is greater than quantity B
 D. The two quantities cannot be compared.

Hint: let $a = -4$, $b = -3$, $c = -2$ Quantity

$$A: \frac{c}{b} = \frac{-2}{-3} = \frac{2}{3} \text{ are quantity B : } \frac{c}{a} = \frac{-2}{-4} = \frac{1}{2} \Rightarrow \frac{2}{3} > \frac{1}{2}$$

Answer: C

18. Suppose b and c are any real numbers?

Quantity A	Quantity B
$b = c - 1$	$c = b + 1$

- A. The two quantities are equal
 B. Quantity A is less than quantity B
 C. Quantity A is greater than quantity B
 D. The relationship cannot be determined from the information given.

Hint: Quantity (A) : $b = c - 1 \Rightarrow c = b + 1$

Quantity B : $c = b + 1$

Answer: A

19. Consider the following two quantities.

Quantity A	Quantity B
The number of prime numbers that are divisible by 3	The number of prime numbers that are divisible by 5.

- A. The two quantities are equal
 B. Quantity A is less than quantity B
 C. Quantity A is greater than quantity B
 D. The relationship cannot be determined from the information given.

Hint: The only prime number that are:

Divisible by 3 is 3 itself

Divisible by 5 is 5 itself

Answer: A

Questions 20 – 23 below are based on the hypothetical data given in Table 1.

Table 1. Family size, annual income and annual expenses (in Ethiopian birr, ETB) of 10 families in Addis Ababa

Code	Family size	Annual income (in ETB)	Annual expenses (in ETB)
Family 1	5	120,000	95,000
Family 2	3	80,000	55,000
Family 3	9	75,000	72,000
Family 4	5	150,000	110,000
Family 5	6	148,000	120,000
Family 6	8	90,000	70,000
Family 7	4	84,000	60,000
Family 8	6	90,000	60,000
Family 9	7	72,000	66,000
Family 10	7	84,000	72,000
Sum	60	993,000	780,000

20. For which three of the families are the ratio of annual income to family size the largest?

A. Families 3, 4 and 5
 B. Families 1, 2 and 4
 C. Families 4, 2 and 5
 D. Families 2, 5 and 7

Answer: C

21. Which one of the following can be inferred from the data in table 1 above?

I. The mean annual saving of the ten families in ETB 21, 300
 II. The mean family size of the ten families is 6
 III. The mean annual expense of the ten families is ETB 99,330.

A. I and II
 B. II and III
 C. I and III
 D. I, II and III

Solution: Heat at:

$$\text{I. mean annual saving} = \frac{993,000 - 780,000}{10} = 21,300$$

$$\text{II. mean family size} = \frac{60}{10} = 6$$

$$\text{III. mean annual exp} = \frac{780,000}{10} = 78,000$$

Answer: A

22. If the difference between each family's annual income and annual expenses directly goes into their bank saving accounts, which two families have the lowest and highest annual savings, respectively?
- A. Families 3 and 1 C. Families 9 and 10
 B. Families 9 and 4 D. Families 3 and 4 **Answer: D**
23. For which one of the families is the ratio of annual income to annual expenses closest to 1,00?
- A. Family 10 C. Family 9
 B. Family 3 D. Family 5 **Answer: C**

Questions 24 – 25 below are based on the data in the pie chart.

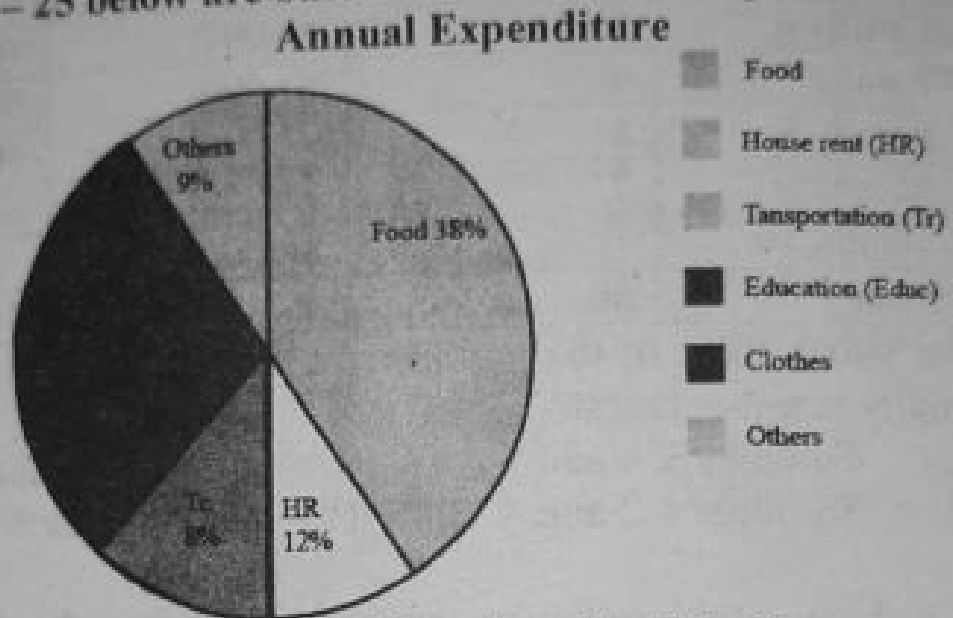


Figure 1. Annual Expenditure of the 10 Families

24. From the pie chart, what is the ratio of the annual expenditure on food to the annual expenditure on education?
- A. 9:18 B. 19:9 C. 2:1 D. 3:2
- Solution:** $38\% : 18\% = 19:9$ **Answer: B**
25. Considering the data provided in table 1 and figure 1 above, which one of the following can be inferred?
- I. The 10 families spend ETB 296,400 annually on food.
 II. The ratio of annual expenditure on transportation to that on clothing is 8:15
 III. The ratio of annual expenditure on house rent to the corresponding expenditure on clothing is 4:5.
- A. I only C. II only
 B. III only D. I, II and III

Solution: Here at

- I. $38\% \text{ of } 780,000 = 0.38 \times 780,000 = 296,400$
 II. $8\% : 15\% = 0.08 : 0.15 = 8:15$
 III. $12\% : 15\% = 12:15 = 4:5$

Answer: D

Section II: Quantitative reasoning (Questions 1 – 24)

DIRECTIONS: Solve each of the problems given in questions 1 – 21 below and select the best answer choice from the given alternatives. Then, find the correct question number and **blacken** the letter of your choice on the separate answer sheet provided.

1. What decimal of an hour is a second?

A. 0.0167 B. 0.000126 C. 0.0256 D. 0.00027

Hint:

$$1\text{sec} = \frac{1}{3600}\text{hour} = 0.00027$$

Answer: D

2. What least number must be added to 1056, so that the sum is completely divisible by 23?

A. 18 B. 2 C. 3 D. 21

Hint: $46 \times 23 = 1058 - 1056 = 2.$

Answer: B

3. The largest 4 digit number exactly divisible by 88 is:

A. 9768 B. 9988 C. 9944 D. 8888

Hint: $10,000 = (113)(88) + 46$

Answer: C

4. If $n = 9 \times 28 \times 26$, which of the following is **NOT** an integer?

A. $n/18$ B. $n/32$ C. $n/21$ D. $n/36$

Hint: $n = 9 \times 28 \times 26 = 3^2 \times 2^3 \times 7 \times 13.$

A) $\frac{n}{18} = \frac{3^2 \times 2^3 \times 7 \times 13}{2 \times 3^2} = 14 \times 26 \leftarrow \text{integer}$

B) $\frac{n}{32} = \frac{3^2 \times 2^3 \times 7 \times 13}{2^5} = \frac{3^2 \times 7 \times 13}{2^2} \leftarrow \text{not integer}$

Answer: B

5. The sum of the first nine natural numbers (1, 2, ..., 9) is

A. 90 B. 55 C. 45 D. 100

Hint: $\text{sum} = (\text{average})(\text{number of terms})$

$$= \left(\frac{1+9}{2} \right) (9) = 45$$

Answer: C

6. If $a + b = 10$ and $a - b = 5$, then $a^2 - b^2$ is equal to
 A. 50 B. $1/2$ C. 5 D. 2

Hint: $a^2 - b^2 = (a - b)(a + b) = (5)(10) = 50$

Answer: A

7. In which of the following pair of number is the first number or expression necessarily less than the second number or expression?

A. $3/7$; $9/49$

B. $x/4$; $14/x$, for $x > 0$

C. $(2/3)^2$; $2/3^2$

D. $[(3/7)(24/25)]$; $(7/3)$; 1

Hint: $\left(\frac{3}{7}\right)\left(\frac{7}{3}\right)\left(\frac{24}{25}\right) = \frac{24}{25} < 1$

Answer: D

8. Which one of the following fractions is greater than $3/4$ and less than $5/6$?

A. $1/2$

B. $4/5$

C. $2/3$

D. $9/10$

Hint: $\frac{3}{4} < \frac{4}{5} < \frac{5}{6}$

Answer: B

9. $(100 \times 5^4) = ?$

A. 62500

B. 76600

C. 67000

D. 77200

Hint: $(100 \times 5^4) = (100 \times 625) = 62500$

Answer: A

10. $(935421 \times 625) = ?$

A. 575648123

C. 584638125

B. 584649124

D. 935425

Hint: $935421 \times 625 = 584638125$

Answer: C

11. In a certain school, 20% of students are below 8 years of age. the number of students above 8 years of age is $2/3$ of the number of students of 8 years of age which is 48. What is the total number of students in the school?

A. 72

B. 150

C. 80

D. 100

Hint: Let $x = 20\%$ of student below 8 years.
 Let $y =$ student of 8 years age.
 Let $z =$ student of above 8 years age.

$$z = \frac{2}{3}y = 48 \Rightarrow y = \frac{3}{2} \times 48 = 72$$

$$\rightarrow 80\% \text{ of student} = y + z = 72 + 48 = 120$$

$$\rightarrow 80\% \text{ of what number is } 120$$

$$80\%k = 120$$

$$k = \frac{120}{80\%} = \frac{120}{0.8} = 150$$

Answer: B

12. A student multiplied a number by $\frac{3}{5}$ instead of $\frac{5}{3}$. What is the approximate percentage error in the calculation?

A. 34% B. 105% C. 75% D. 64%

Hint: Percentage error will be $k = \frac{\frac{5}{3} - \frac{3}{5}}{\frac{5}{3}} \times 100\%$

$$= \frac{25-9}{15} \times \frac{3}{5} \times 100\% = \frac{16}{25} \times 100\% = 64\%$$

Answer: D

13. Two students appeared at an examination. one of them secured 9 marks more than the other and his mark was 56% of the sum of their marks. the marks obtained by them are:

A. 39, 30 B. 43, 34 C. 42, 33 D. 41, 32

Hint: Let $x + 9$ and x was their mark.

$$(x + 9) + x = 2x + 9$$

Since $x + 9$ is 56% of $2x + 9$

$$\Rightarrow x + 9 = \frac{56}{100}(2x + 9) = 0.56(2x + 9)$$

$$\Rightarrow x + 9 = 1.12x + 5.04$$

$$\Rightarrow 1.12x - x = 9 - 5.04 \Rightarrow 0.12x = 3.96$$

$$\Rightarrow x = \frac{3.96}{0.12} = 33$$

$$\text{Thus, } x + 9 = 33 + 9 = 42$$

Answer: C

14. The greatest number of four digits which is divisible by 15, 25, 40 and 75 is:

A. 9600 B. 9000 C. 9400 D. 9800

Hint: 9600 is divisible by 15, 25, 40 and 75.

Answer: A

15. What is the missing number in the following series?

1, 9, 25, 49, (...)

