

Inside Reasoning Skills

Selected original pages from the English edition.

Complete sections, practice sets and explanations.

The original book layout and page numbers are retained.

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STUDY COMMUNITY

2.5 Common Traps and Misconceptions in Verbal Reasoning Questions

Distractors in the Verbal Reasoning Test are usually based on information that appears in the passage but is subtly altered. They may change one word, add an unsupported detail, broaden the scope of a statement or reverse the logical relationship between two pieces of information.

The correct method is not to look for the option that most resembles the passage, but to check whether every material element in an option is supported by it.

1. Almost equivalent wording

An option may use vocabulary similar to the passage but express a stronger or different meaning.

➡ Example

Passage: “The new system substantially reduced delays.”

Option: “The new system eliminated delays.”

“Reduced” means that delays became fewer, whereas “eliminated” means that they disappeared entirely. The option is incorrect even though it concerns the same topic and uses similar wording.

Likewise:

- “without significant changes” does not mean “without any changes”;
- “mainly” does not mean “exclusively”;
- “rarely” does not mean “never”;
- “to a large extent” does not mean “completely”.

Lexical similarity is not enough. The same logical force must be preserved.

2. Partly correct option

Some options contain one correct element and a second element that is incorrect or unsupported. The correct part acts as a lure and may prompt candidates to accept the whole statement too quickly.

➡ Example

Passage: “The programme increased public participation but did not reduce administrative costs.”

Option: “The programme increased public participation and reduced administrative costs.”

The first part is supported, but the second contradicts the passage. The option is therefore incorrect as a whole.

Every option must be checked to the final word. A single material inaccuracy is enough to reject it.

3. Unsupported addition

An option may repeat a correct fact and add a cause, purpose, method or result that the passage does not mention.

➡ Example

Passage: "The number of applications fell by 15% in 2025."

Option: "The number of applications fell by 15% in 2025 because fees increased."

The decrease is supported by the passage, but its cause is not stated. The option cannot be considered correct, even if the explanation appears plausible.

The additional information does not need to be demonstrably false. It is enough that it does not follow from the passage.

4. Omission of information that changes the meaning

Omitting a detail does not automatically make an option incorrect. An option may be less detailed and still remain fully consistent with the passage.

➡ Permissible omission

Passage: "In 2025, more than 80 theatres staged the author's works in highly popular productions."

Option: "Some theatres staged the author's works in 2025."

The option omits the precise number and the popularity of the productions, but it still follows from the passage.

An omission becomes problematic when it removes a critical limitation and thereby broadens the original meaning.

➡ Omission that changes the meaning

Passage: "The new system reduced delays only in services that had previously trained their staff."

Option: "The new system reduced delays in all services."

The option removes the limitation "only in services that had previously trained their staff" and extends the result to all services.

An omission is therefore not incorrect in itself. It becomes incorrect when it changes the scope or conditions of the original statement.

5. Change in scope, quantity or frequency

Information concerning part of a group may not be arbitrarily extended to the whole group. The same applies to quantities and frequency.

➡ Example of scope

Passage: "Some employees work remotely."

Option: "All employees work remotely."

"Some" does not permit the conclusion "all".

➡ Example of quantity

Passage: "At least 50 people participated in the programme."

Option: "Exactly 50 people participated in the programme."

"At least 50" allows any number equal to or greater than 50. It does not mean "exactly 50".

➡ Example of frequency

Passage: "Inspections are usually carried out twice a year."

Option: "Inspections are always carried out twice a year."

"Usually" allows exceptions, whereas "always" excludes them.

Pay particular attention to the following changes:

- "some" → "all";
- "most" → "all";
- "at least" → "exactly";
- "up to" → "by";
- "often" → "always";
- "rarely" → "never".

6. Reversal of a logical relationship or condition

A statement of the form "if A, then B" does not necessarily permit the converse conclusion "if B, then A".

➡ Example of reversal

Passage: "All projects that received funding had completed the administrative review."

The passage establishes:

- If a project received funding, it had completed the administrative review.
- It does not establish:
- If a project completed the administrative review, it received funding.
- Completion of the review may have been necessary without being sufficient in itself for funding.
- The same problem arises in statements containing "only if".

Chapter 3 – Verbal Reasoning Practice

Verbal Reasoning Test 1

QUESTION 1

Historical evidence shows that climatic changes have had a significant impact on the development of many societies. Prolonged droughts have been associated with crises in agrarian civilisations, while milder climatic periods have fostered economic growth in certain regions.

