



General Abilities Test

2015

Instructions

The test consists of two parts – Verbal Reasoning and Quantitative Reasoning. Each of the parts contains 40 questions. Each of the questions is followed by 4 or 5 possible responses, out of which only one is the correct response.

Read questions carefully to understand what is required of you and choose your response accordingly.

It is necessary to mark the chosen response on the answer sheet (see the relevant instructions on the answer sheet).

Responses marked in the test itself will not be checked.

For determining the results of the General Abilities Test, only the answer sheet will be considered.

You have 1 hour and 30 minutes for each of the parts.

An overseer will inform you when the time is expired.

If you do not submit your answer sheet as soon as the time expires, your answers will not be checked.

If you cannot answer a question do not waste time, move on to the next question.

For notes and drawings you can use any blank areas on the test pages.

We wish you success!

Verbal Reasoning

Analogies

Each of the following questions contains a pair of words (or phrases) in bold type (stem pair). Find the relationship between the meanings of the stem words (phrases).

A word (or a phrase) in bold type is given on the right side of the stem pair. Match this word (phrase) with one of the words (phrases) from the possible responses so that the relationship between their meanings is similar (analogous) to the relationship in the stem pair. Note that the order of the words in the stem pair is important.

1. adjust : fit

- (a) reproduction
- (b) evolution
- (c) stagnation
- (d) selection
- (e) mutation

development : -----

2. image : contour

- (a) archipelago
- (b) land
- (c) shore
- (d) sea
- (e) bay

island : -----

3. wheat : wheatear

- (a) tree
- (b) forest
- (c) needle
- (d) cone
- (e) seed

pine : -----

4. substance : molecule

- (a) straight
- (b) graph
- (c) parallel
- (d) segment
- (e) point

line : -----

5. ball : trampoline

- (a) merry-go round
- (b) wheel
- (c) propeller
- (d) bicycle
- (e) mixer

humming top : -----

Completion of Sentences

In each question there is a sentence (or sentences) with several parts missing. The missing parts are marked with dotted lines. Each possible response contains a string of words or phrases separated with slashes (/), representing a possible way of completing the sentence. Choose the response that completes the sentence in the most appropriate (meaningful and coherent) way.

6. Without doubt, speech is ----- by humans for communication only. If we recall that a playing child can talk for hours when there is ----- to listen and effectively senseless 'chatter' ----- among adults, it will become obvious that the purpose of language use, in many cases, ----- communication only.

- (a) used / somebody / is very rare / is not
- (b) not used / somebody / is very rare / is not
- (c) used / nobody / is by no means unusual / is
- (d) not used / nobody / is by no means unusual / is not

7. What doctors say about some maladies is, to a great extent, true of the problems in a country: in its ----- stages, it is ----- ; but if the malady ----- left unidentified and untreated for long, then the opposite will be the case – ----- to cure.

- (a) early / easy to cure the malady, but it is hard to diagnose it / has been / it will already be easy to diagnose, though hard
- (b) late / as hard to cure the malady, as to diagnose it / has not been / it will be easy to diagnose, though hard
- (c) early / as easy to cure the malady, as to diagnose it / has been / it will already be easy to diagnose, and not really hard
- (d) late / hard to cure the malady, but it is easy to diagnose it / has not been / it will not be hard either to diagnose or

8. Jean Cocteau wrote: art produces ----- things that frequently ----- with time. Fashion, ----- , produces ----- things that always ----- with time.

- (a) beautiful / are forgotten / on the other hand / ugly / become even more beautiful
- (b) ugly / become ever more expensive / similarly / ugly / become even uglier
- (c) beautiful / become ugly / similarly / beautiful / become ever more beautiful
- (d) ugly / become more beautiful / on the other hand / beautiful / become ugly

9. While ----- of literature, ----- to show off one's illiteracy in physics and to proudly parade one's incompetence in mathematics. ----- if we consider how heavily modern society depends on science and technology.

- (a) many boast about their complete ignorance / it is socially unacceptable / This looks even more disturbing
- (b) it is socially unacceptable to admit one's own ignorance / it is fairly common / We can explain this only
- (c) nobody boasts about one's own complete ignorance / it is socially acceptable / This looks even more disturbing
- (d) it is socially acceptable to admit one's own ignorance / an even stronger trend is / We can explain this only

10. ----- human conduct really depends on the events in the external world, it ----- immediately determined by these events. What causes our actions ----- the external world itself ----- our perception of the events in the external world.

- (a) Since / is / is not / but
- (b) Even though / is not / is not / but
- (c) Since / cannot be / is / rather than
- (d) Even though / is not / is / rather than

Logical Reasoning

These questions differ from each other with respect to their structure. Therefore, it is important to read carefully what is required in each question and select the response accordingly.

In some cases, presenting data graphically may be helpful for arriving at the correct solution.

11. Consider the pairs of statements provided below:

- I. No student is minor.
Some students are adults.
- II. All cars in the garage have undergone a technical checkup.
There are no cars in the garage that have not undergone a technical checkup.
- III. Some braggarts are cowards.
There are cowards that are not braggarts.
- IV. Nightingales do not build their nests in all tree species.
Nightingales build their nests only in one definite species of tree.

Which of these pairs contains statements with the same content?

- (a) I
- (b) II
- (c) III
- (d) IV
- (e) None

12. There are three offices on each side of a corridor.

- The director's office has only one adjacent office.
- The manager's office has adjacent offices from both sides.
- The accountant's office and the director's office are adjacent.
- The offices of the lawyer and the administrative assistant are on the same side of the corridor.

Which of the following is impossible if all these statements are true?

- (a) The offices of the director and the lawyer are in front of each other, on different sides of the corridor.
- (b) The manager's office is on the left side of the administrative assistant's office.
- (c) The offices of the director and the lawyer are on the same side of the corridor.
- (d) The offices of the director and the administrative assistant are in front of each other, on different sides of the corridor.
- (e) The offices of the director and the manager are on different sides of the corridor.