A. 54 B. 56 C. 81 D. 64

Hint: $1^2, 3^2, 5^2, 7^2, 9^2$

Answer: C

16. Which of the following is the largest fraction?

A. $\frac{7}{8}$ B. $\frac{3}{4}$ C. $\frac{4}{5}$ D. $\frac{7}{9}$

Hint: $\frac{3}{4} < \frac{7}{9} < \frac{4}{5} < \frac{7}{8}$

Answer: A

17. All of the following are ways to write 20 percent of N, EXCEPT?

A. $0.20N$ B. $20N$ C. $\frac{1}{5}N$ D. $\frac{20}{100}N$

Hint: 20% of $N = \frac{20}{100} \times N = \frac{1}{5}N = 0.2N$

Answer: B

18. The highest among the following is:

A. $(0.02)(0.05)$ C. $(0.02)(0.04)$

B. $(0.02)(0.02)$ D. $(0.02)(0.03)$

Hint: $0.02 < 0.03 < 0.04 < 0.05$

Answer: A

19. A circular region has circumference c centimeters and area k square centimeters. If $c = 3k$, what is the radius of the circle in centimeters?

A. $\frac{3}{2}$ B. $\frac{1}{3}$ C. $\frac{2}{3}$ D. 3

Hint: $\frac{\text{circumference}}{\text{Area}} = \frac{c}{k} = \frac{2\pi r}{\pi r^2}$

$$\Rightarrow \frac{c}{k} = \frac{3k}{k} = \frac{2}{r} \Rightarrow \frac{r}{2} = \frac{1}{3} \Rightarrow r = \frac{2}{3}$$

Answer: C

20. In one month, Hana used $\frac{1}{6}$ of her monthly salary for a car payment and $\frac{1}{4}$ more than the car payment for rent. What fraction of her monthly salary did Hana use that month for the car payment and rent combined?

A. $\frac{7}{12}$ B. $\frac{3}{8}$ C. $\frac{5}{12}$ D. $\frac{5}{24}$

Hint: Let x be Han's monthly salary.

$$\Rightarrow \text{fraction} = \frac{(\text{car payment}) + (\text{rent})}{\text{Total}}$$

$$= \frac{\left(\frac{1}{6} \text{ of } x\right) + \left(\frac{1}{6} \text{ of } x + \frac{1}{4} \text{ of } x\right)}{x}$$

$$= \frac{\frac{1}{6}x + \frac{1}{6}x + \frac{1}{4}x}{x} = \frac{\frac{7}{12}x}{x} = \frac{7}{12}$$

Answer: A

21. The population of a town increased from 175,000 to 262,500 in a decade. The average percent increase of population per year is:

A. 5.37% B. 5% C. 7.03% D. 8%

$$\begin{aligned} \text{Hint: } \text{Percent increase} &= \frac{262,500 - 175,000}{175,000 \times 10} \times 100\% \\ &= \frac{0.5 \times 100\%}{10} = 5\% \end{aligned}$$

Answer: B

22. A fruit seller sold 40% of the oranges he had and still has 420 oranges. How many oranges did he have originally?

A. 700 oranges C. 588 oranges
B. 600 oranges D. 672 oranges

$$\text{Hint: } 60\% \text{ of } x = 420 \Rightarrow 0.6x = 420$$

$$x = \frac{420}{0.6} = 700$$

Answer: A

Data Interpretation questions (58 – 60)

DIRECTIONS: The following table gives the percentage of marks obtained by seven students in six different subjects in an examination. Answer questions 58 – 60 based on the data in the table and **blacken** the letter of your choice on the separate answer sheet provided.

Student	Maths	Chemistry	Physics	Geography	History	Computer science
Ayele	90	50	90	60	70	80
Aman	100	80	80	40	80	70
Seid	90	60	70	70	90	70
Ruth	80	65	80	80	60	60
Meron	80	65	85	95	50	90
Tekle	70	75	65	85	40	60
Tilahun	65	35	50	77	80	80

23. What is the aggregate of marks obtained by Seid in all the six subjects?

A. 409 B. 419 C. 450 D. 429

Solution: Seid marks = $90 + 60 + 70 + 70 + 90 + 70 = 450$

Answer: C

24. In which subject is the overall percentage best?

A. Chemistry B. Maths C. Physics D. History

Answer: B

25. The number of students who obtained 60% and above marks in each subjects is?

A. 2 B. 1 C. 3 D. 4

Hint: Seid and Ruth scored 60% and above in each subject.

Answer: A

- C. Mohammed, Meaza, and Alemayhu
D. Mohammed, Meaza, and Alemayhu

Answer: C

Section two: Quantitative Reasoning (Questions 36 – 60)

Directions: Solve each of the problems given in questions 36 – 54 below and select the best answer from the given alternatives. Then find the correct question number and blacken the letter of your choice on the separate answer sheet provided.

36. When a number is divided by 2 the result is equal to the result when that same number is divided by 4. What is that number?

A. -2 B. 0 C. 2 D. 4

Solution: Let x be the number and k be the result

$$\frac{x}{2} = k \dots * \text{ and } \frac{x}{4} = k \dots **$$

From * and **

$$\frac{x}{2} = \frac{x}{4} \Rightarrow 4x = 2x$$

$$\Rightarrow 4x - 2x = 0 \Rightarrow x = 0$$

Answer: B

37. If $\frac{6}{x} = \frac{18}{x+6}$, what is the value of $\frac{x}{3}$?

A. 1 B. 2 C. 3 D. 4

Solution: $\frac{6}{x} = \frac{18}{x+6} \Rightarrow 6(x+6) = 18x$

$$\Rightarrow 6x + 36 = 18x \Rightarrow -12x = -36 \text{ then } x = 3$$

$$\text{If } x = 3 \text{ then } \frac{x}{3} = \frac{3}{3} = 1$$

Answer: A

38. What is the value of $x + 10$, if $(x - 5) = \frac{11}{(x + 5)}$, for $x \neq -5$?
- A. -10 B. 4 C. 10 D. 25

$$\text{Solution: } x - 5 = \frac{11}{x + 5} \Rightarrow (x - 5)(x + 5) = 11$$

$$\Rightarrow x^2 - 25 = 11 \Rightarrow x = \pm\sqrt{36} = \pm 6$$

$$\text{i) If } x = -6 \text{ then } x + 10 = -6 + 10 = 4$$

$$\text{ii) If } x = 6 \text{ then } x + 10 = 6 + 10 = 16$$

Answer: B

39. Which of the following is less than z if z is a number between 0 and 1?

A. z^2 B. $\sqrt{z}$ C. $2z$ D. $1/z$

$$\text{Hint: Let } z = \frac{1}{4} \text{ then } z^2 < z < \sqrt{z}$$

Answer: A

40. What is the sum of the following values
($1/4 + 0.25 + 25/100 + 10/40 + 25/50 + 50/100$)?
- A. 1 B. 2 C. 3 D. 4

$$\text{Solution: } \frac{1}{4} + 0.25 + \frac{25}{100} + \frac{10}{40} + \frac{25}{50} + \frac{50}{100}$$

$$= \frac{1}{4} + \frac{25}{100} + \frac{25}{100} + \frac{10}{40} + \frac{25}{50} + \frac{50}{100}$$

$$= \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{2} + \frac{1}{2} = \frac{4}{4} + \frac{2}{2} = 1 + 1 = 2$$

Answer: B

41. What is the value of $(0.0001 \times 20^4) \div 16/10$?
- A. 1 B. 4 C. 10 D. 100

$$\text{Hint: } (10^{-4} \times 2^4 \times 10^{-4}) \times \frac{10}{16} = 10$$

42. If 75 percent of x is equal to p percent of 25, where $p > 0$, what is the value of x/p ?

Answer: C

A. $1/3$ B. $3/16$ C. $3/4$ D. 3

Hint:

$$75\% \text{ of } x = P\% \text{ of } 25 \Rightarrow \left(\frac{75}{100}\right)x = \left(\frac{P}{100}\right)25$$

$$\Rightarrow 75x = 25P \Rightarrow \frac{x}{P} = \frac{25}{75} = \frac{1}{3}$$

Answer: A

43. If $15 + x$ is 5 more than 20, what is the value of x ?

A. 5 B. 10 C. 25 D. 50

Solution: $15 + x = 20 + 5 \Rightarrow 15 + x = 25$ then $x = 25 - 15 = 10$

Answer: B

44. When 80,000 is written as 8.0×10^n , what is the value of n ?

A. 2 B. 3 C. 4 D. 5

Solution: $80,000 = 8.0 \times 10^4$ then $8.0 \times 10^n = 8.0 \times 10^4$

$$\Rightarrow 10^n = 10^4 \Rightarrow n = 4$$

Answer: C

45. The price for one quintal of sugar is birr 5,800 and it decreases at the rate of birr 2 every three months. The price for one quintal of coffee is birr 4,200 and it increases at the rate of birr 8 every four months. How many years will it take the two commodities to become equal in price?

A. 10 B. 20 C. 50 D. 60

Solution: The price of one quintal sugar is birr 5800 and decreases at rate of birr 2 every 3 months 5,800, 5792, ... formed an arithmetic sequence $d = -8$.

$$A_n = 5800 + (n - 1)(-8) = 5808 - 8n \dots *$$

The price of coffee of one quintal is 4200, 4176, ... forms arithmetic sequence $d = 24$, $A_n = 4200 + (n - 1) 24 = 4176 + 24n$

$$32n = 1632 \Rightarrow n = 51 \text{ yrs}$$

$$t = n - 1 = 50 \text{ yrs}$$

Answer: C

46. If as many 7 - meter pieces of wire as possible are cut from a wire that is 36 meters long, what is the total length of the wire that is left over?

A. 1 meter C. 3 meters

B. 2 meters D. 4 meters

Hint: $7x = 36 \Rightarrow x = 36 \div 7 = 5$, Remainder 1

Answer: A

47. Hawa used $\frac{1}{4}$ of her monthly salary for buying teff and $\frac{1}{2}$ more than the price of teff for house rent. What fraction of her monthly salary did Hawa use that month for the teff and rent combined?

A. $\frac{1}{3}$ B. $\frac{7}{12}$ C. $\frac{5}{8}$ D. $\frac{3}{4}$

Solution: Let x be Hawa's monthly salary

$$\text{Hawa spend for teff} = \frac{1}{4}x$$

$$\text{Hawa spend for house rent} = \frac{1}{4}x + \frac{1}{2}\left(\frac{1}{4}x\right)$$

$$\text{Hawa spend for teff and house rent} = \frac{\frac{x}{4} + \frac{x}{4} + \frac{x}{8}}{x}$$

$$\text{Hawa's combined spend} = \frac{2x + 2x + x}{8} = \frac{5x}{8x} = \frac{5}{8}$$

Answer: C

48. When 5 times the number x is added to 12, the result is 32. What number results when 2 times x is added to 7?

A. -15 B. -5 C. 5 D. 15

Solution: $5x + 12 = 32$ then $2x + 7 =$ _____

$$\Rightarrow 5x = 32 - 12 = 20$$

$$\Rightarrow 5x = 20 \text{ then } x = 4; \text{ since } x = 4, \text{ then } 2x + 7 = 2(4) + 7 = 15$$

Answer: D

49. If three students have scores X , Y and 80, with their sum equal to 180, what is the average (arithmetic mean) of the three scores?

A. 60 B. 70 C. 80 D. 90

Solution: The sum of three scores is $x + y + 80 = 180$ then the

$$\text{average} = \frac{x + y + 80}{3} = \frac{180}{3} = 60$$

Hence arithmetic mean is 60.

Answer: A

50. If the sum of three consecutive integers is 33, what is the middle integer?

A. 9 B. 10 C. 11 D. 12

Solution: Let n be any integer number then n , $n + 1$, $n + 2$ are three consecutive integers $\Rightarrow n + n + 1 + n + 2 = 33$

$$\Rightarrow 3n + 3 = 33 \Rightarrow 3n = 30 \text{ then } n = 10, n + 1 = 11 \text{ and } n + 2 = 12$$

Hence the three consecutive integers are $(n, n + 1, n + 2) = (10, 11, 12)$ the middle integer is 11.

Answer: C

51. What is the value of E , if $ABCDE$ is a five digit positive number divisible by 5 and 10?

A. 0 B. 1 C. 2 D. 5

Solution: ABCDE is divisible by 5 and 10 if and only if the unit digit $E = 0$.