Today, climate change is attributed primarily to human activity. Its consequences affect not only the environment, but also migration, the economy and public health. However, not all societies are affected in the same way. Countries with strong infrastructure and advanced technology can adapt more easily, while other regions remain more vulnerable. Although technology can mitigate some effects, scientists believe that it is not sufficient on its own without international cooperation and emissions reductions.

Which of the following statements is supported by the passage?

- A. Technology can mitigate some effects of climate change, but scientists believe that international cooperation is also required if it is to be addressed effectively.
- B. Strong infrastructure and technology reduce the vulnerability of certain societies, suggesting that adaptive capacity can substantially limit the consequences even without a corresponding reduction in global emissions.
- C. The fact that societies are exposed differently to climatic changes shows that their effects depend more on adaptive capacity than on the intensity of the climatic change itself.
- D. Historical experience shows that technological progress has changed the way societies respond to climate, thereby reducing the present need for collective international action.

QUESTION 2

The transition to clean energy is now a central objective for advanced economies. Investment in solar and wind farms, together with rapid advances in battery technology, is creating new markets and jobs. However, this transition is not economically neutral. Traditional fossil-fuel industries, which employ millions of people, face losses of income and local economic decline.

Some countries are attempting to balance these effects through “just transition” programmes that retrain workers for new sectors. Nevertheless, inequalities between wealthy and poorer regions may widen, as investment tends to be concentrated in countries with already developed infrastructure.

The EU aims to achieve full climate neutrality by 2050, while China has committed to peak its carbon emissions by 2030 and reach net zero by 2060. Yet the transition is energy-intensive and depends on access to scarce raw materials such as lithium and cobalt. Demand for these metals has already triggered geopolitical competition, highlighting a new form of “green dependency”.

Which statement best captures the passage’s central reservation?

- A. The success of the energy transition depends not only on the development of clean technologies, but also on economies’ ability to secure stable access to the necessary raw materials.
- B. Just-transition programmes can limit losses in traditional industries, making social inequalities primarily a temporary rather than a structural problem.
- C. The concentration of green investment in economies with developed infrastructure suggests that the energy transition may reinforce existing inequalities, even if dependence on fossil fuels is reduced.
- D. The green transition may create new economic and geopolitical dependencies, even while helping to reduce emissions.

QUESTION 3

In 2023, South Korea recorded a significant increase in exports of technology products, with particularly strong growth in semiconductors and artificial intelligence. At the same time, the government invested in green-energy infrastructure and programmes for the digital transformation of small and medium-sized enterprises. This growth helped to reduce unemployment in major cities, but rural areas continued to experience economic difficulties and population decline.

The country also expanded its trade agreements with South-East Asian states in an effort to reduce its dependence on the Chinese market. According to economic analysts, this strategy strengthened the country’s international competitiveness, while also intensifying competition for access to critical raw materials used in microchip production.

Which action is explicitly presented as an attempt by South Korea to reduce its dependence on a particular market?

- A. The increase in technology exports was a key component of growth, while investment in digital and energy transformation mainly helped to spread the benefits to rural areas.
- B. Expanding trade agreements with South-East Asian states in order to reduce dependence on the Chinese market.
- C. Expanding trade agreements in South-East Asia strengthened international competitiveness while reducing the country’s dependence both on the Chinese market and on critical raw materials.

D. The country's economic strategy combined technological development with trade diversification, without ensuring that the economic benefits were distributed evenly between urban and rural areas.

QUESTION 4

In the modern world, people are exposed every day to more information than the brain can process. Social media, notifications and the continuous flow of news create a state of "cognitive overload". Research shows that constantly switching attention between multiple stimuli reduces working memory and the ability to concentrate.

Information overload also leads to psychological fatigue and anxiety. Many people feel that they are "drowning" in data without having time to evaluate it. Although technology promises better access to information, in practice it often contributes to misinformation because algorithms promote content that reinforces existing views. Psychologists recommend "digital detox" strategies, such as limiting screen time and reading sources selectively. The real challenge is not access to information, but the ability to distinguish what deserves our attention.

Which statement most fully expresses the passage's main conclusion?

- A. Continuous exposure to large volumes of information primarily impairs concentration when it requires frequent shifts of attention between different stimuli.
- B. Algorithms can facilitate content selection, but when they reinforce existing views they may make it more difficult to evaluate information meaningfully.
- C. The greatest challenge in the modern information environment is not access to information, but selecting and evaluating what deserves our attention.
- D. Digital-detox practices address part of the problem by reducing exposure to information, but they do not in themselves ensure a better assessment of its quality.

QUESTION 5

Advances in genomics have opened up new possibilities in personalised medicine. By analysing DNA, doctors can predict which medicines are likely to be most effective for each patient. This approach is already being used in cancer treatment, enabling more precise targeting and fewer side effects.