13. Consider the four statements below:

1. There is a giraffe or a hippopotamus in the zoo – at least one of them.
2. If there is a rhino in the zoo, then there is a zebra too.
3. It is not the case that there are both a zebra and an elephant in the zoo – at least one of them is missing.
4. If there is a giraffe in the zoo, then there is no zebra there.

Which of the following describes correctly the relationship between these statements?

- (a) No 1 follows from No 2 and No 3 taken together.
- (b) No 2 follows from No 3 and No 4 taken together.
- (c) No 3 follows from No 2 and No 4 taken together.
- (d) No 4 follows from the remaining three taken together.
- (e) None of them follows from the remaining three taken together.

14. The average temperature of the Earth's atmosphere and oceans has been constantly increasing since the latter decades of the 19th century up to the present. This phenomenon is known as global warming. According to a group of scientists, **global warming is not caused by factors related to human industrial activities. Instead, it is caused by a particularly strong activity of the Sun's radiation, which has been at its peak for the past 150 years.**

Which of the following supports the given hypothesis most?

- (a) Most of the research centers, representatives of which deny the link between global warming and human industrial activities, are financed by big industrial corporations.
- (b) Some scientists doubt the reliability of the data concerning the temperature levels of the Earth atmosphere and ocean waters, on which the claims about global warming are based.
- (c) The scientists who believe that the causes of global warming are linked with human industrial activities are subject to strong pressures from the political circles not to make results of their studies public.
- (d) The global warming effect was weakest in the periods when, because of the increased amount of tiny liquid or solid particles (aerosols) in the atmosphere, the Sun radiation reached the Earth surface in lesser quantities.
- (e) The analysis of the global warming trends has shown that the mean temperature of the Earth atmosphere has drastically increased for the last 25 years.

Reading Comprehension

Read the text below carefully. For each question, select the response that is correct according to the text.

Several years ago, Japanese scientists created an android* called 'Actroid-DER'. Its mission was to act as a speaker during corporate events, which did not require much personal depth. Actroid is a kind of android (humanoid robot) with strong visual human-likeness; it blinks, speaks, can recognize human faces, etc. Even though as much as 250,000 US dollars were spent on this actroid girl, her movements were still unnatural and clumsy. The actroid was shipped to Carnegie Mellon University in Pittsburg, where she was supposed to acquire personal qualities. This was, at least, the ambition of 5 optimistic graduate students who were working at the Entertainment Technologies Center of the university. They were supposed to make this attractive robot girl more convincingly human and less like a robot. As the first step, they changed her name and called her 'Yume' – a Japanese word for 'dream'.

Actroids are robots of a new generation. These robots are not created as industrial machines; they are independent agents, supposed to play roles of humans or other living creatures at home, school or workplace. To this kind of robots belong, for example, the robot-vacuum cleaner 'Rumba' running on carpets, the small robot seal, and the cute robot puppy that obeys our instructions – sits when asked, or flips over, without ever leaving any mess behind, to top it all. In future we may have more sophisticated robots that will cook for us or nurse our babies. We may be monitoring and guiding these robots from a distance.

In the Entertainment Technologies Center, the team working on the 'Yume Project' was preparing to present their transformed android. They had faced a hard task: the robot, perfect from the technical point of view, had to come out more convincing and natural too. Yan Lin, the team's computer programmer, developed a program to control Yume's emotions. But an attempt to endow the robot girl with the ability to detect faces and make more realistic eye contact was only half successful: when meeting a person, she would first establish eye-contact and then slowly turn her head in the right direction. To mask her jerky movements and unnatural gaze, the team decided to account for Yume's conduct by her character and to dress her accordingly. It was decided that she would be slightly punk, slightly goth**, attracting your attention from far away. To hide her zombie-stiff hands, engineers fitted Yume with a pair of long black fingerless gloves; and they put on her lips dark lipstick, to cover up her inability to ever quite close her mouth.

Notwithstanding this special image, Yume is still the same old 'Actroid-DER'; she, however, now at least knows her place. The team learnt how hard it is to start with big expectations and end up with disappointment; they taught Yume a new greeting text: "I am not a human! – Admits the robot girl – I can never be exactly like you. This is not so bad. I like being an android, to be honest." The faculty, impressed with the progress Yume had made, gave the graduate students' team highest grades.

* Android – a machine, a robot, with human appearance and qualities.

** Goth subculture emerged in Great Britain under the influence of punks. Unlike punks, goths are calmer, and more intellectual. Goths are characterized with the dominance of black color in attire, iron accessories, extravagant hairdos, etc.

15. The author calls the five graduate students of Carnegie Mellon University ‘optimists’ because:

- (a) They attempted to create an actroid that would resemble a human being, would be able to blink, breath, etc.
- (b) They created a beautiful humanoid robot that was able to speak and did not look like a machine.
- (c) They called the clumsy actroid ‘Yume’ – meaning ‘dream’ in Japanese – expressing thereby their hopeful attitude.
- (d) They attempted to endow the actroid, which initially did not need any personal depth, with personal qualities.

16. What is the purpose of the episode about Rumba, the robot seal, and the robot puppy in the text?

- (a) To highlight similarities and differences among industrial robots and social robots.
- (b) To introduce the reader to robots of a new generation that are independent agents and can, in some sense, ‘relate’ to people.
- (c) To introduce the reader to sophisticated robots that can perform human roles without human control.
- (d) To introduce the reader to model robots of a new generation, production of which is planned for the future and which will assist humans at home as well as at work.

17. Why was the robot girl Yume transformed into a punk or goth?

- (a) The initial image of Yume was less interesting for specialists, while as a punk or goth, Yume attracted attention from the first glance.
- (b) The program developed by Yan Lin was only partially successful, failing to control Yume’s emotions.
- (c) The new image, features, and attributes characteristic of punks and goths made less noticeable Yume’s unnatural qualities.
- (d) The extravagant image was supposed to guarantee the success for the transformed Yume.