Answer: A

52. The arithmetic mean of p and q is 15, and the average of y and x is 15. What is the average of p, y, x and q ?

A. 7.5 B. 15 C. 22.5 D. 30

Solution: The arithmetic mean of p and q is:

$$\frac{p+q}{2} = 15 \Rightarrow p+q = 30 \dots *$$

The arithmetic mean of x and y is :

$$\frac{x+y}{2} = 15 \Rightarrow x+y = 30 \dots **$$

From $*$ and $**$ the arithmetic mean of p, q, x and y is

$$\frac{p+q+x+y}{4} = \frac{30+30}{4} = \frac{60}{4} = 15$$

Answer: B

53. Which of the following is the average of the first 10 odd numbers?

A. 10 B. 15 C. 20 D. 25

Solution: The first 10 odd numbers are 1, 3, 5, ..., 19 forms an arithmetic mean with $A_1 = 1$, $A_{10} = 19$ and the common difference $d = 2$ then the sum of the numbers

$$S = \frac{n}{2}(A_1 + A_n) = \frac{10}{2}(1+19) = 100$$

$$\text{Then the average} = \frac{5}{10}(20) = \frac{100}{10} = 10$$

Answer: A

54. A number is called "even - odd" if it is halfway between an even integer and an odd integer. If x is an even - odd number, which of the following must be true?

I. $2x$ is an integer.

II. $2x$ is even - odd

III. x is halfway between two even integers

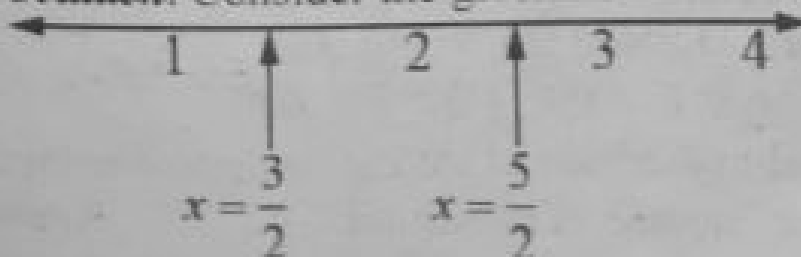
A. I only

C. I and II only

B. II only

D. II and III only

Solution: Consider the given number line



$$\left. \begin{array}{l} 2x = 2\left(\frac{3}{2}\right) = 3 \\ 2x = 2\left(\frac{5}{2}\right) = 5 \end{array} \right\} \text{is an integer}$$

Answer: A

Directions: Questions 55 – 60 below are based on the hypothetical data given in the table below.

Questions 55 – 60 are based on the hypothetical data given below.

Annual Income and Expenditure of Five Schools

School	Income (in ETB)	Expenditure (in ETB)
A	1,200,000	1,000,000
B	1,400,000	1,200,000
C	1,000,000	1,100,000
D	2,000,000	1,600,000
E	1,600,000	1,100,000
Sum	7,200,000	6,000,000

55. How many schools had higher rate of saving compared to the rate of the saving from the total income of all school?

A. 1 B. 2 C. 3 D. 4

Solution: Rate of saving school A = each school income – each school expenditure

$$\text{Rate of saving A} = 1,200,000 - 1,000,000 = 200,000$$

$$\text{Rate of saving school B} = 1,400,000 - 1,200,000 = 200,000$$

$$\text{Rate of School C} = 1,000,000 - 1,100,000 = -100,000$$

$$\text{Rate of saving school D} = 2,000,000 - 1,600,000 = 400,000$$

$$\text{Rate of saving school E} = 1,600,000 - 1,100,000 = 500,000$$

$$\text{Total rate of saving} = \text{total income} - \text{total expenditure}$$

$$= 7,200,000 - 6,000,000 = 1,200,000 \text{ then}$$

$$\text{the rate of saving} = \frac{1,200,000}{5} = 240,000$$

$$\therefore \text{rate of saving at A} = 200,000 < 240,000$$

$$\text{Rate of saving at B} = 200,000 < 240,000$$

$$\text{Rate of saving at C} = 100,000 < 240,000$$

$$\text{Rate of saving D} = 400,000 > 240,000$$

$$\text{Rate of saving at E} = 500,000 > 240,000$$

School D and E had higher rate of saving compared to the rate of saving from the total income of all school.

Answer: B

56. If each school was expected to save at least 10% of its income, how many schools have met the expectation?

- A. 1 B. 2 C. 3 D. 4

Solution: School A = $1,200,000 \times 10\% = 120,000$ birr

School B = $1,400,000 \times 10\% = 140,000$ birr

School C = $1,000,000 \times 10\% = 100,000$ birr

School D = $2,000,000 \times 10\% = 200,000$ birr

School E = $1,600,000 \times 10\% = 160,000$ birr

So, school D and E met the expectation because school D: $400,000 > 200,000$ and school E: $500,000 > 160,000$.

Answer: B

57. Assume that one school will be awarded based on the proportion of saving to the income generated. Which school do you think deserves the award?

- A. B B. C C. D D. E

Solution:

From the above two question school C saving to income generated proportion i.e., $\text{saving} = 1,000,000 \times 10\% = 100,000$ and $\text{income generated} = 1,000,000 - 1,100,000 = -1,000,000$

Answer: B

58. Which one of the following is **NOT TRUE** about the income – expenditure data given above?

- A. The difference between income and expenditure was the highest for School E.
- B. All schools have managed to keep their expenditure lower than their income.
- C. Most of the schools had annual income which was larger than the average annual income of the five schools combined.
- D. Only one school had an annual expenditure which was larger than the average annual expenditure of the five schools combined.

Solution:

- A. The difference between income and expenditure = $1,000,000 - 1,100,000 = 500,000$ was the highest for E than the rest of the schools. **True**
- B. All school have managed to keep their expenditure lower than their income. **True**

- C. Most of the schools had annual income which was larger than the average annual income of the five schools combined.

The average annual income of the five schools:

$$= \frac{7,200,000}{5} = 1,440,000$$

Therefore school A annual income < the average annual income i.e., $1,200,000 < 1,440,000$

School B annual income < the average annual income i.e., $1,400,000 < 1,440,000$

School C annual income < the average annual income i.e., $1,000,000 < 1,440,000$

School D annual income < the average annual income i.e., $2,000,000 > 1,440,000$

School E annual income > the average annual income

∴ Most of the schools had annual income which was larger than the average annual income of the five school is FALSE.

- D. Only one school had an annual expenditure which was larger than the average annual expenditure of the five schools combined. TRUE because average annual expenditure of five schools.

$$= \frac{6,000,000}{5} = 1,200,000$$

Annual expenditure school D > the average of all the school expenditure i.e., $1,600,000 > 1,200,000$

Answer: C

59. The difference between the average annual income and the average annual expenditure of the five schools in ETB is ____.

A. 100,000

C. 200,000

B. 240,000

D. 1,200,000

Solution: Average annual income = $\frac{7,200,000}{5} = 1,440,000$

Average annual expenditure = $\frac{6,000,000}{5} = 1,200,000$

Hence the difference between average annual income and the average annual expenditure is:

$$= 1,440,000 - 1,200,000 = 240,000$$

Answer: B

60. The average annual income of the five schools in ETB is
- A. 1,200,000
B. 1,400,000
C. 1,300,000
D. 1,440,000

Solution: Average annual income = $\frac{7,200,000}{5} = 1,440,000$

- Tip:** The sum of the ages of 5 children born at the interval of 3 years each is 50 years what is the age of the youngest child?
- A. 4 years B. 8 years C. 10 years D. 12 years

Solution: Let the ages of the children be y , $(y + 3)$, $(y + 6)$, $(y + 9)$ and $(y + 12)$ years then

$$y + (y + 3) + (y + 6) + (y + 9) + (y + 12) = 50$$

$$5y + 30 = 50 \Rightarrow 5y = 20 \Rightarrow y = 4$$

$\therefore$ Age of the youngest child is 4 yrs.

- Tip:** A boy was asked to multiply a number by 25. He instead multiplied the next number by 52 and got the answer 324 more than the correct answer the number to be multiplied was:
- A. 10 B. 12 C. 15 D. 25

Solution: Let the number be x then $52x - 25x = 324$ i.e., $27x = 324$
 $\Rightarrow x = 12$

- Tip:** If the sum of two numbers is 22 and the sum of their squares is 404, then the product of the numbers is
- A. 40 B. 44 C. 80 D. 88

Solution: Let the number be x and y then, $x + y = 22$ and $x^2 + y^2 = 404 = 80$

$$\Rightarrow 2xy = (x + y)^2 - (x^2 + y^2) = 22^2 - (404) = 484 - 404$$

$$\Rightarrow xy = \frac{80}{2} = 40$$

Answer: A

DIRECTIONS: For questions 1 – 7 read each of the following words carefully and choose the word that correctly completes the analogy. Then, **blacken** the letter of your choice on the separate answer sheet provided.

1. ADULT is to CHILD as CAT is to:

- A. KITTEN B. MARE C. HERD D. ANIMAL

Clues: A **child** grows to an **adult** (a fully grown person).

And a **kitten** (young cat) grows to a **cat**, a fully grown cat.
(Age relationship) **Answer: A**

2. CAP is to HEAD as RING is to:

- A. EAR B. LEG C. HAND D. NECK

Clues: A **cap** is a soft hat which is worn on the **head** by men and boys. A **ring** is a piece of jewelry that is worn on the **hand** (wearing and where they are worn) **Answer: C**

3. CROWD is to DISPERSED as MEETING is to:

- A. RECESSED C. DEPRESSED
B. ADJOURNED D. DISCUSSED

Clues: A **crowd** is a large number of people **collected** or **gathered** together. **Dispersed** means to move a part of go away in different directions. These two words are opposite in meaning (crowd $\neq$ dispersed)

Meeting is opposite with **recessed**.

(**Meeting** = coming together to discuss; **recessed** not coming together) → (antonym relationship) **Answer: A**

4. FOOT is to LEG as HAND is to:

- A. FINGERS B. ARM C. THUMB D. TOE

Clues: **Foot** is the lower part of **leg** as **hand** is the lower end part of **arm**. → (part to the whole relationship) **Answer: A**

5. SUCCESS is to EFFORT as FAILURE is to:

- A. LAZINESS C. DISASTER
B. DEVOTION D. CHANCE

Clues: **Success** is the result of **effort** as **failure** is the result of **laziness** → (cause – effect relationship). **Answer: A**

6. BEGIN is to START as EMPLOY is to:

- A. CELEBRATE C. END
B. FIRE D. HIRE

Clues: Begin and start are similar words; employ and hire are synonyms, too. → (Synonym relationship). **Answer: D**

7. BEEF is OXEN as PORK is to:

A. LION B. GOAT C. PIG D. SHEEP

Clues: Beef is meat prepared from oxen as pork is meat prepared from a pig. → (The name of meat prepared from different animals). **Answer: C**

DIRECTIONS: Questions 8 – 10 consist of words printed in capital letters followed by four words. Choose the word that is most nearly **similar** in meaning to the word in capital letters. Then, find the question number and **blacken** the letter of your choice on the separate answer sheet provided.

8. MISERABLE:

A. Abject B. Refutable C. Violet D. Challenging

Answer: A

9. POVERTY:

A. Deficit B. Humility C. Restraint D. Destitution

Clues: Destitution is much more related with poverty. **Destituion** means being without money, food and other things necessary for life. **Answer: D**

10. MISFORTUNE:

A. Collapse C. Adversity
B. Crisis D. Defenselessness

Clues: Misfortune means bad luck = negative and unpleasant. **Answer: C**

Antonyms

DIRECTIONS: Questions 11 – 13 consist of words printed in capital letters followed by four words. Choose the word that is most nearly **opposite** meaning to the word in capital letters. Then, find the question number and **blacken** the letter of your choice on the separate answer sheet provided.

11. MEAN:

A. Cruel B. Friendly C. Malicious D. Unkind

Clues: Mean (adj) which means unkind (of behavior).

→ The opposite is sociable or friendly. **Answer: B**

12. CONDENSE:

A. Block B. Convert C. Summarize D. Expand

Clues:

Condense (v) which means to put something such as a piece of writing into **fewer words** to put a lot of information into a small space. → The opposite word is **enlarge or expand**.