At the same time, major bioethical issues arise: who has access to genetic data? How can we ensure that such data are not used to discriminate in employment or insurance? Regulators are seeking a balance between innovation and the protection of personal data. Although costs are falling, inequalities in access persist. The technology is widely used in wealthy countries, whereas its use remains limited in developing regions. Experts argue that personalised medicine does not replace conventional methods, but complements them by offering more accurate diagnosis and more effective treatment.

Which statement follows from the passage?

- A. The increasing use of genetic data reinforces the need for protection against discrimination, which may slow the introduction of new treatments.
- B. Falling costs facilitate the spread of personalised medicine, but current differences in access appear to be linked mainly to countries' level of economic development.
- C. Greater diagnostic and therapeutic precision suggests that personalised medicine may gradually assume a more important role than some conventional approaches.
- D. Personalised medicine can improve patient treatment, but it also presents challenges concerning equitable access and the protection of genetic data.

QUESTION 6

Human memory does not work like a video recording that captures and reproduces events accurately. Instead, it is an active process in which experiences are reconstructed through selective retention, associations and reinterpretation. Neuroscientists have shown that whenever we remember something, the memory is activated and “rewritten”, influenced by new information and emotional states. This explains why eyewitness accounts often differ even when they concern the same event.

The hippocampus and prefrontal cortex contain the principal networks involved in the long-term storage of information. However, when we experience intense stress or fear, the release of cortisol can disrupt memory consolidation, leading to omissions or distortions. Certain techniques, such as repeated exposure to a narrative, can also strengthen the belief that an inaccurate memory is true—a phenomenon known as the “false-memory effect”.

Researchers are examining how these phenomena affect justice, education and everyday life. Although imaging technologies such as MRI and PET reveal the brain regions involved, the subjective nature of memory reminds us that truth is not always fixed, but is shaped through the lens of experience and interpretation.

Which statement best expresses the meaning of the passage?

- A. Human memory is a dynamic and reconstructive function influenced by emotions, stress and subsequent experiences.
- B. The reconstructive nature of memory explains why even powerful experiences may change during recall, without implying that every memory is equally unreliable.
- C. Repeated reinforcement of a narrative can increase a person's belief that a memory is true, regardless of its accuracy.
- D. Neuroimaging techniques can identify the networks involved in memory, but are not sufficient to determine whether the content of a specific memory is accurate.

QUESTION 7

Over the past century, humanity has shifted from a rural to a predominantly urban society. More than 56% of the world's population now lives in cities, a figure expected to reach 70% by 2050. This shift affects not only the economy, but also social relationships, health and psychological well-being.

Urbanisation has created opportunities for innovation, education and cultural exchange. However, it is also associated with increased anxiety, environmental pressure and social isolation. Studies show that residents of large cities experience higher levels of stress and weaker social cohesion than people living in smaller communities.

Population density, noise pollution and a lack of green spaces contribute to this phenomenon. At the same time, technology enables the creation of "smart cities" that use data to improve energy and traffic management, but their success depends on citizen participation. The urban environment can therefore become sustainable and humane only if technology is combined with social cohesion and justice.

Which statement is most fully supported by the passage?

- A. Smart cities can reduce some of the pressures associated with urbanisation, but their effectiveness also depends on non-technological factors.
- B. Urbanisation expands opportunities for development, but may also weaken psychological well-being and social ties.
- C. Population density, noise pollution and a lack of green spaces are important mechanisms through which urbanisation may affect psychological well-being.
- D. Urbanisation creates both economic opportunities and social pressures, but technological management of cities can offset much of the loss of social cohesion.

QUESTION 8

Microplastics—minute fragments of plastic measuring less than five millimetres—have been detected almost everywhere: in the air, in the oceans and even in human blood. They originate from tyre wear, clothing, cosmetics and the breakdown of larger pieces of plastic waste. Although visible only under a microscope, their effects are far-reaching. In marine ecosystems, microplastics absorb toxic substances and enter the food chain through fish and shellfish. By consuming these foods, people are exposed to substances that may affect the endocrine and immune systems. Researchers have found traces of microplastics even in remote parts of Antarctica, demonstrating that pollution knows no borders.

The solutions are not straightforward. Banning certain plastic products, such as single-use bags, is only a beginning. The development of biodegradable materials and changes in consumer habits are considered equally important. Scientists agree that tackling the problem requires international cooperation, since no country can solve it alone.

Which statement most fully expresses the passage's main conclusion?