18. Below are listed several aspects of the work on Yume project:

- I. A computer program to control Yume 's emotions developed by Yan Lin;
- II. Coordinating Yume's gaze and movements;
- III. Specific image to obscure Yume's actroid-like conduct;
- IV. Yume's greeting text that emphasizes her status.

Which of the following correctly indicates the main reason(s) for the faculty awarding highest grades to Yume team?

- (a) Only II
- (b) Only I and II
- (c) Only III
- (d) Only III and IV

19. Consider the following information about one social robot:

Robot 'Snackbot' is about 1.5 meters tall. He resembles humans slightly, notwithstanding his grotesque features. In the canteen of the School of Computer Science, Snackbot takes orders and serves food. He sometimes confuses orders or change; he does, however, always warn customers in advance that he may make mistakes and, when mistaken, apologizes.

Which of the following **cannot be concluded** from the comparison of Snackbot with Yume?

- (a) Snackbot has a grotesque appearance, while Yume is a beautiful actroid; however, both 'know' their places perfectly well.
- (b) Yume is a robot of the new generation; accordingly, she moves realistically, exactly like a human, and her greeting text too is more adequate than that of Snackbot, who does not like being a robot.
- (c) People are never disappointed by encounters with them, because Snackbot says in advance that he may make mistakes, while Yume acknowledges that she is not a human and can never be like a human.
- (d) Even though Yume has stiff hands and cannot quite close her mouth, she still likes to be an android; Snackbot, too, has unusual appearance and is often unable to do what is expected of him.

20. What is the main purpose of the text?

- (a) To introduce the reader to various stages of the transformation process of one social robot.
- (b) To give an account of the way one social robot was taught its greeting text.
- (c) To analyze in general the role social robots play in human life.
- (d) To analyze factors due to which one social robot project proved to be only partially successful.

Analogies

Each of the following questions contains a pair of words (or phrases) in bold type (stem pair). Find the relationship between the meanings of the stem words; then choose from the possible responses the one in which the relationship between the two words (phrases) is most similar (analogous) to the relationship you have found in the stem pair. Note that the order of the words (phrases) in pairs is important.

21. iceberg : under water

- (a) abyss : on bottom
- (b) trench : in ditch
- (c) plant : in soil
- (d) flock : on pasture
- (e) crack : in fissure

22. forges : falsified

- (a) recognizes : ciphered
- (b) recovers : restored
- (c) writes : interpreted
- (d) clarifies : identified
- (e) mimics : caricatured

23. bohemian : expedient

- (a) mystical : supernatural
- (b) sensational : expected
- (c) progressive : successful
- (d) propagating : distributed
- (e) immigrating : alienated

24. tinkling : hand bell sound

- (a) bellowing : predator behavior
- (b) spinning : river whirlpool
- (c) flapping : wings motion
- (d) sliding : skiing springboard
- (e) twirling : kind of toy

25. axis of symmetry : backbone

- (a) zenith : peak
- (b) stage : amphitheater
- (c) view : horizon
- (d) ridge : range
- (e) lighthouse : target

26. sail : bridle

- (a) spiral : spring
- (b) rope : wire
- (c) bolt : screw
- (d) bar : latch
- (e) rod : trap

27. loan : gift

- (a) hotel : home
- (b) frontline : warfare
- (c) visa : pass
- (d) camp : tent
- (e) prize : certificate

Completion of Sentences

In each question there is a sentence (or sentences) with several parts missing. The missing parts are marked with dotted lines. Each possible response contains a string of words or phrases separated with slashes (/), representing a possible way of completing the sentence. Choose the response that completes the sentence in the most appropriate (meaningful and coherent) way.

28. Social life ----- fully described by a number of scientific laws that ----- . Interrelations between mass and gravity in one place in the world, compared to another, do not change significantly, and a brick falls in China with the same acceleration as it does in Kansas, ----- interrelations between work and wages ----- .

- (a) can always be / cover all people, all places and times / however, / vary by place and time
- (b) cannot be / cover all people, all places and times / however, / vary by place and time
- (c) can always be / were discovered in the context of a specific culture, in a specific place and time / likewise, / are governed by different laws in different contexts
- (d) cannot be / are valid in the context of a specific culture, in a specific place and time / likewise, / are governed by roughly the same laws

29. The psychologist Lloyd-Morgan ----- anthropomorphism (ascribing human qualities to animals) in explanations of animal behavior. He formulated the so called 'principle of economy', according to which it is ----- to interpret any particular pattern of animal behavior as an expression of higher mental functions, if it ----- explained by the animal's ----- .

- (a) argued against / not justified / can be / lower faculties
- (b) fully embraced / reasonable / can be only / lower faculties
- (c) argued against / unacceptable / cannot be / higher faculties
- (d) fully embraced / acceptable / cannot be / still higher faculties

30. ----- the ability to select where to live ----- able to determine where to grow, ----- that germinate ----- environments.

- (a) Although / is not associated with animals only, neither are plants / because they cannot produce seeds / in drastically diverse
- (b) It is well known that / is mainly associated with animals. Plants, on the other hand, are not / since they produce seeds / only in specific
- (c) Although / is mainly associated with animals, plants, in a sense, are also / for example, by producing seeds / only in specific
- (d) It is well known that / is not associated with animals only. Plants, in a sense, are also / since they produce seeds / in drastically diverse

Logical Reasoning

These questions differ from each other with respect to their structure. Therefore, it is important to read carefully what is required in each question and select the response accordingly.

In some cases, presenting data graphically may be helpful for arriving at the correct solution.

31. Four friends – Anna, Sophia, Gio and Dato – are sitting around a table, at four different sides. All of them are of different ages.