Answer: D

13. SELFISH:

A. Altruistic B. Meager C. Generous D. Greedy
Clues: **Selfish** (adj) means greedy. The antonym word is given freely/generous.

Answer: C

DIRECTIONS: Questions 14 – 18 deal with restoring words correctly into a passage. The following five words listed at random are removed from the passage given below. Numbers are written instead of the words. Read the passage and choose the word that correctly completes the passage. Then, **blacken** the letter of your choice on the separate answer sheet provided.

emissions exception unprecedented warmest trend

The Earth's climate has changed throughout history. The current warming 1 is of particular significance because most of it is extremely likely to be the result of human activity since the mid-20th century and proceeding at a rate that is 2. The planet's average surface temperature has risen about 1.1 degrees Celsius since the late 19th century, a change driven largely by increased carbon dioxide and other human-made 3 into the atmosphere. Most of the warming occurred in the past 35 years, with 16 of the 17 warmest years on record occurring since 2001. Not only was 2016 the 4 year on record, but eight of the 12 months that make up the year from January through September, with the 5 of June – were the warmest on record for those respective months.

14. Which of the following is the correct word that should replace 3 (the third blank in the passage) is _____.
A. trend B. emissions C. warmest D. unprecedented

Answer: B

15. Which of the following is the correct word that should replace 5 (the fifth blank in the passage) is _____.
A. Exception B. trend C. warmest D. unprecedented

Answer: A

16. Which of the following is the correct word that should replace 2 (the second blank in the passage) is _____
 A. Exception B. emissions C. unprecedented D. warmest
Answer: C
17. The correct word that should replace 1 (the first blank in the passage) is _____
 A. trend B. emissions C. warmest D. unprecedented
Answer: A
18. Which of the following is the correct word that should replace 4 (the fourth blank in the passage) is _____
 A. exception B. trend C. unprecedented D. warmest
Answer: D

DIRECTIONS: In questions 19 – 23 three of the words are in the same classification, the remaining one word does not belong to the others. From the given four alternatives, choose the word that does not belong in the same classification as the others and **blacken** the letter of your choice on the separate answer sheet provided.

19. Choose the odd one out of the following words.
 A. Anger C. August
 B. Disgust D. Laughter
Clues: Words in option A, B and D are about sense of emotional feeling related to pitiness and excitement August in among months of the year.
Answer: C
20. Which one of the following words does **NOT** belong with the others?
 A. Earth C. Mars
 B. Cosmos D. Jupiter
Clues: Earth, Mars and Jupiter are planets found in the solar system.
Answer: B
21. Choose the word that is different from the other three.
 A. Zoology C. Psychology
 B. Ecology D. Biology
Clues: **Biology, Ecology** and **Zoology** are the scientific study of living things (animals and planets) their structure, relationship, etc.
Psychology: The scientific study of the mind and how it is influences behavior.
Answer: D

- others?
- A. Grape
- B. Apple
- C. Orange
- D. Sugarcane

Answer: D

- A. Leaf C. Stem
B. Dirt D. Root

Answer: B

24. The natural balance between prey and predator has been increasingly _____, usually because of the human provided.

- A. Recognized C. Disturbed
B. Predicted D. Observed

25. Typically, legal proceedings begin with an investigation meant to _____ evidence, followed by a trial that establishes whether that evidence _____ a criterion – “**beyond a reasonable doubt**” in criminal proceedings, and “**according to the preponderance of evidence**” in civil proceedings.

- A. Verify: contradicts C. Show: declare
B. Collect: meets D. Mean: amounts

26. It was a war the prime minister and her wise counselors wished to _____ if they could and were determined in any event to _____ as long as possible. They were repeatedly meeting and discussing on this issue until the case was under their control.

- A. Provoke: delay
B. Oppose: fight
C. Avoid: postpone
D. Curtail: Promote

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Logical and Analytical reasoning (27 – 35)

DIRECTIONS: In this section (Questions 27 – 32) each question or a group of questions is based on a passage or set of conditions. Read each question carefully and select the best answer and **blacken** the letter of your choice on the separate answer sheet provided.

27. Today's secondary school students are not being educated. They are being trained. Their teachers demand little of them other than that they memorize facts and follow directions. The current emphasis on training in basic maths and verbal skills, while a useful step, rarely leads to the essential second step: development of independent critical thinking.

The author would probably consider which of the following aspects of a student's term paper to be most praiseworthy?

- A. Evidence of extensive research prior to writing
- B. Evidence of original insights and freshly developed concepts
- C. The use of grammatically correct sentence structure
- D. The choice of a challenging topic

Answer: B

28. Obesity is a serious problem in many developed countries. Research suggests that obesity can lead to a number of health problems including diabetes, asthma, and heart disease. Recent research has even indicated that there may be a relationship between obesity and some types of cancer. Major public health campaigns that increase awareness and propose simple lifestyle changes that will, with diligence and desire, eliminate or at least mitigate the incidence of obesity are a crucial first step in battling this critical problem.

This paragraph best supports the statement that

- A. A decline in obesity would radically decrease the incidence of asthma.
- B. People in those countries watch too much television and do not exercise enough.
- C. Fast-food restaurants and unhealthy school lunches contribute greatly to obesity.

- D. Public health campaigns that raise consciousness and propose lifestyle changes are a productive way to fight obesity.

Answer: D

29. Alula must be a basketball player; he is wearing a basketball jersey. The conclusion above is valid only if it is true that:
- A. All basketball players were basketball jerseys.
 - B. Only basketball players wear basketball jerseys.
 - C. Basketball players often wear basketball jerseys.
 - D. Basketball players are required to wear basketball jerseys.

Answer: C

30. A company worker has six children. No one else in the factory has six children. Which one of the following conclusions logically follows the statements given above?
- A. All workers in the company have six children each.
 - B. Some of the company workers have more than six children.
 - C. Some of the company workers have more than six children.
 - D. Everybody in the company has children.

Answer: C

31. Today's secondary school students spend too much time thinking about trivial and distracting matters such as fashion. Additionally, they often dress inappropriately on college grounds. Rather than spending time writing another detailed dress policy, we should make school uniforms mandatory. If students were required to wear uniforms, it would increase a sense of discipline in our students. Another positive effect would be that teachers and administrators would no longer have to act as clothing police, freeing them up to focus on more important issues. This paragraph best supports the statement that
- A. Students are not interested in being part of a community.
 - B. Students who wear school uniforms get into better colleges.
 - C. School uniforms should be compulsory for secondary school students.
 - D. Inappropriate clothing leads to failing grades.

Answer: C

32. Hassen is standing to the right of Bereket. Beletu is standing on the opposite side of Bereket. Since the opposite of right is wrong, Beletu must be standing on the wrong side of Bereket. Which of the following logical errors has the author of the argument above committed?
- A. He has used a single term to mean two different things.
 - B. He has confused cause the effect.
 - C. He has provided in factual evidence for his conclusion.
 - D. He has drawn a general conclusion from an insufficient number of examples.

Answer: A

DIRECTIONS: Read the following assumptions and answer Questions 33 – 34.

Assume J, L, N, M, P, C, A, B, F, E, and R represent persons living in a university dormitory. All live in a building having six floors each having two rooms/apartments. No more than two persons live in any apartment/room. Some rooms may be empty. L and his roommate live two floors above A and his roommate, C. J lives alone, three floors below W and two floors below E. M lives one floor below A and C. N lives three floors above the floor on which B and F have single rooms. R and P live in single rooms two floors below M.

Answer: D

33. Which of the following lists the persons named in the correct order, going from the bottom floor to the top?
- | | |
|---------------------|---------------------|
| A. R, F, N, E, L, C | C. R, B, M, A, L, N |
| B. P, B, J, C, N, L | D. L, E, A, M, F, R |

Answer: D

34. Which of the following is true about where r lives?
- A. Second floor, below J or A and C
 - B. Third floor, above M or E
 - C. Fourth floor, opposite A and C
 - D. First floor, below B or F

Answer: D

DIRECTIONS: Question 35 needs to be answered based on the statement, followed by two conclusions labeled I and II. You have to assume the statement is true, then consider the conclusions and decide which of them logically follows beyond a reasonable doubt from the information given in the statement. Then, **blacken** the letter of your choice on the separate answer sheet provided.

35. **Statement:** If all the players play to their full potential, we will win the football match. We have won the football match.

Conclusions: I. All players played to their full potential.

II. Some players did not play to their full potential.

- A. Only conclusion I follows
- B. Both I and II follows
- C. Only conclusion II follow
- D. Either I and II follows

Answer: A

1. If $x > y$ compare the two quantities in column A and column B.

Quantity A	Quantity B
30% of x	50% of y

- A. The two quantities are equal.
 B. Quantity A is less than quantity B.
 C. The relationship cannot be determined from the information given.
 D. Quantity A is greater than quantity B.

Solution: Since $x > y \Rightarrow 30\% \text{ of } x = 0.3x$
 $\Rightarrow 50\% \text{ of } y = 0.5y$

i) If $x = -2, y = -3$ then $A > B$

ii) If $x = 3, y = 2$ then $A < B$.

$\therefore$ The relationship cannot be determined.

Answer: C

2.

Quantity A	Quantity B
$(-21)^{12}$	$(-31)^{13}$

- A. The two quantities are equal.
 B. Quantity A is greater than quantity B.
 C. Quantity A is less than quantity B.
 D. The relationship cannot be determined from the given information.

Solution: Quantity A: $(-21)^{12} = (-1)^{12}(21)^{12} = 21^{12}$

Quantity B: $(-31)^{13} = (-1)^{13}(31)^{13} = -31^{13}$ from this $A > B$

Answer: B

3. If s is the number between 0 and 1, which of the following is NOT more than s ?

- A. $\sqrt{s}$ B. $\frac{1}{s}$ C. $2s$ D. s^2

Solution: $0 < s < 1$ then $s^2 < s < \sqrt{s} < 2s < \frac{1}{s}$

Eg let $s = 0.5$ which lies between 0 and 1 then

$$s^2 = 0.25, \sqrt{s} = 0.707, 2s = 1 \text{ and } \frac{1}{s} = 2$$

$\therefore s^2 = 0.25$ is not more than s

Answer: D

4. Look at the pattern carefully: 10 20 25 35 40 50 55 then which of the following pairs pattern of numbers comes next?

- A. 60, 65 B. 65, 70 C. 60, 75 D. 60, 70

Solution: Pattern: 10 20 25 35 40 50 55 x y
 by observing the patterns, two even numbers comes together and

next two odd numbers, the difference between two even numbers and also the difference between two odd numbers is 10. Whereas the difference between even and odd numbers is 5 then, $x = 65$, $y = 70$
 $\therefore x = 65$ and $y = 70$

Answer: B

5. What is the simplified form of $(1 + 10^{-1}) \times (-1)^{10}$?
 A. 10 B. 1 C. 0.1 D. 100

$$\text{Solution: } (1 + 10^{-1}) \times (-1)^{10} = \left(1 + \frac{1}{10}\right) \times \frac{1}{(-1)^{10}} = 10(1) = 10$$

Answer: A

6. If $b \neq 0$ and $\frac{a}{5} = \frac{b}{7}$, what is the value of $\frac{a}{b}$?

A. $\frac{7}{5}$ B. $\frac{1}{7}$ C. $\frac{1}{5}$ D. $\frac{5}{7}$

$$\text{Solution: } \frac{a}{5} = \frac{b}{7} \Rightarrow 7a = 5b \Rightarrow \frac{a}{b} = \frac{5}{7}$$

Answer: D

7. Look at the pattern carefully: 32 31 32 29 32 27 32, then which of the following pair of numbers comes next?

A. 29 32 C. 25 32
 B. 29 30 D. 25 30

Solution: 32 31 32 29 32 27 32 from the pattern 1st, 3rd, 5th, ... continue constantly which is 32 whereas 2nd, 4th, 6th and so on continues like 31, 29, 27, ... constantly decreased by 2.
 $\therefore$ 8th term is 25 and 9th term is 32

Answer: C

8. $1 \div 0.1 \div 0.01 \div 0.001$ is equal to

A. 1,000,000 B. 0.001 C. 100 D. 0.0001

Solution:

$$1 \div 0.1 \div 0.01 \div 0.001 = \frac{1}{\frac{0.1}{\frac{0.01}{\frac{0.001}{1}}}} = \frac{1}{\frac{0.1}{0.01}} = \frac{1}{\frac{1}{10}} = \frac{1}{\frac{1}{10,000}} = \frac{1}{1} \times 100 = 100$$

$$1 \div 0.1 \div 0.001 = \frac{1}{\frac{1}{100}} = 100$$

Answer: C

9. What number increased by 3 is equal to 3 less than twice the number?

A. 3 B. 9 C. 12 D. 6

Solution: Let x - be the unknown number then $x + 3 = 2x - 3 \Rightarrow 2x - x = 3 + 3 \Rightarrow x = 6$

Answer: D

10. Three professors contested an election for a university president and received 1,136, 7636 and 11,628 votes, respectively. What percentage of the total votes did the winning professor get?