- A. The presence of microplastics even in remote regions indicates that the sources and transmission mechanisms of plastic pollution extend beyond national borders.
- B. Replacing conventional plastics with biodegradable materials is one crucial intervention, but the passage suggests that changes in consumption and international policy are also required.
- C. The spread of microplastics highlights a global problem with environmental and potential biological effects, requiring changes in materials and consumption alongside international cooperation.
- D. International cooperation is necessary because the geographical spread of microplastics limits the effectiveness of an exclusively national response.

QUESTION 9

The seventeenth century was a period of profound scientific transformation. Copernican astronomy, Galileo's physics and Newton's laws overturned centuries of Aristotelian thought. For the first time, observation and experiment were placed above doctrine and authority. Scientists began to form communities and academies, such as the Royal Society in London, where the exchange of ideas promoted critical thought. This period was not peaceful. Many thinkers were persecuted for their ideas, while the Church sought to retain control over knowledge. Nevertheless, the Scientific Revolution laid the foundations of the modern scientific method and rationalism. Later discoveries in biology, chemistry and technology were built on this new spirit of inquiry and observation. Historians of science now stress that the Revolution was not a single event, but a long process that changed the way human beings understand nature and themselves.

Which statement most fully expresses the passage's main argument?

- A. The creation of scientific communities helped establish a new way of producing knowledge because the exchange of ideas reduced dependence on individual authorities.
- B. The significance of the Scientific Revolution lies more in the change it brought to methods of investigating nature than in individual discoveries in astronomy and physics.
- C. Conflict with traditional authorities contributed to the development of critical thought, but the formation of scientific communities was equally important in disseminating the new model of knowledge.
- D. The Scientific Revolution gradually established a new model of knowledge based on observation, experiment and the questioning of authority.

QUESTION 10

Groupthink is a psychological phenomenon in which members of a group pursue consensus at the expense of rational judgement. It occurs in political teams, boards of directors and even scientific

groups. When there is a strong desire for unanimity, members avoid expressing disagreement because they believe that doing so would disrupt unity.

The absence of opposing views leads to poor decisions because the group ignores alternatives or underestimates risks. Classic examples include the failed Bay of Pigs invasion and economic crises that could have been anticipated. Social psychologists recommend preventive mechanisms such as appointing a “devil’s advocate” and encouraging open expression.

Although technology facilitates collaboration, it does not eliminate groupthink. On the contrary, online groups often reinforce uniformity of opinion through algorithms that promote similar ideas. Genuine innovation therefore arises not from unanimity, but from the creative clash of ideas.

Which statement best describes the central mechanism of groupthink as presented in the passage?

- A. Online forms of collaboration can facilitate the exchange of ideas, but do not ensure a greater diversity of views when algorithms reinforce homogeneous content.
- B. An excessive pursuit of consensus can restrict critical thinking and lead to flawed collective decisions.
- C. The creative clash of ideas can help limit groupthink, provided that members feel able to disagree without threatening the group’s cohesion.
- D. Consensus becomes problematic when it suppresses disagreement, but appointing a “devil’s advocate” is sufficient to ensure that alternatives and risks are examined adequately.

The answer table for the Test appears on the following page.

Detailed Answers and EPSO Tips

Q.	Correct Answer	Why the Other Options Are Rejected	 EPSO Tip
1	A	B begins with a correct observation—strong infrastructure and technology facilitate adaptation—but goes beyond the passage by claiming that this can substantially limit the consequences even without a corresponding reduction in global emissions. The passage stresses that technology is not sufficient on its own without international cooperation and emissions reductions. C introduces an unsupported ranking by claiming that the effects depend <i>more</i> on adaptive capacity than on the intensity of climate change. D reverses the conclusion by diminishing the need for international action.	Beware of a small addition that changes the conclusion. A difficult distractor may begin with a true detail and add an unsupported relationship or comparison.
2	D	A is true but partial : it focuses on access to critical raw materials and does not capture the broader issue of social, economic and geopolitical dependencies. B makes an unjustified leap: just-transition programmes seek to limit losses, but the passage warns that regional inequalities may widen , not that they are merely temporary. C is also a true observation about inequality, but is narrower than D. D best captures the central reservation: the green transition may reduce emissions while creating new dependencies.	A true detail is not necessarily the best answer. When asked for the <i>central reservation</i> , select the option that incorporates the greatest part of the argument.
3	B	A links investment to the spread of benefits to rural areas, whereas the passage states that those areas continued to face economic difficulties and population decline. C is misleading: the agreements were intended to reduce dependence on the Chinese market, but competition for critical raw materials increased ; that dependency was not reduced. D is a plausible general synthesis, but does not answer the specific question, which asks which action was presented explicitly as an attempt to reduce dependence on a particular market .	Answer the precise question. A generally correct summary may be a distractor when the task asks for a specific purpose, cause or action.