- Dato is younger than Gio.
- To the right from Gio, the oldest of the four is sitting, while to the left from him – the youngest.
- The one sitting in front of Sophia is older than Gio.

Which of the following is the correct ordering of the friends from the youngest to the oldest?

- (a) Sophia, Dato, Anna, Gio
- (b) Sophia, Anna, Dato, Gio
- (c) Dato, Gio, Sophia, Anna
- (d) Dato, Sophia, Gio, Anna
- (e) Sophia, Dato, Gio, Anna

32. Consider two premises and a conclusion following from them:

Premise I: All freshmen of our university study philosophy and mathematics.

Premise II: Some freshmen of our university are sportsmen.

Conclusion: Therefore, some sportsmen study philosophy.

Below are described various ways of modifying the first premise. Which of the changes will yield a valid argument (i.e. the conclusion still following from the new set of premises)?

In the Premise I,

- (a) replace 'and' with 'or'
- (b) replace 'All' with 'Some'
- (c) insert 'only' after 'study'
- (d) replace 'All' with 'Some' and replace 'and' with 'or'
- (e) replace 'All' with 'No' and 'study' – with 'studies'

33. Cuckoos lay eggs in other birds' nests and make them foster their offspring. To explain why 'hosts' do not get rid of parasitic eggs or fledglings by just throwing them out of the nest, several hypotheses have been proposed. According to one of them, called the 'Mafia Hypothesis', through the process of evolution, some species of cuckoos have developed 'mafia' behavior: **the cuckoo regularly checks out the host's nest, protects it, but if no longer finds its egg or fledgling in there, destroys the host's nest.**

*Which of the following, if true, would **challenge** the 'Mafia hypothesis' most?*

- (a) Some bird species that host cuckoos can differentiate cuckoo's fledglings from their own ones by voice, however, feed all of them equally.
- (b) Some cuckoo species only lay eggs in nests of just one specific host species, while others are not so 'specialized' and lay eggs in nests of various birds.
- (c) In some cases cuckoo's eggs are visually very different from the host bird's eggs, while in other cases the eggs are visually similar.
- (d) It is widely known that in many cases cuckoo protects the nest hosting its own egg or fledgling from predators.
- (e) All cuckoo species are so adapted to specific host species that hosts can never distinguish cuckoo's eggs or fledglings from their own ones.

34. Consider statements:

- No honest person is a cheat.
- Some cheats are generous.

*Which of the following is **necessarily false**, if these statements are true?*

- (a) All honest persons are generous.
- (b) All generous persons are honest.
- (c) Some honest persons are generous.
- (d) No generous person is honest.
- (e) There is no honest person that is not generous.

Reading Comprehension

Read the text below carefully. For each question, select the response that is correct according to the text.

Everybody knows that penguins live in Antarctica, however, very few are aware of the fact that they are not true penguins. "They are manchots, - wrote a famous French author, Anatole France, - and if manshots are called penguins, what is the name of genuine penguins?" Before scientists resolved their arguments on how to name Antarctic and Arctic penguins, the latter went extinct.

Arctic penguins belonged to the species of great auk of the alcid family. Sailors and whalehunters of the northern Atlantic called great auks 'penguins'. This bird had many other names too, which indicates that humans had known it since very old times. With white plumage on its breast and black plumage on its back, auks looked chubby and clumsy because of a thick layer of fat under the skin that was serving as a heat insulator. During summer, white spots appeared between their eyes, which turned into a wide white strip during winter.

When whale hunting shifted towards Antarctica, sailors discovered innumerable wingless, black and white birds walking upright. They were taken to be penguins, known earlier. Notwithstanding the fact that they are never called penguins in scientific texts, the name 'penguin' quickly came to be associated with these Antarctic birds all over the world. In the end of the 18th century, a French naturalist, Georges Buffon studied Captain James Cook's and naturalist George Foster's reports concerning their voyage in the southern seas. Having examined descriptions of Antarctic penguins, Buffon reached the conclusion that their similarity with great auks was only external: they, too, had undeveloped wings and were very similar in coloring.

Great auks spent most of their time in cool waters of the northern Atlantic, however, moved to land during the breeding season - in countless numbers, they gathered on rocky islands of the northern arctic, where there was a plenty of fish and almost no threat of predators. Because of their lack of the ability to fly, their clumsiness in moving around on land, and their unreserved gullibility towards humans, great auks were totally unprotected from new dangers. Humans were actively hunting auks already in the 8th century; the process, however, became increasingly large-scale during gold mining expeditions on Baffin Island. For numerous crews of big ships, great auks served as the main source for replenishing their food supplies. Sailors were hunting on land, where these birds, hoarded in large groups, met them without any suspicion. Capturing great auks was very easy as they had no recourse: sea shores were enclosed with high cliffs that auks could not climb or fly over.

This 'hunt' continued until great auks became extremely rare. Scientists included them in the list of protected birds; this, however, proved to be counter-effective. Stuffed auks and auk eggs came to attract increasing interest of museums and private collectors. By the early 19th century, great auks were surviving only on one of Iceland's remotest islands. This island, however, sank as a result of volcanic activity. Many birds were killed, while those that survived resettled on Eldey, an island that was easily accessible for humans. Sailors found the last surviving pair of auks in 1844. In attempts to capture them, they destroyed the last auk egg too. This is the story of the extinction of great auks - the 'lawful' holders of the title 'penguin'.

35. What is the relation between the first and the third paragraphs of the text?

- (a) The third paragraph justifies the question asked in the first paragraph.
- (b) The first and the third paragraphs present information related to two different questions concerning auks.
- (c) Information presented in the third paragraph shows that the question set in the first paragraph is not justified.
- (d) The first and the third paragraphs present characteristics of two different species of alcid family.

36. There are several different hypotheses about the etymology of the word 'Pinguinus'.

This word:

- I. Meant 'white head' in Welsh.
- II. Referred to short wings in English.
- III. Meant 'fat' in Latin.