A. 65% B. 57% C. 59% D. 61%

Solution: total participant = $1136 + 7636 + 11,628 = 20,400$
winner get = 11628

Percentage of winning professor get = $\frac{11,628}{20,400} \times 100\%$

Percentage of winning professor get 57%

Answer: B

11. If one fourth of one - third of a number is 15, then what is three - tenth of that number?

A. 39 B. 45 C. 54 D. 34

Solution: one fourth of one third of the number is 15

Let x - be the unknown number

$$\Rightarrow \frac{1}{4} \text{ of } \frac{1}{3} \text{ of } x = 15$$

$$\left(\frac{1}{4} \times \frac{1}{3} \times x \right) = 15 \Rightarrow x = 15 \times 12 = 180$$

$$\text{Three tenth of } x = \frac{3}{10} \text{ of } 180 = \frac{3}{10} \times 180 = 54$$

Answer: C

12. An athlete completes a journey in 10 hours. He travels first half of the journey at the rate of 21 km/hr and second half at the rate of 24 km/hr. What is the total journey in km?

A. 216 B. 225 C. 218 D. 230

Solution: $v_1 = 21 \text{ km/hr}$

$$S_{\text{total}} = v_{\text{av}} \times \Delta t$$

$$v_2 = 24 \text{ km/h}$$

$$S_{\text{total}} = \left(\frac{v_1 + v_2}{2} \right) \Delta t$$

$$\Delta t = 10 \text{ hr}$$

$$S_{\text{total}} = \frac{(21 \text{ km/hr} + 24 \text{ km/hr})}{2} 10 \text{ hr} = 225 \text{ km}$$

Answer: B

13. If $y \neq 0$ and $xy = \frac{y}{6}$, what is the value of x ?

A. $\frac{1}{2}$ B. $\frac{1}{8}$ C. $\frac{1}{4}$ D. $\frac{1}{6}$

$$\text{Solution: } xy = \frac{y}{6} \Rightarrow \frac{xy}{y} = \frac{y}{6y} \Rightarrow x = \frac{1}{6}$$

Answer: D

14. What number should come next in the series: 7, 10, 8, 11, 9, 12, ...?

A. 13 B. 10 C. 12 D. 7

Solution: 7, 10, 8, 11, 9, 12, y ...

1st, 3rd, 5th ... 7, 8, 9, ... is an arithmetic sequence with common difference 1

2nd, 4th, 6th, ... = 10, 11, 12, ...

$\therefore y = 10$ hence 7, 10, 8, 11, 9, 12, 10, ...

Answer: B

15. The difference between a positive improper fraction and its reciprocal is $\frac{9}{20}$? What is the value of the fraction?

A. $\frac{5}{4}$ B. $\frac{3}{5}$ C. $\frac{4}{3}$ D. $\frac{4}{2}$

Solution: $\frac{a}{b} = \frac{5}{4}$ is a fraction and $\frac{b}{a} = \frac{4}{5}$ is proper fraction then

$$\frac{a}{b} - \frac{b}{a} = \frac{a^2 - b^2}{ab} = \frac{25 - 16}{20} = \frac{9}{20}$$

Answer: A

16. What is the product of $(\sqrt{7} - 2)(\sqrt{7} + 2)$?

A. 5 B. 4 C. 2 D. 3

$$\text{Solution: } (\sqrt{7} - 2)(\sqrt{7} + 2) = 7 + 2\sqrt{7} - 2\sqrt{7} - 4 = 3$$

Answer: D

17. The sum of ages of 5 children born at the interval of 3 years each is 50 years. What is the age of the youngest child?

A. 8 years B. 4 years C. 6 years D. 10 years

Solution: Let x be the age of the youngest child $x, x + 3, x + 6, x + 9, x + 12$ patterns of the age of 5 children i.e.,

$$x + x + 3 + x + 6 + x + 9 + x + 12 = 50 \Rightarrow 5x + 30 = 50 \Rightarrow x = 4$$

$\therefore 4, 7, 10, 13, 16$ the age of youngest child 4 years

Answer: B

18. What number should come next in the series 544, 509, 474, 439, ...?

A. 445 B. 420 C. 404 D. 414

Solution: 544, 509, 474, 439, ... forms decreasing arithmetic sequence with common difference $d = -35$, hence the next term is 404.

Answer: C

19. A library has an average of 510 visitors on Sundays and 240 on other days. What is the average number of visitors per day in a month of 30 days beginning with a Sunday?

A. 285 B. 283 C. 276 D. 290

Solution: The average number of visitors per day.

$$\bar{x} = \frac{f_1 \bar{x}_1 + f_2 \bar{x}_2}{f_1 + f_2} \text{ where } f_1 = \text{number of Sundays on months}$$

$\bar{x}_1$ - average of Sunday visitors

f_2 - number of other days

$\bar{x}_2$ - average of other days

$$\bar{x} = \frac{4 \times 510 + 26 \times 240}{4 + 26} = \frac{2040 + 6240}{30} = \frac{8280}{30} = 276 \text{ per day}$$

Answer: C

20. What number should come next in the series: 58, 52, 46, 40, 34, ...

A. 32 B. 30 C. 28 D. 34

Solution: The given pattern 58, 52, 46, 40, 34, ... form arithmetic sequence with common difference $d = -6$

Then the sixth term $a_6 = 34 + (-6) = 28$

Answer: C

Data interpretation

Table: Number of candidates that took and qualified in a license examination from different regions over the year? Question (21 – 25) based on the following table.

Region	year									
	1997- 2000		1998 – 2001		1999 - 2002		2000 - 2003		2001 – 2004	
	Took	Qual	Took	Qual	Took	Qual	Took	Qual	Took	Qual
AA	5200	720	8500	980	7400	850	6800	775	9500	1125
AM	7500	840	9200	1050	8450	920	9200	980	8800	1020
OR	6400	780	8800	1020	7800	890	8750	1010	9750	1250
TI	8100	950	9500	1240	8700	980	9700	1200	8950	995
SP	7800	870	7600	940	9800	1350	7600	945	7990	885

21. What is the percentage of total number of qualified candidates to the total number of candidates took the exam among all the five regions in 2002?

A. 11.84% B. 11.52% C. 11.48% D. 11.89%

Solution: Percentage of qualified candidates

$$= \frac{4990}{42,150} \times 100\% = 11.84\%$$

Answer: A

22. What is the percentage of candidates qualified from region AM for all the years together, over the candidate took the exam from region AM during all the years together?

A. 11.75% B. 11.46% C. 11.57% D. 11.15%

Solution: Percentage of candidates qualified from region AM all the years together.

$$= \left(\frac{840 + 1050 + 920 + 980 + 1020}{7500 + 9200 + 8450 + 9200 + 8800} \right) 100\% = \frac{4,810}{43,150} \times 100\% = 11.15\%$$

Answer: D

23. In which of the given years the number of candidates took the exam from region OR has maximum percentage of qualified candidate?

A. 2001 B. 2003 C. 2004 D. 2000

Solution: Qualified parentage of OR candidates took exam

$$\text{In 2000} = \frac{780}{6400} \times 100\% = 12.19\%$$

$$\text{In 2001} = \frac{1020}{8800} \times 100\% = 11.591\%$$

$$\text{In 2003} = \frac{1010}{8750} \times 100\% = 11.543\%$$

$$\text{In 2004} = \frac{1250}{9750} \times 100\% = 12.82\%$$

Maximum percentage qualified in 2004

24. What is the average number of candidates who took the exam from region TI during the given year?

A. 8800 B. 8900 C. 8860 D. 8990

Solution: Average = $\frac{8100 + 9500 + 8700 + 9700 + 8950}{5}$

$$\text{Average} = \frac{44,950}{5} = 8,990$$

Answer: D

25. What percent is the total number of qualified candidates in 1997 – 2000 to the total number of those qualified 2001 – 2004?
A. 84% B. 76% C. 78% D. 80%

Solution:

In 1997–2000 qualified candidates = $720 + 840 + 780 + 950 + 870 = 4160$

In 2001 – 2004 qualified = $1125 + 1020 + 1250 + 995 + 885$
candidates = 5275

Percent of total candidates in 1997 – 2000 to 2001 – 2004

$$= \frac{4160}{5275} \times 100\% = 78\%$$

Answer: C

1. If n is an integer such that $(-3)^{2n} = 3^{9-n}$ then what is the value of n .
 A. 4 B. 3 C. 2 D. 1

Solution: Here at $(-3)^{2n} = 9^n$, so that $9^n = 3^{9-n} \Rightarrow 3^{2n} = 3^{9-n}$

$$\Rightarrow 2n = 9 - n \Rightarrow 3n = 9, \text{ therefore, } n = \frac{9}{3} = 3$$

Answer: 3

2. What is the value of $5.005/2.0002$?
 A. 2.05 B. 2.501 C. 2.50 D. 2.5015

Solution: Here at we have:

$$\frac{5.005}{2.002} = \frac{5005 \times 10^{-3}}{2002 \times 10^{-1}} = \frac{5005}{2002} = 2.50$$

Answer: C

3. How many multiple of 4 are their between 12 and 96 inclusive?
 A. 22 B. 23 C. 24 D. 25

Solution: Here we can use arithmetic progration concept.

$$A_1 = 12, d = 4, A_n = 96$$

$$A_n = A_1 + (n - 1)d \Rightarrow 96 = 12 + (n - 1)4$$

$$\Rightarrow 4n - 4 + 12 = 96 \text{ implies } 4n = 88$$

$$n = 8 \frac{8}{4} = 22.$$

Answer: A

4. If the product of six integers in negative, at most how many of the integers can be negative?

A. 2 B. 3 C. 4 D. 5

Hint: From six given any integers let one of them is positive and the rest 5 of them are negative.

- (5 positive)(1 negative) = $(+)(+)(+)(+)(+).(-) = \text{negative}$
- (3 positive)(3 negative) = $(+)(+)(+).(-)(-)(-) = \text{negative}$
- (1 positive)(5 negative) = $(+).(-)(-)(-)(-)(-) = \text{positive -ve}$

Answer: D

5. Which one of the following is the largest?

A. 80% of 340 C. 60% of 450
 B. 30% of 900 D. 50% of 540

Hint: $x\% \text{ of } y = \frac{(x\%)(y)}{100\%}$, here at:

A. $\frac{(80\%)(340)}{100\%} = 272$ C. $\frac{60\% \times 340}{100\%} = 270$

B. $\frac{30\% \times 900}{100\%} = 270$ D. $\frac{50\% \times 540}{100\%} = 270$ **Answer: A**

6. $\left(\frac{1}{5}\right)^5$ is equal to _____

- A. 0.03125 B. 0.00625 C. 0.00025 D. 0.00032

Hint: Here at $\left(\frac{1}{5}\right)^5 = (0.2)^5 = (2 \times 10^{-1})^5 = 2^5 \times 10^{-5}$

$$\therefore \left(\frac{1}{5}\right)^5 = 32 \times 10^{-5} = 0.00032$$

7. By how much is $\frac{3}{7}$ large than 20% of 2.

- A. $\frac{1}{35}$ B. $\frac{4}{7}$ C. $\frac{3}{7}$ D. $\frac{2}{35}$

Solution: 20% of 2 = $\frac{20\% \times 2}{100\%} = \frac{40}{100} = 0.4 = \frac{2}{5}$

$$\frac{3}{7} - \frac{2}{5} = \frac{15 - 14}{35} = \frac{1}{35}$$

$\therefore \frac{3}{7}$ is larger than 20% of 2 by $\frac{1}{35}$.