Q.	Correct Answer	Why the Other Options Are Rejected	💡 EPSO Tip
4	C	A correctly describes one mechanism of cognitive overload—continuous shifts of attention—but not the overall conclusion. B captures a genuine point about algorithms and misinformation, but remains partial. D is also plausible: a digital detox may reduce exposure without guaranteeing better evaluation. However, the passage states explicitly that the key challenge is selecting and evaluating information , which C expresses most fully.	A “most complete conclusion” question may contain several true options. Look for the one that captures the central position rather than merely one mechanism or solution.
5	D	A begins with a genuine issue—the risk of discrimination—but adds that this may slow the introduction of treatments , which is not stated. B is a close distractor: the passage contrasts wealthy countries with developing regions, but does not establish that differences in access are primarily linked to economic level. C goes beyond the passage by predicting that personalised medicine may become more important than conventional approaches, whereas the passage says it complements them. D correctly combines the therapeutic benefits with the challenges of access and data protection.	Watch words such as “primarily”, “more” and “gradually”. They are not absolute, but may introduce an unsupported ranking or prediction.
6	A	B is a plausible inference consistent with the reconstructive nature of memory, but adds the claim that not all memories are equally unreliable, which is not the central conclusion. C is factually correct , since repeated exposure to a narrative can strengthen belief in an inaccurate memory, but it is only one specific phenomenon. D is a reasonable methodological inference concerning MRI and PET, but likewise does not summarise the passage. A captures the central mechanism: memory is dynamic and reconstructive and is influenced by later experiences, emotions and stress.	An option may be entirely true and still not be correct. In a question about overall meaning, choose the most comprehensive synthesis.

Q.	Correct Answer	Why the Other Options Are Rejected	💡 EPSO Tip
7	B	A is correct but narrower: it concerns smart cities and the need for non-technological factors. C is also supported, but describes specific environmental mechanisms affecting psychological well-being. D correctly combines economic opportunities and social pressures, but exaggerates by claiming that technological management can offset much of the loss of social cohesion. The passage requires a combination of technology, social cohesion and justice. B most fully captures the dual impact of urbanisation.	Beware of “correct but narrow” options. In EPSO tests, a distractor is often true but covers only one paragraph of the passage.
8	C	A is a correct partial inference: microplastics in remote regions indicate cross-border spread. B is also supported, but focuses on solutions—biodegradable materials, consumer change and international action—without fully capturing the nature and effects of the problem. D correctly explains why international cooperation is required, but is even narrower. C alone combines global reach + environmental and potential biological effects + multiple interventions + international cooperation .	Compare the scope of the options. When three statements are true, the correct answer may be the one that brings together the problem, its consequences and the response.
9	D	A correctly describes the role of scientific communities, but covers only one aspect of the change. B is a strong distractor because the passage does present the move towards observation and experiment as crucial; however, it limits the overall argument mainly to methodological change. C combines the questioning of authority with scientific communities, but still does not express the long-term transformation of the model of knowledge as fully as D . D summarises the core of the Scientific Revolution: the gradual establishment of a new model based on observation, experiment and the questioning of authority.	Do not select the most sophisticated partial interpretation. When asked for the main argument, assess which option best covers the passage’s entire line of reasoning.

Q.	Correct Answer	Why the Other Options Are Rejected	💡 EPSO Tip
10	B	A describes a modern condition that may reinforce uniformity, but not the central mechanism of groupthink. C describes a possible means of countering groupthink rather than the mechanism that creates it. D begins correctly—consensus becomes problematic when it suppresses disagreement—but goes beyond the passage by claiming that appointing a “devil’s advocate” is sufficient to ensure adequate consideration of alternatives and risks. B states the central mechanism precisely: the excessive pursuit of consensus suppresses critical thought and may produce flawed collective decisions.	Distinguish between a “mechanism”, a “consequence” and a “solution”. An option may be correct on the same subject yet answer a different question from the one asked.

4.5 Translating Word Problems into Mathematical Relationships

In Numerical Reasoning problems, the difficulty does not always lie in the calculations. It often lies in recognizing the mathematical relationship described in words. Candidates must identify which data are relevant, what quantity is required, which base is being used, and how the quantities are related.