Which of these possible meanings of the word is/are connected with the characteristics of the great auk?

- (a) Only I
- (b) Only II
- (c) Only I and III
- (d) I, II and III

37. Which of the following explains the fact that birds, presently known as penguins, are not called by this name in scientific texts?

- (a) Despite the similarities between penguins and great auks, scientists consider as decisive their different habitats – the North Pole and the South Pole.
- (b) Arctic penguins were discovered earlier than Antarctic penguins; this is why it was necessary to distinguish them.
- (c) Despite significant similarities in appearance between the great auk and Antarctic penguins, they belong to different bird families.
- (d) Scientists attempted to replace names given to these birds by sailors with Latin terms.

38. What was the important factor that accounts for two opposing tendencies: firstly propagation of Arctic penguins in countless numbers and secondly their extinction later?

- (a) their adaptation to secure environment and, as a result, inability to cope with new challenges
- (b) their specific anatomical features – clumsiness and a thick layer of fat under the skin
- (c) adaptation problems caused by the specific features of their range
- (d) multiplicity of predators and their vulnerability to various threats

39. According to the text, it can be affirmed that the main factor in the extinction of Arctic penguins was:

- (a) natural disasters
- (b) the inclusion of the great auk into the list of protected birds by scientists
- (c) the indifference of scientists to the cause of protecting rare bird species
- (d) unreasonable, consumerist attitude of humans towards nature

40. Nowadays, on the island of Eldey, there is a small memorial – a statue of a great auk. Which of the following **does not** indicate a plausible motive for its construction?

This memorial was built:

- (a) as a symbol of lost natural heritage.
- (b) as an indicator of the last habitat of Arctic penguins.
- (c) to attract tourists to the island.
- (d) to commemorate a natural disaster that took place on the island.

I

While working on the mathematical part of the test, take into consideration:

- Figures accompanying some of the questions do not reflect the sizes and proportions specified. Therefore, do not base your conclusions concerning lengths of segments and other magnitudes on the actual sizes and proportions on a Figure. Concentrate instead on the information given in the question;
- If nothing is mentioned in the question concerning a segment depicted in a Figure, then it should be assumed that this segment is a straight line or part of a straight line;
- For representing numbers, only the decimal system is used throughout the test.

Mathematical Notations and Formulae:

1. **0** is neither positive nor negative; **1** is not a prime number.

2. **Percentage:** $k\%$ of a is equal to $a \cdot \frac{k}{100}$.

3. **Powers:** $a^n = a \cdot a \cdot a \dots \cdot a$ (n -times);

$$a^n \cdot a^m = a^{n+m}$$

$$a^n : a^m = a^{n-m}$$

$$(a^n)^m = a^{n \cdot m}$$

4. **Proportion:** if $\frac{a}{b} = \frac{c}{d}$, then $ad = bc$.

5. **Velocity:** $\text{velocity} = \frac{\text{distance}}{\text{time}}$

6. **Arithmetic mean:**

$$\text{Mean of data} = \frac{\text{sum of data}}{\text{number of data}}$$

7. **Probability:** if probabilities of all elementary events are the same, then the **probability of a compound event** is equal to the number of all elementary events associated with this event divided by the total number of elementary events.

If nothing is stated to the contrary, it is always assumed that probabilities of all elementary events are the same.

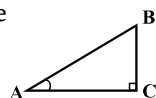
8. **Contracted multiplication formulae:**

$$(a + b)^2 = a^2 + 2ab + b^2 ;$$

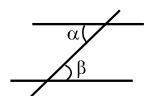
$$(a - b)^2 = a^2 - 2ab + b^2 ;$$

$$(a + b)(a - b) = a^2 - b^2 .$$

9. On a Figure, an angle can be marked with a small arc placed between the sides, a right angle - by a small square. $\angle A$ stands for the measure of the angle A .



10. **Parallel lines:** when two parallel lines are intersected by a third line, alternate angles are equal: $\alpha = \beta$.

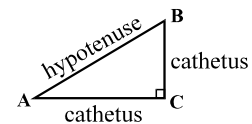


11. **Triangles:**

• The sum of measures of all angles of a triangle is equal to 180° .

• **Pythagorean Theorem:**

In any right triangle the square of the hypotenuse is equal to the sum of the squares of the catheti:



$$AB^2 = AC^2 + BC^2$$

• The area of a triangle is equal to the half of the product of one of its sides and the height to this side: $S = \frac{ah}{2}$.

12. **Quadrilaterals:**

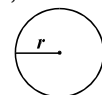
• The sum of measures of all angles of a quadrilateral is equal to 360° .

• The area of a rectangle is equal to the product of its length and its width: $S = a \cdot b$.

• The area of a parallelogram is equal to the product of its side and the height to this side: $S = a \cdot h$.

13. **Circle, circumference:**

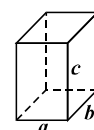
• The circumference of a circle is calculated using its radius by the formula: $L = 2\pi r$; the numerical value of π , with two decimal digit precision, is 3.14;



• The area of a circle with radius r is calculated by the formula: $S = \pi r^2$.

14. **Box (rectangular prism):**

• The volume of a box is equal to the product of its length, width and height: $V = a \cdot b \cdot c$;



• In the case of a cube $a = b = c$.

Quantitative Comparisons

Compare with each other the quantities given in columns A and B.

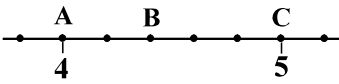
If the quantity in column A is greater than the quantity in column B, choose (a);

If the quantity in column B is greater than the quantity in column A, choose (b);

If the quantities in columns A and B are equal, choose (c);

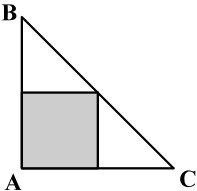
If the information provided is not sufficient to determine which of the quantities is greater, choose (d).