8. What is x-percent of y divided by y percent of x?

- A. x B. 1 C. y D. 5

Hint: x% of y = $\frac{(x\%)(y)}{100\%}$

$$y\% \text{ of } x = \frac{(y\%)(x)}{100\%}$$

$$\frac{x\% \text{ of } y}{y\% \text{ of } x} = \frac{\frac{(x\%)(y)}{100\%}}{\frac{(y\%)(x)}{100\%}} = \frac{(x\%)(y)}{(y\%)(x)} = \frac{(xy)\%}{(xy)\%} = 1$$

Logical Reasoning

9. Consider the positions of x, x^2 and x^3 on the number line. Which of the following could be a value of x.

- A. 2 B. $\frac{5}{3}$ C. $-\frac{2}{5}$ D. $-\frac{5}{2}$

Hint: On the number line, the smallest number are located to the left of the other. Here at: $x < x^3 < x^2$.

$$\Rightarrow -\frac{2}{5} < \left(\frac{-2}{5}\right)^3 < \left(\frac{-2}{5}\right)^2 = -0.4 < -0.064 < 0.16 \quad \text{Answer: C}$$

10. If $x = 17 \times 21$, which one of the following is NOT an integer.

A. $x \div 3$ B. $x \div 7$ C. $x \div 42$ D. $x \div 5$

Solution: Hint: $x = 17 \times 21 = 17 \times 7 \times 3 = 51 \times 7$;

$x = 17 \times 21$ is divisible by 3, 7 and 51.

Answer: C

11. If A and B are positive integers and $A \Delta B = A(A + 2B)$, what is the value of $2 \Delta [4 \Delta (1 \Delta 3)]$?

A. 40 B. 64 C. 88 D. 164

Hint: $A \Delta B = A(A + 2B)$

$$2 \Delta [4 \Delta (1 \Delta 3)] = 2 \Delta [4 \Delta (1(1 + 2(3)))] = 2 \Delta (4 \Delta 7)$$

$$\Rightarrow 2 \Delta (4 \Delta 7) = 2 \Delta [4(4 + 2(7))] = 2 \Delta 72$$

$$\Rightarrow 2 \Delta 72 = 2(2 + 2(72)) = 2(146) = 292$$

No answer

12. How many numbers between 100 and 300 meet one or both of the condition given in the two statements below?

Statement 1: The number begins with 2.

Statement 2: The number ends with 2.

A. 90 B. 100 C. 110 D. 120

Explanation: Here at:

The number begins with 2 are 200, 201, 202, ... 299.

Using arithmetic sequence: $A_1 = 200, d = 1$

$$A_n = A_1 + (n - 1)d \Leftrightarrow 299 = 200 + (n - 1) \Rightarrow n - 1 = 99 \Rightarrow n = 100$$

And the number ends with 2 are: 102, 112, 122, ..., 292, so that

$$a_1 = 102, d = 10, a_n = a_1 + (n - 1)d \Leftrightarrow 292 = 102 + (n - 1)10$$

$$\Rightarrow 10n - 10 = 292 - 102 \Leftrightarrow 10n = 200, \text{ gives } n = 20$$

Therefore, the total number of the two condition is

$$100 + 20 = 120.$$

Quantitative Reasoning

13. In which of the following is the first number or expression equal to the second number or expression.

A. $\left[\frac{1}{3} + \frac{1}{4}\right] / \left[\frac{1}{3} - \frac{1}{4}\right]; 7$

C. $25(26) + 26(75); 2500$

B. $8 - (-12) \cdot 5; 5 + (-8) + 12$ D. $\left[5 - \frac{1}{10}\right] / \left[10 + \frac{1}{10}\right] \cdot \frac{1}{2}$

Answer: A

14. If x and y are integers and $x > y > 0$, how many integers are there between, but not including x and y ?

A. $x - y$ B. $x + y$ C. $x - y - 1$ D. $x + y - 1$

Explanation:

The number of positive integer between x and y , excluding x and y for $x > y$ is $x - y - 1$.

Clue: The number of integer between

- i) 4 and 3 is $4 - 3 - 1 = 0$ (No integer)
- ii) 4 and 2 is $4 - 2 - 1 = 1$ (one integer that is 3)
- iii) 8 and 3 is $8 - 3 - 1 = 4$
- iv) x and y is $x - y - 1$

Answer: C

15. The closest value of the product of 408 and 500 is _____
A. 20,000 B. 40,000 C. 200,000 D. 400,000

Hint: $408 \sim 400$, so that

$$408 \times 500 \sim (400)(500) = 200,000$$

16. Which of the following numbers does not satisfy the inequality $x - 3 > 3x - 2$?

A. -3 B. -1 C. 0 D. -2

Solution: $x - 3 > 3x - 2 \Leftrightarrow -3 + 2 > 3x - x$

$$\Rightarrow -1 > 2x \text{ implies } x < -\frac{1}{2}$$

The set of all real number $\left\{x : x < -\frac{1}{2}\right\}$ satisfy the inequality.

Answer: C

17. Divide 64 by a quarter and add 5. What is the resulting number?
A. 261 B. 256 C. 21 D. 11

Solution: $64 \div \frac{1}{4} + 5 = 64 \times 4 + 5 = 261$

18. Ali, Aminat, and Yosef have their own collections of stamps. If the ratio of Ali's stamps to those of Aminat is 5 to 1 and the ratio of Aminat's stamps to those of Yosef is 3 to 2, what is the ratio of Ali's to Yosef's stamps?

A. 5:1 B. 5:2 C. 10:3 D. 15:2

Here is how to crack it

Let Ali = a, Aminat = b and Yosef = C a:b = 5:1 and b:c = 3:2

$$\frac{a}{c} = \left(\frac{a}{b}\right)\left(\frac{b}{c}\right) = \left(\frac{5}{1}\right)\left(\frac{3}{2}\right) = \frac{15}{2} = 15:2$$

19. Which one of the following sum is Largest?

A. $\frac{5}{6} + \frac{7}{17}$ B. $\frac{6}{7} + \frac{5}{11}$ C. $\frac{7}{8} + \frac{3}{7}$ D. $\frac{8}{9} + \frac{1}{3}$

Here is how to find (identify)

$$\frac{5}{6} < \frac{6}{7} < \frac{7}{8} < \frac{8}{9} \text{ and } \frac{1}{3} < \frac{7}{17} < \frac{3}{7} < \frac{5}{11}$$

$$\Rightarrow \frac{6}{7} + \frac{5}{11} = \frac{66 + 35}{77} = \frac{101}{77} \text{ is largest}$$

20. $\frac{5^6 - 5^5}{4}$ is equal to:

A. $\frac{1}{4}$ B. $\frac{5}{4}$ C. 5^5 D. 5

Here at: $\frac{5^6 - 5^5}{4} = \frac{5^5(5-1)}{4} = \frac{5^5(4)}{4} = 5^5$

21. In the sequence -24, -18, -12, -6; ... each number after the first is 6 greater than the preceding number. Which of the following could NOT be a number in the sequence?

A. 648 B. 762 C. 963 D. 1104

Solution: Here is how to identify -24, -18, -12, -6, ... are arithmetic sequence with common difference of $d = 6$, so the general n^{th} term of sequence is $A_n = A_1 + (n-1)d$.

$$A_n = -24 + (n-1)(6) = 6n - 30$$

All the terms can be generated by $6n - 30$ where, $n = 1, 2, 3, \dots$

Here at:

A. $6n - 30 = 648 \Rightarrow 6n = 678$, therefore, $n = \frac{678}{6} = 113$

B. $6n - 30 = 762 \Rightarrow 6n = 792$, $\therefore n = \frac{792}{6} = 132$

C. $6n - 30 = 963 \Rightarrow 6n = 993 \Rightarrow n = 165.5$

Since $n = 165.5$ is not natural number,
 $\Delta 963$ is not part of sequence.

22. Suppose that $-1 \leq x \leq 0$.

Quantity A	Quantity B
$x^3 + 1$	$x^2 + 2x + 2$

- A. Quantity A is greater than quantity B.
 B. Quantity A is less than quantity B.
 C. The two quantities are equal.
 D. The relationship cannot be determined from the information given.

Here is how to crack it

Let's start with $x = -1, -\frac{1}{4}, -\frac{1}{2}, 0$

	Quantity A	Quantity B
$x = -1$	$(-1)^3 + 1 = 0$	$(-1)^2 + 2(-1) + 2 = 1$
$x = -\frac{1}{4}$	$\left(-\frac{1}{4}\right)^3 + 1 = \frac{63}{64}$	$\left(-\frac{1}{4}\right)^2 + 2\left(-\frac{1}{4}\right) + 2 = \frac{25}{16}$
$x = -\frac{1}{2}$	$\left(-\frac{1}{2}\right)^3 + 1 = \frac{7}{8}$	$\left(-\frac{1}{2}\right)^2 + 2\left(-\frac{1}{2}\right) + 2 = \frac{5}{4}$

(Quantity A) < (Quantity B)

Answer: B

23. Consider the following two quantities.

Quantity A	Quantity B
$2^{28} + 2^{28} + 2^{28}$	2^{29}

- A. Quantity A is greater than quantity B.
 B. Quantity A is less than quantity B.
 C. The two quantities are equal.
 D. The relationship cannot be determined from the information given.

Here is how to crack it.

$$\text{Quantity A} = 2^{28} + 2^{28} + 2^{28} = 2^{28} (1 + 1 + 1) = 3 (2^{28})$$

$$\text{Quantity B} = 2^{29} = (2)(2^{28})$$

$$\Rightarrow 3(2^{28}) > 2(2^{28})$$

Answer: A

24. Two sides of a right triangle are 10 and 12 unit long. Which of the following could be the length of the third side?

- A. $2\sqrt{11}$ B. $3\sqrt{7}$ C. $3\sqrt{11}$ D. A and B

Hint: Let the hypotenuse of triangle be $C = 12$ unit.

$$C^2 + 10^2 = 12^2 \Rightarrow C^2 = 144 - 100 = 44$$

$$C = \sqrt{44} = 2\sqrt{11} \text{ unit}$$

25. If x and y are prime numbers greater than 2, which of the following must be true?

(I) $x = y$ is even

(II) xy is odd

(III) $x^2 - y^2$ is even

A. I and II only

C. II and III only

B. I and III only

D. I, II and III

Clue: The set of prime numbers are 3, 5, 7, ...

$$11 + 5 = 16 \leftarrow \text{even}$$

$$(11)(5) = 55 \leftarrow \text{odd}$$

$$11^2 - 5^2 = 121 - 25 = 96 \leftarrow \text{even}$$

Answer: D

26. On a test containing 60 questions, Azeb answered 75% of the first 40 questions correctly. What percent of the other 20 questions does she need to answer correctly for her grade on the entire examination to be 80%.

Here is the way how to find.

Let x be the required $(75\% \text{ of } 40) + (x\% \text{ of } 20) = 80\% \text{ of } 60$.

$$\Rightarrow \left(\frac{75}{100} \times 40 \right) + \frac{x}{100} (20) = \left(\frac{80}{100} \right) (60)$$

$$\Rightarrow 30 + 0.2x = 48$$

$$\Rightarrow 0.2x = 48 - 30 = 18 \Leftrightarrow x = \frac{18}{0.2} = 90\%$$

27. If an airplane starts at point R and travels 14 miles directly north to S, then 48 miles directly east to T, what is the straight line distance (in miles) from T to R?

A. 25

B. 34

C. 50

D. 2500

Here is how to crack it.

$$(TR)^2 = (14)^2 + (48)^2 = 2500$$

$$TR = \sqrt{2500} = 50 \text{ miles}$$



28. A circular region has circumference C centimeters and area k square centimeters. If $C = 3k$. What is the radius of the circle in centimeters?