◆ The Logic of Applied Reasoning

Each problem of this type is based on five stages:

1. **Identify what is required.** Determine exactly which quantity must be calculated and the unit in which it must be expressed.
2. **Record the data.** Separate the useful information from the descriptive or unnecessary details in the question.
3. **Identify the base and the constant relationship.** Determine the total to which a percentage applies, which quantity remains constant, and which quantities change.
4. **Translate the verbal relationship into a mathematical expression.** Choose the appropriate ratio, percentage, rate, equation, or proportional relationship.
5. **Calculate and check.** Confirm that the result has the correct unit, moves in the expected direction, and is of a reasonable order of magnitude.

The basic sequence is therefore:

Required quantity → Data → Relationship → Calculation → Check

◆ The Role of Keywords

Keywords form the “vocabulary” of mathematical relationships. They provide clues to the underlying relationship, but they are not mechanical rules. They must always be interpreted within the full context of the question.

Keyword	Mathematical meaning	Example and interpretation
twice as many, three times as many	multiplication by 2 or 3	“Class A has twice as many students as Class B.” If $B = x$, then $A = 2x$.
half, one third	division by 2 or 3	“Women account for one third of the workforce.” $\text{Women} = \text{Total} \div 3$.

Keyword	Mathematical meaning	Example and interpretation
increase/decrease by p%	$\times(1 \pm p/100)$	"A decrease of 20%" means New value = Old value $\times 0.8$.
percentage of the total, proportion	Subgroup = Total $\times$ Percentage	"30% of customers shop online" means $0.30 \times$ Total.
per 1,000/per person	division and scaling	"7 births per 1,000 inhabitants" means $(\text{Births} \div \text{Population}) \times 1,000$.
same rate/same output	for a fixed amount of work, more workers means less time: inverse proportion; for a fixed period, more machines means more output: direct proportion	"6 workers take 15 days; how long will 10 workers take?" $6 \times 15 = 10 \times x$.
constant relationship, in the same proportion	a ratio remains constant	"A : B = 2 : 3. If A = 10, then B = 15."
multiple/fraction of	a magnitude relationship involving multiplication or division	"A's speed is 1.5 times B's speed" means $v_A = 1.5v_B$.
per capita/per student/per worker	ratio to the relevant population	Expenditure per inhabitant = Total expenditure $\div$ Population.

Rule: A keyword is a clue, not proof in itself of which operation is required. The appropriate mathematical relationship depends on what is being compared, which base is used, and which quantity remains constant.

◆ Examples Focusing on Keywords

Example 1 – "Twice as many"

There are 60 children at a summer camp. The number of children who prefer hide-and-seek is twice the number who prefer going to the cinema. If every child chooses one of the two activities, how many prefer the cinema?

Analysis

The phrase *twice as many* indicates a ratio of 2:1.

Let cinema = x . Then hide-and-seek = $2x$, so the total is $3x$.

$$3x = 60 \Rightarrow x = 20$$

Answer: 20 children.

Caution: Do not simply subtract 40 from 60. Without setting up the relationship, you do not know which group each number represents.

Example 2 – “Increase by 25%, then decrease by 10%”

A product costs €80. Its price is increased by 25% and then reduced by 10%. What is the final price?

Calculation

$$80 \times 1.25 = 100$$

$$100 \times 0.90 = 90$$

Answer: €90.

Interpretation: The word *by* indicates a change relative to the relevant base. The order of the operations matters: successive percentage factors are multiplied, not added.

Trap: Do not calculate $25 - 10 = +15\%$. That is not valid because the two percentages are applied to different bases.

Example 3 – “Per 1,000 inhabitants”

A city has 240,000 inhabitants and records 1,920 births. How many births are there per 1,000 inhabitants?

Solution

$$(1,920 \div 240,000) \times 1,000 = 8\text{‰}$$

Answer: 8 births per 1,000 inhabitants.

Interpretation: The word *per* indicates conversion to a common unit—in this case, 1,000 inhabitants.

Trap: Do not multiply by 100. The symbol ‰ means “per thousand”, not percent.

Example 4 – “At the same rate” (inverse proportion)

Six workers complete a project in 15 days. How many days will 10 workers take if they all work at the same rate?

Calculation

$$t_2 = t_1 \times (w_1 \div w_2) = 15 \times (6 \div 10) = 9 \text{ days}$$

Answer: 9 days.

Interpretation: The phrase *at the same rate* means that the amount of work is fixed, so $\text{workers} \times \text{time} = \text{constant}$. The relationship is inverse: the more workers there are, the fewer days are required.

Trap: Do not try to keep the sum constant. It is the product that remains constant.

Example 5 – “Percentage of the total”

Of a company’s 1,200 employees, 25% are engineers, and 40% of those engineers are women. How many female engineers are there?

Solution

$$1,200 \times 0.25 \times 0.40 = 120$$

Answer: 120 female engineers.