	<i>A</i>	<i>B</i>	
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41.	<p>Real numbers axis is divided into equal parts by points marked on it (see the figure). Coordinates of points A and C are indicated on the figure.</p>		(a) (b) (c) (d)
	the coordinate of B	$4\frac{2}{3}$	

42.	<p>a and b are positive numbers. x is 6 times greater than a, b is 2 times smaller than x.</p>		(a) (b) (c) (d)
	b	$3a$	

43.	<p>Let to each letter of the English alphabet correspond the number of its place in the alphabet. Then for each sequence of letters, there is a specific number corresponding to it. For example, to the sequence of letters 'nbad' corresponds the number 14214, since 'n' is the 14th letter in the English alphabet, 'b' – the 2nd, 'a' – the 1st, 'd' – the 4th.</p>		(a) (b) (c) (d)
	<p>the number of letters in the sequence, to which the number 1020 corresponds.</p>	3	

44.	<p>ABC is an isosceles right triangle. One of the vertices of a square inscribed in it coincides with A, while other vertices lie on sides of the triangle ABC.</p> 	(a) (b) (c) (d)
	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> <p>the ratio of the area of the inscribed square and the area of the triangle ABC</p> </div>	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> $\frac{1}{2}$ </div>

45.	<p>Vakhtang's and Gia's salaries were equal. In the end of the year, Vakhtang's salary was increased by 120%, while Gia's salary was doubled.</p>	(a) (b) (c) (d)
	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> <p>Vakhtang's salary after the increase of the wage</p> </div>	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> <p>Gia's salary after the increase of the wage</p> </div>

46.	<p>a and b are positive numbers such that $a + b > 1$.</p>	(a) (b) (c) (d)
	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> $a \cdot b$ </div>	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> 1 </div>

Problems

47. a is a natural number. Which of the following expressions has the greatest value?

- (a) $\frac{6}{a+1}$
- (b) $\frac{5}{a+2}$
- (c) $\frac{4}{a+3}$
- (d) $\frac{5}{a+4}$
- (e) $\frac{4}{a+5}$

48. If the sum of the areas of all faces of a cube is 24 cm^2 , then its volume is:

- (a) 8 cm^3
- (b) 10 cm^3
- (c) 16 cm^3
- (d) 24 cm^3
- (e) 40 cm^3

49. On the screen of a calculator, only those digits of a number for place values of units and tenths can be seen. After adding to 85 a natural number m , the screen displayed 43. Which of the following could have been m ?

- (a) 38
- (b) 42
- (c) 46
- (d) 58
- (e) 62

50. There are 3 girls in a room. Their average height is 1.4 m. A fourth girl, whose height is 1.8 m, enters the room. What is the average height of the girls in the room now?

- (a) 1.4 m
- (b) 1.5 m
- (c) 1.6 m
- (d) 1.7 m
- (e) 1.8 m

51. a , b and c are natural numbers. It is known that $2a + b$ is odd, while $a + 2c$ is even. Which of the following **cannot be** odd?

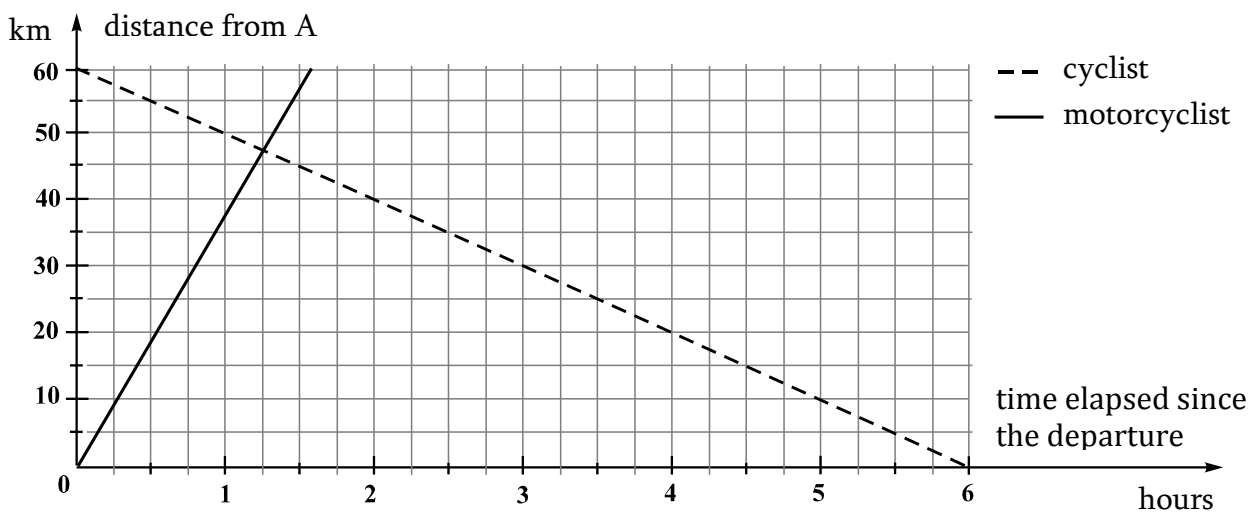
- (a) $a + b + c$
- (b) $b + c$
- (c) $a + c$
- (d) $2c + a + b$
- (e) $2c + a + 2b$

Data Analysis

Shalva is supposed to solve the following task:

The distance between *points A and B* is 60 km. Two tourists simultaneously departed from each of these points towards each other: one leaving point B on a bicycle, the other leaving point A on a motorcycle. Both tourists were moving without rest, the cyclist with a constant velocity of 10 km/h, and the motorcyclist – with a constant velocity of 40 km/h. How many hours would it take the tourists to meet each other?

Shalva constructed a graph to solve the task. He represented the relation between the distance of the tourists from the point A and the time elapsed since their departures.