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

Here is how to crack it.

$$C = 2\pi r \text{ and } k = \pi r^2$$

$$\Rightarrow r = \frac{C}{2\pi} \text{ and } r = \sqrt{\frac{k}{\pi}} \text{ implies } \frac{C}{2\pi} = \sqrt{\frac{k}{\pi}}$$

$$\text{Since } C = 3k \text{ implies } \frac{3k}{2\pi} = \sqrt{\frac{k}{\pi}} \text{ squaring}$$

$$\frac{k}{\pi} = \frac{9k^2}{4\pi^2} \Leftrightarrow \frac{9k^2}{k} = \frac{4\pi^2}{\pi} \Rightarrow k = \frac{4\pi}{9}$$

$$\text{Therefore, } r = \sqrt{\frac{k}{\pi}} = \sqrt{\left(\frac{4\pi}{9}\right) \frac{1}{\pi}} = \sqrt{\frac{4}{9}} = \frac{2}{3}$$

29. A train travels 60 miles per hour for 3 hours and then 45 miles per hour for 2 hours. What is the train's average speed in miles per hour during the 5 hour period?
- A. 55 B. 54 C. 51 D. 50

Solution:

The distance travel in first 3 hours:

$$d_1 = (60 \text{ mi/hr})(3 \text{ hr}) = 180 \text{ mile}$$

The distance travel in 2nd two hours is:

$$d = \left(\frac{45 \text{ mil}}{\text{hr}}\right)(2 \text{ hr}) = 90 \text{ mile}$$

$$\text{Average speed} = \frac{\text{Total distance}}{\text{Time taken}} = \frac{180 + 90}{5} = 54 \quad \text{Answer: B}$$

30. If m is a number between 0 and 1, which of the following is NOT more than m ?

- A. m^2 B. $\frac{1}{m}$ C. $2m$ D. $\sqrt{m}$

$$\text{Clue: Let } m = \frac{1}{2}$$

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

$$\text{C. } 2m = 2\left(\frac{1}{2}\right)$$

B. $\frac{1}{m} = \frac{1}{\frac{1}{2}} = 2$

Answer: A

31. If $\frac{1}{5}$ of a certain number is 6 then $\frac{1}{6}$ of the number is ____.
- A. 5 B. 6 C. 30 D. 36

Solution: Here at, let a certain number is x.

$$\Rightarrow \frac{1}{5}x = 6 \Rightarrow x = 30 \text{ and } \frac{1}{6}x = \frac{1}{6}(30) = 5$$

Answer: A

Data Interpretation

Number of car Accidents in X Town and Estimates of property Damage in Ethiopian Birr (ETB).

Year	Number of car Accidents	Property damage estimate in ETB
1990	1270	12,050,000
1991	1289	12,688,000
1992	1345	12,090,000
1993	1578	12,100,000
1994	1645	12,400,000
1995	1888	12,500,000
1996	2010	12,700,000
1997	2100	12,800,000
1998	2150	12,950,000
1999	2175	13,100,000
Total	17,450	125,378,000

32. For which specific year is the ratio of property damage estimate to number of car accidents the highest?

A. 1999 B.. 1998 C. 1991 D. 1990

Solution:

$$\text{In 1999: } \frac{13,100,000}{2,175} = 6023$$

$$\text{In 1998: } \frac{12,950,000}{2150} = 6023$$

$$\text{In 1991: } \frac{12,688,000}{1289} = 9843$$

$$\text{In 1990: } \frac{12,050,000}{1270} = 9488$$

Answer: A

33. Which of the following can be inferred from the data in the table above?

- I. The increase in car accidents from 1990 to 1991 is the lowest during the 10 years period.
- II. The increase in car accidents from 1994 to 1995 is the highest during the 10 year period.
- III. On average, one car accident is estimated to cause about 9488 ETB is property damage during the 10 – year period.

A. I and II B. I and III C. I, II and III

Solution:

- I) $1289 - 1270 = 19 \leftarrow$ lowest car accident increase
- II) $1888 - 1645 = 243 \leftarrow$ highest car accident increase
- III) Average car accident to cause property damage =

$$\frac{12,378,000}{17,450} = 7184$$

Answer: A

34. What is the annual average (arithmetic mean) of car accidents recorded in town (x) from 1990 to 1999?

A. 3490 B. 1745 C. 1163 D. 8725

Hint:

$$\text{Average} = \frac{\text{Total number of car accidents}}{10} = \frac{17,450}{10} = 1745$$

Word problem

35. Meron is now 14 years older than Nati. If in 10 years Meron will be twice as old as Nati, how old will Meron be in 5 years?

A. 29 B. 21 C. 23 D. 33

Solution:

Let x = age of Nati

y = age of Meron

$\Rightarrow y = x + 14 \leftarrow$ The present age of Meron

In 10 years meron's age will be:

$$y + 10 = 2(x + 10) = 2x + 20$$

$$y + 10 = 2x + 20, \text{ but } y = x + 14$$

$$\Rightarrow (x + 14) + 10 = 2x + 20$$

$$\Rightarrow 24 - 20 = 2x - x = x$$

$\Rightarrow x = 4, y = 18 \leftarrow$ present age of Nati and Meron

In 5 years will be $x = 4 + 5$ and $y = 18 + 5 = 23$. **Answer: C**

36. When 10 is divided by the positive integer P , then the remainder is $P - 4$. Which of the following could be the value of P ?

- A. 8 B. 7 C. 4 D. 3

Clue: If 10 is divided by P , the remainder is $P - 4$.

A. When 10 is divided by 8. The remainder is 2.

$$\Rightarrow P - 4 = 2 \Rightarrow P = 6, \text{ but } P = 8$$

B. When 10 is divided by 7, the remainder is 3.

$$\Rightarrow P - 4 = 3 \Rightarrow P = 7 \text{ is the same } 7 - 4 = 3$$

Answer: B

37. The average (arithmetic mean) of 6 numbers is 8.5. When one number is discarded, the average of the remaining numbers becomes 7.2. What is the discarded number?

- A. 15.4 B. 15.0 C. 12.4 D. 10.0

Clue: Let a, b, c, d, e, f are the number

$$\Rightarrow \frac{a + b + c + d + e + f}{6} = 8.5 \Rightarrow a + b + c + d + e + f = 6(8.5) = 51$$

Let a = discarded number

$$\Rightarrow \frac{b + c + d + e + f}{5} = 7.2 \Rightarrow b + c + d + e + f = (7.2)(5) = 36$$

$$\therefore (a + b + c + d + e + f) - (b + c + d + e + f) = 51 - 36 = 15$$

Answer: B

38. A football club collected birr 599 from its members. If each member contributed at least birr 12, what is the greatest number of members the club could have?

- A. 52 B. 51 C. 50 D. 49

Clue:

A. $\frac{599}{52} = 11.51$ birr/member

B. $\frac{599}{51} = 11.74$ birr/member

C. $\frac{599}{50} = 11.98$ birr/member

D. $\frac{599}{49} = 12.22$ birr/member

Answer: D

39. A lamp is manufactured to sell for birr 35, which yields a profit of 25% of cost. If the profit is to be reduced to 15% of cost, the new retail price will be:

A. 44 B. 32 C. 16 D. 12

Clue: Let x = cost price

$$\Rightarrow x + 25\% \text{ of } x = 35 \Rightarrow 25\% \text{ of } x = 35 - x$$

$$\Rightarrow \frac{(25)(x)}{100} = 35 - x \text{ implies } 25x = 3500 - 100x$$

$$\Rightarrow 125x = 3500 \text{ provides } x = \frac{3500}{125} = 28$$

If the profit is to be reduced to 15% of cost, the new selling price

$$\text{will be: } 28 + 15\% \text{ of } 28 = 28 + \frac{(15)(28)}{100} = 32.2 \text{ birr} \quad \text{Answer: B}$$

40. If $n = 3$, what is the value of $2^{2n} + 1$.

A. 13 B. 17 C. 33 D. 65

Hint: $2^{2n} + 1 = (2^2)^n + 1 = 4^n + 1$

When $n = 3$, $4^3 + 1 = 64 + 1 = 65$

41. What is the greatest common factor of 42, 126 and 210?

A. 6 B. 14 C. 21 D. 42

Hint: Express 42, 126 and 210 in prime factorizations.

$$\left. \begin{aligned} \rightarrow 42 &= 2 \times 3 \times 7 \\ \rightarrow 126 &= 2 \times 3^2 \times 7 \\ \rightarrow 210 &= 2 \times 3 \times 5 \times 7 \end{aligned} \right\}$$

$\rightarrow$ The greatest common factor of 42, 126 and 210 is $2 \times 3 \times 7 = 42$.

42. If a radius of a circle inscribed in a square is k , then the perimeter of the square is:

A. K^2 B. $\frac{k}{4}$ C. $4k^2$ D. $8k$

Hint: If radius, $r = k$, then diameter $= 2k \leftarrow$ the side length of the square.

$$\text{Perimeter} = (4)(2k) = 8k$$

Answer: D

43. Which of the following fractions has the smallest value?

A. $\frac{2}{9}$ B. $\frac{1}{7}$ C. $\frac{1}{8}$ D. $\frac{3}{11}$

Hint: Here at, $\frac{2}{9} = \frac{1}{4.5}$ and $\frac{3}{11} = \frac{1}{\cancel{11}_3} = \frac{1}{3.7}$

$$\Rightarrow \frac{1}{8} < \frac{1}{7} < \frac{1}{4.5} < \frac{1}{3.7} = \frac{1}{8} < \frac{1}{7} < \frac{2}{9} < \frac{3}{11}$$

Answer: C

44. If the sum of 30, 50 and y is 180, then the average (arithmetic mean) of 30, 50 and y is:
 A. 60 B. 70 C. 80 D. 100

Hint: mean $(\bar{x}) = \frac{30 + 50 + y}{3} = \frac{180}{3} = 60$

45. If $x > 0$ and $2x - 1 = \frac{1}{2}(x + 1)$, then $x =$ _____.

- A. 1 B. $2\sqrt{2}$ C. $\frac{1}{2}$ D. $\sqrt{2}$

Hint: $2x - 1 = \frac{1}{2}x + \frac{1}{2} \Rightarrow 2x - \frac{1}{2}x = \frac{1}{2} + 1$

$$\Rightarrow \frac{3x}{2} = \frac{3}{2} \Leftrightarrow x = 1$$

46. If the value of the following expression $\left[\left(1 + \frac{m}{n} \right) / \left(\frac{m}{n} \right) \right]$ is to

Hint: $x = \frac{a}{b} \Rightarrow a = bx$

Therefore, $y = \frac{a}{a+b} = \frac{bx}{bx+b} = \frac{bx}{b(x+1)} = \frac{x}{x+1}$

48. If the perimeter of a triangle is 18 then the length of one of sides **CANNOT** be:

A. 8 B. 9 C. 3 D. 1

Hint: Let a , b and c are length of sides of triangle. We have given $a + b + c = 18$.

The following three cases must satisfy.

(i) $a + b > c$, (ii) $a + c > b$ (iii) $b + c > a$ thus

A. If $c = 8$, $a + b > 8$, but $a + b = 10$

B. If $c = 9$, $a + b > 9$, but $a + b = 9$ because $a + b + c = 18$.

Therefore, $9 > 9$ is false.

C. If $c = 3$, $a + b > 3$, but $a + b = 15$

$\therefore 15 > 3$ is true

D. If $c = 1$, $a + b > 1$, but $a + b = 17$

$\therefore 17 > 1$ is true

Answer: B

49. Which of the following has the greatest value?

A. $\sqrt{0.3}$ B. 0.3 C. $\frac{1}{3}$ D. $\frac{2}{5}$

Hint: $\frac{1}{3} = 0.333 \dots$ and $\frac{2}{5} = 0.4$

Answer: D

50. $(C + x)/x$ is equal to:

A. $C^2 + 1$ B. c C. $\frac{c}{x} + 1$ D. $\frac{c}{x} + x$

Hint: $\frac{c+x}{x} = \frac{c}{x} + \frac{x}{x} = \frac{c}{x} + 1$

51. Which of the following numbers **Does not** have a reciprocal?

Hint: The reciprocal of x is $\frac{1}{x}$, $x \neq 0$.