Interpretation: The phrase *40% of the engineers* describes a “percentage of a percentage”, so the factors must be multiplied in sequence.

Trap: Adding 25% and 40% would produce an incorrect result. The percentages apply successively, not cumulatively.

Example 6 – “Per capita”

A country has a population of 250,000 and total energy consumption of 1.5 billion kWh. What is its per-capita energy consumption?

Solution

$$1,500,000,000 \div 250,000 = 6,000 \text{ kWh per person}$$

Answer: 6,000 kWh per inhabitant.

Interpretation: *Per capita* means dividing by the population—converting a total into an amount per person.

Trap: You must divide, not multiply.

Common Errors and Traps

Trap	What happens	Correction
Reversing ratios	Replacing “A to B” with “B to A” changes the mathematical relationship and usually the result.	Preserve the order used in the question: $A : B = A/B$, whereas $B : A = B/A$.

Trap	What happens	Correction
Confusing percentages with percentage points	A change between two percentages can be expressed either as a difference in percentage points or as a relative percentage change. These are not the same.	From 30% to 40% is an increase of 10 percentage points, but a relative increase of $(40-30)/30 \times 100 = 33.3\%$. From 30% to 33% is an increase of 3 percentage points, but a relative increase of 10%.
Omitting or confusing units	Quantities expressed in different units cannot be compared or combined correctly without conversion.	First convert the quantities into compatible units and check the unit of the final result.
Using the wrong direction of change	The wrong multiplier may be used, or the initial and final values may be reversed. A stated decrease can therefore produce a larger value, or an increase a smaller value.	Check that the direction agrees with the question: an increase should produce a larger final value and a decrease a smaller one, provided that the same quantity and base are being compared.
Adding successive or nested percentages	Percentages applied successively or to different bases cannot generally be added. For example, an increase of 25% followed by an increase of 40% is not an overall increase of 65%.	Use successive multipliers: $1.25 \times 1.40 = 1.75$, so the overall increase is 75%. Similarly, if 40% applies to a subgroup that accounts for 25% of the total, calculate 0.25×0.40 , not $25\% + 40\%$.
Mechanical use of keywords	A word such as <i>per</i> , <i>constant</i> , or <i>more</i> does not determine the required operation on its own.	Use keywords as clues, not automatic rules. First determine what is being compared and which quantity or relationship remains constant.
Failing to perform a reasonableness check	A numerically correct calculation may use the wrong data, unit, or relationship and produce an unrealistic result.	Perform a short final check: are the order of magnitude, unit, and direction of the result correct?

Quick Check

If your result seems implausible, it probably is. Common sense is the best validity check.

“The real power of mathematics lies not in performing calculations, but in recognizing the relationships that give rise to them.”

◆ EPSO Challenge

The following questions are deliberately more demanding than the Quick Practice exercises. The mathematical technique required is not specified. Your task is to translate the verbal information into mathematical relationships, identify the correct calculation base, and combine more than one step.

1

A department employs 1,200 staff. Of these, 35% work in Directorate A. Following a reorganisation, 20% of Directorate A's staff are transferred to Directorate B, while the total number of employees remains unchanged. What percentage of the total workforce still works in Directorate A?

- A. 28%
- B. 30%
- C. 27%
- D. 32%
- E. 35%

2

Four identical machines produce a total of 1,680 units in 7 hours. One machine is taken out of service. The three remaining machines continue to operate at the same output per machine per hour for 10 hours. How many units will be produced?

- A. 1,650
- B. 1,700
- C. 1,900
- D. 1,800
- E. 2,000

3

A region had a population of 480,000 and total annual expenditure of €1.44 billion. In the following year, its population increased by 5%, while total expenditure increased by 10%. By approximately what percentage did expenditure per capita increase?

- A. 10.0%
- B. 5.0%
- C. 4.8%

D. 15.5%

E. 2.5%

4

In a training programme, the ratio of participants from the public sector to those from the private sector is 3:2. Another 40 private-sector participants then enrol, while the number of public-sector participants remains unchanged. The new ratio of public-sector to private-sector participants is 3:4. How many participants were there in total initially?

A. 80

B. 120

C. 150

D. 90

E. 100

5

A company offers two subscription plans. Sixty per cent of its customers have the basic plan and the remainder have the premium plan. The monthly price is €20 for the basic plan and €35 for the premium plan. Following a price change, the basic plan rises by 10%, while the premium plan falls by 20%. The number and distribution of customers remain unchanged. How does the company's total monthly revenue change?