52. Shalva represented one of the data incorrectly. Which of the following is represented incorrectly on the graph?

- (a) Distance between the point A and point B is 60 km.
- (b) The motorcyclist departed from the point A, and the cyclist departed from the point B.
- (c) The velocity of the motorcyclist was 40 km/h.
- (d) The velocity of the cyclist was 10 km/h.
- (e) Both the cyclist and the motorcyclist were moving without rest, each with a constant velocity.

53. According to the graph constructed by Shalva, the tourists met in:

- (a) 1 hour after they departed
- (b) 1 hour and 15 minutes after they departed
- (c) 1 hour and 30 minutes after they departed
- (d) 1 hour and 45 minutes after they departed
- (e) 2 hours after they departed

54. According to the graph constructed by Shalva, the distance between the tourists in 1 hour after their departures was:

- (a) longer than 5 km, but shorter than 10 km.
- (b) longer than 10 km, but shorter than 15 km.
- (c) longer than 15 km, but shorter than 20 km.
- (d) longer than 20 km, but shorter than 25 km.
- (e) longer than 25 km, but shorter than 30 km.

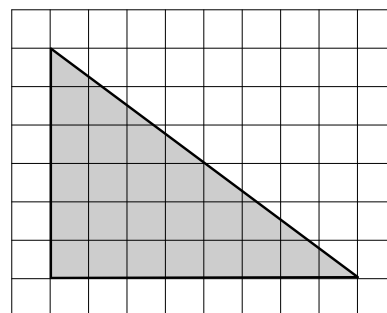
55. Which of the following pieces of reasoning is correct?

- (a) It will take the cyclist $60 : 10 = 6$ hours to reach point A, and it will take the motorcyclist $60 : 40 = 1.5$ hours to reach point B. Therefore, they will meet in $(6 + 1.5) : 2 = 3.75$ hours after their departures.
- (b) It will take the cyclist $60 : 10 = 6$ hours to reach point A, and it will take the motorcyclist $60 : 40 = 1.5$ hours to reach point B. Therefore, they will meet in $(6 - 1.5) : 2 = 2.25$ hours after their departures.
- (c) It will take the cyclist $60 : 10 = 6$ hours to reach point A, and it will take the motorcyclist $60 : 40 = 1.5$ hours to reach the point B. Therefore, they will meet in $6 - 1.5 = 4.5$ hours after their departures.
- (d) The tourists are approaching each other with a velocity of $10 + 40 = 50$ km/h. Both together have travelled $60 + 60 = 120$ km. Therefore, they will meet in $\frac{120}{50} = 2\frac{2}{5}$ hours after their departures.
- (e) The tourists are approaching each other with a velocity of $10 + 40 = 50$ km/h. Therefore, they will meet in $\frac{60}{50} = 1\frac{1}{5}$ hours after their departures.

Problems

56. All vertices of a triangle coincide with crossings of a grid all of the cells of which are squares (see the figure). The ratio of the shortest side of the triangle with its perimeter is:

- (a) $\frac{1}{4}$
- (b) $\frac{2}{5}$
- (c) $\frac{1}{3}$
- (d) $\frac{5}{8}$
- (e) $\frac{3}{10}$



57. The n^{th} term of the sequence is calculated by the formula: $x_n = \frac{4}{n} + 2$. What is the sum of the 4th and the 5th terms of this sequence?

- (a) $4\frac{1}{2}$
- (b) $5\frac{4}{5}$
- (c) 6
- (d) $6\frac{1}{3}$
- (e) 9

58. If 3 bottles of **different** volumes are filled with 3 liters of water, then:

- (a) Any pair of bottles contains more than 2 liters of water.
- (b) Each of the bottles contains less than 1 liter of water.
- (c) At least one pair of bottles contains more than 2 liters of water.
- (d) Any pair of bottles contains less than 2 liters of water.
- (e) At least one pair of bottles contains more than 1.5 liters of water.

59. Balls that were numbered from 1 through 6 were distributed in two boxes. Balls with numbers 1, 2, and 3 were placed in the first box, and the rest – in the second box. Now one ball is to be drawn from each of the boxes. What is the probability that the sum of the numbers of the drawn balls will be 7?

- (a) $\frac{1}{9}$
- (b) $\frac{1}{6}$
- (c) $\frac{7}{9}$
- (d) $\frac{1}{3}$
- (e) $\frac{2}{3}$

60. In a bakery 7 sacks of flour are used daily. Whenever there are less than 7 sacks of flour remaining in the bakery, 20 additional sacks are procured next morning, as soon as the bakery opens.

There were 8 sacks of flour on Monday evening by the end of the workday. How many sacks will be there on Saturday of the same week by the end of the workday?

- (a) 11
- (b) 12
- (c) 13
- (d) 14
- (e) 15

Quantitative Comparisons

Compare with each other the quantities given in columns A and B.

If the quantity in column A is greater than the quantity in column B, choose (a);

If the quantity in column B is greater than the quantity in column A, choose (b);

If the quantities in columns A and B are equal, choose (c);

If the information provided is not sufficient to determine which of the quantities is greater, choose (d).

	A	B	
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61.	$1 - \left(\frac{1}{8}\right)^5$	$1 - \left(\frac{1}{5}\right)^5$	(a) (b) (c) (d)
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62.	A triangle is drawn by connecting three points on a circle. One of the sides of the triangle is 9 cm in length.		(a) (b) (c) (d)
	the length of the radius of the	4cm	

63.	Temur's daily income is 45-50 GEL. He spends 15-20 GEL daily, saving the rest of his income. After having worked for m days in a row, Temur saved 130 GEL.		(a) (b) (c) (d)
	m	4	

64.	Consider the point A (-2; -1) on a coordinate plane. Let B be the point symmetrical to A with respect to the axis X, and C be the point symmetrical to A with respect to the axis Y.		(a) (b) (c) (d)
	the length of the segment AB	the length of the segment AC	

65.	k and n are natural numbers.		(a) (b) (c) (d)
	<i>the greatest common divisor of k and n</i>	<i>the greatest common divisor of k and $2n$</i>	

Problems

66. Givi traveled by train from Tbilisi to Poti for 8 hours and 30 minutes and arrived in Poti at 7:20 am. When did Givi's train depart from Tbilisi?