A. 0 B. $\frac{1}{3}$ C. -2 D. 1

Answer: A

52. Which one of the following expressions has an even integer value for all integers a and c ?

A. $80 + 2ac$ B. $3a + 3c$ C. $2a + c$ D. $a + 2c$

Hint: Every even integers are expressed in multiple of 2, i.e. $\{0, 2, 4, 6, \dots, 2n\}$ where $n \in \mathbb{Z}$. Hence: $8a + 2ac = 2(4a + ac)$ are even integers for all a and c . **Answer: A**

53. If $x = 3$ is one solution to the equation $x^2 + rx - 20 = 4$ then r is equal to _____.

A. 5 B. -8 C. 3 D. 8

Hint: When $x = 3$; $(3)^2 + r(3) - 20 = 4$

$$3r = 24 - 9 = 15, \text{ therefore, } r = \frac{15}{3} = 5$$

54. A triangle has a base (B) and an altitude (h). A second triangle has a base twice the altitude of the first triangle, and an altitude twice the base of the first triangle. What is the area of the second triangle?

A. $\frac{1}{2}Bh$ B. $\frac{1}{2}B^2h^2$ C. $2Bh$ D. $4Bh$

Hint: First triangle base = B , and altitude = h

Second triangle base = twice of first triangle altitude = $2h$

Second triangle altitude = twice of first triangle base (B) = $2B$.

$$\therefore \text{Area of second triangle} = \frac{1}{2}(2B)(2h) = 2Bh. \quad \text{Answer: C}$$

55. A certain machine fills a bag with 7 kg of potato chips in 3.5 seconds. At this rate, how many seconds will it take the machine to fill a bag with 15 kg of potato chips?

A. 6.5 B. 7.0 C. 7.5 D. 8

$$\text{Hint: Chips in kilogram per second} = \frac{7\text{kg}}{3.5\text{ sec}} = 2\text{ kg/sec}$$

The time required to fill 15 kg of potato chips is

$$15\text{ kg} / 2\text{ kg/sec} = 7.5\text{ sec.}$$

56. A piece of paper with an area of 60 square centimeter is divided into two pieces so that the area of one is $\frac{2}{3}$ of the area of the other. What is the area of one of the pieces (in square centimeter)?

A. 20 B. 24 C. 30 D. 45

Hint: $\frac{2}{3}$ of 60 = 40 and $\frac{1}{3}$ of 60 = $\frac{1}{3}(60) = 20$

57. Sales for a business were 3 million dollars more the second year than the first, and sales for the third year were double the sales for the second year. If sales for the third year were 38 million dollars, what were sales, in millions of dollars, for the first year?
 A. 16 B. 17.5 C. 20.5 D. 22

Hint: Let sales for first year = A

Sales for 2nd year = B

Sales for 3rd year = C

$$B - A = 3,000,000 \Rightarrow B = 3,000,000 + A$$

$$C = 2B = 38,000,000$$

$$\Rightarrow B = 19,000,000$$

$$3,000,000 + A = 19,000,000 \Rightarrow A = 16,000,000$$

58. In a group of 15, 7 can speak English, 8 can speak Arabic, and 3 can speak neither. What fraction of the group can speak both English and Arabic?

A. $\frac{1}{2}$ B. $\frac{1}{3}$ C. $\frac{1}{5}$ D. $\frac{2}{3}$

Hint: Let who speak: English = A and Arabic = B

$n(A \cup B)' = 3$ but $n(A \cup B) = n(U) - n(A \cup B)'$ we have

$$n(U) = 15, \text{ so that } n(A \cup B) = n(U) - n(A \cup B)' = 15 - 3 = 12$$

$$\Rightarrow n(A \cap B) = n(A) + n(B) - n(A \cup B) = 7 + 8 - 12 = 3$$

Therefore, a fraction of group can speak both English and Arabic

$$\text{are } \frac{3}{15} = \frac{1}{5}$$

Answer: B

Data Interpretation

Questions 58 – 60 below are based on the hypothetical data given in table below.

From the table: Total population primary school age population and school environment by sex and regional in thousands.

Region	Total population		School age population		School environment	
	Male	Female	Boys	Girls	Boys	Girls
Addis Ababa	1387	1500	162	166	220	267
Afar	756	603	141	114	34	22

	9309	9317	1913	1887	1711	1572
Amhara	12,883	12,934	2709	2670	2734	2099
Oromia	7203	7287	1522	1500	1474	1113
SNNPR	2268	1950	445	389	157	95
Somali	2080	2143	443	431	447	436
Tigray	35,886	35,734	7,335	7,157	6,777	5,604
Total						

59. The total male population, in million, in the seven regions is nearly:

- A. 13 B. 20 C. 26 D. 35

Answer: D

Hint: Total male population is nearly.

60. The three least populous regions in order are:

- A. Afar, Addis Ababa, Somalia
B. Afar, Addis Ababa, SNNPR
C. Addis Ababa, Tigray, Somalia
D. Afar, Oromia, Tigray

Hint: Afar = $756 + 603 = 1359$

Addis Ababa = $1,387 + 1500 = 2887$

Somali = $2,268 + 1950 = 4218$

Answer: A

61. Assuming that the total population of the county at the time the above data is taken is 73 million, what is the share, in percent, of the population of Amhara and Oromia together?

- A. 40 B. 50 C. 60 D. 70

Hint: Amhara = $9309 + 9317 = 18,926$

Oromia = $12,883 + 12,934 = 25,817$

Amhara + Oromia = $18,926 + 25,817 = 44,443$

$\Rightarrow 44,443,000$ is what percent of $70,000,000$

$\Rightarrow x\%$ of $70,000,000 = 44,443,000$

$$\frac{(x)(70,000,000)}{100} = 44,443$$

$$x = \frac{44,443,000}{70,000,000} \times 100\% \approx 60\%$$

Answer: C

62. If the radius of a circle is increased by 30% the area of circle is increased by _____

- A. 30% B. 69% C. 130% D. 169%

Hint: If a quantity is increased by a percentage then the percentage of the quantity is added to the original. Let r be original radius. Thus, $R = r + 30\%$ or $r = r(1 + 0.3) = r(1.3)$

$$\frac{A_2}{A_1} = \frac{\text{Area of circle after increased}}{\text{Area of original circle}} = \frac{\pi R^2}{\pi r^2} = \frac{\pi(1.3r)^2}{\pi r^2} = 1.69$$

$$A_2 = A_1 (1.69) = A_1 + 0.69A_1 = A_1 (1 + 0.69)$$

$\therefore$ Area of circle increased by 69%.

63. The price of car increased by 2.5%. What is the price of car previously costing Birr 320,000?
A. 800,000 B. 400,000 C. 328,000 D. 360,000

Hint: Percentage increase:

$$\Rightarrow 320,000 + 2.5\% \text{ of } 320,000 = 320,000 + \frac{2.5}{100}(320,000) = 328,000$$

Answer: C

64. In survey, $\frac{5}{16}$ of people said that they preferred to use self

service restaurants. In contrast, $\frac{3}{8}$ of the people indicated that they preferred to be preserved by waiter/ waitress. The remaining 150 respondents stated that they had no clear preference. How many people participated in the survey?

- A. 480 B. 390 C. 360 D. 300

Hint: Let x be had no preference, $\frac{5}{16}$ = self service

$\frac{3}{8}$ = by waiter/ waitress

$$\Rightarrow x + \frac{5}{16} + \frac{3}{8} = 1 \Leftrightarrow x = 1 - \frac{11}{16} = \frac{5}{16}$$

$$\text{Number of people by self service} = \frac{5}{16} = 150$$

$$\text{Number of people by waiter} = \frac{\frac{3}{8}(150)}{\frac{5}{16}} = 180.$$

$$\text{Total number of peoples in survey} = 150 + 150 + 180 = 480 \text{ people.}$$

65. What amount, when increased by 5% gives 504?

A. 529.2 B. 336 C. 1008 D. 480

Hint: Let x be amount:

$$x + 5\%x = 504 \Rightarrow x(1 + 0.05) = 504$$

$$\Rightarrow x = \frac{504}{1.05} = 480$$

66. In a sale, all prices have reduced by 25%. The sale price of a dress is Birr 350. What was the original price?

A. 262.50 B. 466.70 C. 1400 D. 437.5

Hint: Let x be original price $\Rightarrow x - 25\%$ of $x = 350$

$$\Rightarrow x(1 - 0.25) = 350 \Rightarrow x = \frac{350}{0.75} = 466.7$$

Answer: B

67. In a bowl containing 12 marbles, 6 are yellow and 6 are green. If 2 marbles are picked from the bowl at random, what is the probability that they will both be yellow?

A. $\frac{1}{6}$ B. $\frac{5}{11}$ C. $\frac{1}{2}$ D. $\frac{5}{22}$

Hint: Drawing yellow marble $= \frac{6}{12} = \frac{1}{2}$, but now that marble is no longer in the bowl. So on the second draw the probability of drawing yellow marble is $= \frac{\text{remaining yellow marble}}{\text{remaining marble}} = \frac{5}{11}$.

$$\therefore \text{The probability of both} = \left(\frac{1}{2}\right)\left(\frac{5}{11}\right) = \frac{5}{22}$$

Answer: D

68. Quantity comparison:

9 is x percent of 25

y is 25 percent of 80

Column A

X

Column B

Y

- A. The quantity in column A is greater.
 B. The quantity in column B is greater.
 C. The two quantities are equal.
 D. The relationship cannot be determined from the information given.

Hint: First translate the statement. $9 = \frac{x}{100}(25) \Rightarrow 9 = \frac{x}{4}$, get $x = 36$

Now translate the 2nd statement, $y = \frac{25}{100}(80) = 20$

$\Rightarrow x > y$ provided that $36 > 20$.

69. The average of nine number is 16. The average of four of these numbers is 11. What is the average of the other five numbers?
 A. 14.46 B. 20 C. 1 D. 5

Answer: A

Hint: Let $x_1, x_2, x_3, \dots, x_9$ are the number.

$$\Rightarrow \frac{x_1 + x_2 + x_3 + \dots + x_9}{9} = 16 \Rightarrow x_1 + x_2 + x_3 + \dots + x_9 = 144$$

$$\text{But } \frac{x_1 + x_2 + x_3 + x_4}{4} = 11 \Rightarrow x_1 + x_2 + x_3 + x_4 = 44$$

$$\Rightarrow (x_1 + x_2 + x_3 + \dots + x_9) - (x_1 + x_2 + x_3 + x_4) = 144 - 44 = 100$$

$$\Rightarrow \frac{x_5 + x_6 + x_7 + x_8 + x_9}{5} = \frac{100}{5} = 20$$

Answer: B

70. The average (arithmetic mean) of a set of six numbers is 32. If a certain number x is removed from the set, the average of the remaining numbers in the set is 25.

A. 13.6 B. 77 C. 67 D. 125

Hint: Let a, b, c, d, e and f are the number.

$$\frac{a + b + c + d + e + f}{6} = 32 \Rightarrow a + b + c + d + e + f = 192$$

If a certain number x is removed from the set, five numbers left.

$$\Rightarrow \frac{a + b + c + d + e}{5} = 25 \Rightarrow a + b + c + d + e = 125$$

$$= 192 - 125 = 67$$

Answer: C

71. The price of a jacket was reduced by 20%. During a special sale, the price was discounted another 10%. What was the total percentage discount from the original price of the jacket?

A. 25% B. 30% C. 72% D. 28%

Hint: Let x be the original price of the jacket.

• After 20% discount: $x - x(0.2) = 0.8x$

• Again 10% discount: $0.8x - (0.8x)(0.1) = 0.72x$

So that total percentage discount from the original is given by

$$\left(\frac{x - 0.72x}{x} \right) \times 100\% = (1 - 0.72)(100\%) = 28\%$$

Answer: D