- (a) 00 :10
- (b) 23 : 50
- (c) 23 : 10
- (d) 22 : 50
- (e) 22 : 20

67. A rectangle is divided into two rectangles, one of which is a square. The area of the square is 3 times smaller than the area of the initial rectangle. How many times smaller is the perimeter of the square compared to the perimeter of the initial rectangle?



- (a) 1.5 times
- (b) 2 times
- (c) 2.5 times
- (d) 3 times
- (e) 3.5 times

68. Anna, Tina, and Nino bought fruit. Compared to Tina, Anna bought 4 kg less fruit, while Nino bought 3 times more fruit. Anna bought b kg of fruit. Which of the following expressions represents correctly how many kg of fruit the three of them bought together?

- (a) $3b + 4$
- (b) $3b + 12$
- (c) $5b + 8$
- (d) $5b + 12$
- (e) $5b + 16$

69. All vertices of a regular decagon lie on a circle with the center at the point O . AB is one of the sides of this decagon. What is the size of the angle OAB ?

- (a) 60°
- (b) 64°
- (c) 70°
- (d) 72°
- (e) 76°

70. There were some chocolates on a dish. Lia took one third of the chocolates, and then Gia took one third of the remaining chocolates. Eventually, 4 chocolates were left on the dish. How many chocolates were there on the dish initially?

- (a) 9
- (b) 12
- (c) 18
- (d) 27
- (e) 36

Data Sufficiency

71. Some members of a group of tourists speak only English, some members of the same group speak only German, and the remaining members speak both English and German.

Two conditions are given:

- I. 12 tourists speak English.
- II. 18 tourists speak German.

For determining what is the number of tourists speaking both languages:

- (a) Condition I is sufficient, Condition II – is not.
- (b) Condition II is sufficient, Condition I – is not.
- (c) Conditions I and II are sufficient jointly, while none of them is sufficient independently.
- (d) Both conditions are sufficient independently.
- (e) These conditions are not sufficient even jointly.

72. Some members of a group consisting of girls and boys attend dance classes. There are both boys and girls among dance class attendants.

Two conditions are given:

- I. One quarter of the boys attend dance classes.
- II. One quarter of the girls attend dance classes.

For determining what is the ratio of the group members attending dance classes:

- (a) Condition I is sufficient, Condition II – is not.
- (b) Condition II is sufficient, Condition I – is not.
- (c) Conditions I and II are sufficient jointly, while none of them is sufficient independently.
- (d) Both conditions are sufficient independently.
- (e) These conditions are not sufficient even jointly.

73. Area of a rectangle is 1000 m^2 .

Two conditions are given:

- I. One side of the rectangle is 2.5 times longer than the other side.
- II. One side of the rectangle is 20m long.

For determining what is the perimeter of the given rectangle:

- (a) Condition I is sufficient, Condition II – is not.
- (b) Condition II is sufficient, Condition I – is not.
- (c) Conditions I and II are sufficient jointly, while none of them is sufficient independently.
- (d) Both conditions are sufficient independently.
- (e) These conditions are not sufficient even jointly.

74. A sportswear store sells one type of cap, one type of T-shirt, and one type of jacket.

Two conditions are given:

- I. One jacket costs more than 4 T-shirts and 1 cap together.
- II. One jacket costs more than 2 T-shirts and 3 caps together.

For determining whether 2 jackets cost more than 8 T-shirts:

- (a) Condition I is sufficient, Condition II – is not.
- (b) Condition II is sufficient, Condition I – is not.
- (c) Conditions I and II are sufficient jointly, while none of them is sufficient independently.
- (d) Both conditions are sufficient independently.
- (e) These conditions are not sufficient even jointly.

75. b is a natural number.

Two conditions are given:

- I. If b is divided by 9, the remainder is 2.
- II. If b is divided by 3, the remainder is 2.

For determining what is the remainder of dividing b by 6:

- (a) Condition I is sufficient, Condition II – is not.
- (b) Condition II is sufficient, Condition I – is not.
- (c) Conditions I and II are sufficient jointly, while none of them is sufficient independently.
- (d) Both conditions are sufficient independently.
- (e) These conditions are not sufficient even jointly.

Problems

76. Half kg of butter costs 20% more than one kg of cheese. By how many percent is the price of one kg of butter greater than one kg of cheese?

- (a) 20%
- (b) 40%
- (c) 80%
- (d) 120%
- (e) 140%

77. $1.01 \cdot 10^5 =$

- (a) $10^2 + 10^3$
- (b) $10^2 + 10^4$
- (c) $10^3 + 10^5$
- (d) $10^3 + 10^4$
- (e) $10^4 + 10^5$

78. There are 8 blue, 8 red, 7 green and 6 white balloons in a box. One is to take several balloons simultaneously out of the box blindfolded. What is the **maximum** number of balloons one can take in order to be sure that at least one balloon of each color remains in the box?

- (a) 4
- (b) 5
- (c) 7
- (d) 11
- (e) 25

79. If $-5 < 3a + 7$, then:

- (a) $2a + 5 > -3$
- (b) $2a - 5 < -1$
- (c) $3a + 5 > 1$
- (d) $3a - 5 < 2$
- (e) $a > 8$

80. For two figures that have no common points, let us call the ratio of the largest and the smallest distances between their points the **relative distance** between them.

What is the **relative distance** between the two circles, each with a diameter of 4 cm, which lie in the same plane, if the distance between their centers is 8 cm?

- (a) 2
- (b) 2.5
- (c) 3
- (d) 3.5
- (e) 4