A. It decreases by approximately 6.2%.

B. It increases by approximately 2.3%.

C. It decreases by 10%.

D. It remains unchanged.

E. It increases by 5%.

6

A city recorded 2,400 births in a population of 300,000. In the following year, the number of births fell by 10%, while the population fell by 4%. What is the new approximate number of births per 1,000 inhabitants?

A. 8.0

B. 7.0

C. 7.2

D. 8.3

E. 7.5

◆ Detailed Answers

1. Correct answer: A — 28%

Initially, 35% of the total workforce works in Directorate A. Twenty per cent of this group is transferred, so 80% of the original Directorate A workforce remains.

$$35\% \times 80\% = 28\%$$

Alternatively:

$$1,200 \times 0.35 = 420$$

$$\text{Transferred: } 420 \times 0.20 = 84$$

$$\text{Remaining: } 420 - 84 = 336$$

$$(336 \div 1,200) \times 100 = 28\%$$

EPSO Tip: The 20% does not apply to the entire workforce. It applies only to the 35% originally assigned to Directorate A. Always identify the base of each percentage.

2. Correct answer: D — 1,800

Four machines produce 1,680 units in 7 hours. Output per machine per hour is:

$$1,680 \div (4 \times 7) = 60$$

After the breakdown, three machines operate for 10 hours:

$$3 \times 10 \times 60 = 1,800 \text{ units}$$

EPSO Tip: Two factors change simultaneously: the number of machines and the operating time. Do not apply only the ratio $\frac{3}{4}$ to the original output and overlook the increase from 7 to 10 hours.

3. Correct answer: C — approximately 4.8%

There is no need to calculate the actual expenditure per capita first.

$$\text{Expenditure per capita} = \text{Total expenditure} \div \text{Population}$$

Expenditure becomes 1.10 times its original level, while the population becomes 1.05 times its original level. The new ratio relative to the old ratio is therefore:

$$1.10 \div 1.05 = 1.0476\ldots$$

Therefore, the increase is:

$$+4.76\% \approx +4.8\%$$

EPSO Tip: If both the numerator and denominator of an indicator change, do not simply subtract the two percentage changes. Examine the change in the ratio itself.

4. Correct answer: E — 100

Initially, the ratio of public-sector to private-sector participants is 3:2.

Let public-sector participants = $3x$ and private-sector participants = $2x$.

Forty participants are added only to the private-sector group, and the new ratio is 3:4:

$$3x \div (2x + 40) = 3 \div 4$$

Cross-multiplying:

$$12x = 6x + 120$$

$$6x = 120$$

$$x = 20$$

The initial total was:

$$3x + 2x = 5x = 5 \times 20 = 100$$

EPSO Tip: In problems where a ratio changes because a quantity is added to or removed from only one group, first identify which quantity remains constant.

5. Correct answer: A — a decrease of approximately 6.2%

For convenience, assume that the company has 100 customers.

Basic plan: 60 customers

Premium plan: 40 customers

Initial monthly revenue from the basic plan:

$$60 \times \text{€}20 = \text{€}1,200$$

Initial monthly revenue from the premium plan:

$$40 \times \text{€}35 = \text{€}1,400$$

Total initial revenue:

$$\text{€}1,200 + \text{€}1,400 = \text{€}2,600$$

New basic-plan price after the 10% increase:

$$\text{€}20 \times 1.10 = \text{€}22$$

New premium-plan price after the 20% decrease:

$$€35 \times 0.80 = €28$$

New basic-plan revenue:

$$60 \times €22 = €1,320$$

New premium-plan revenue:

$$40 \times €28 = €1,120$$

Total new revenue:

$$€1,320 + €1,120 = €2,440$$

Change:

$$€2,440 - €2,600 = -€160$$

Percentage change:

$$(-160 \div 2,600) \times 100 \approx -6.15\%$$

The company's total monthly revenue therefore decreases by approximately 6.2%.

EPSO Tip: You cannot combine +10% and -20% directly because they apply to different prices and different customer groups. The weighting of each category must be taken into account.

6. Correct answer: E — 7.5 per 1,000 inhabitants

After the 10% fall, the number of births is:

$$2,400 \times 0.90 = 2,160 \text{ births}$$

After the 4% fall, the population is:

$$300,000 \times 0.96 = 288,000 \text{ inhabitants}$$

The new birth rate per 1,000 inhabitants is:

$$(2,160 \div 288,000) \times 1,000 = 7.5$$

Answer: 7.5 births per 1,000 inhabitants.

EPSO Tip: A 10% decrease in the number of births does not mean that births per 1,000 inhabitants also fall by 10%, because the population changes at the same time.

Success in numerical word problems depends primarily on correctly identifying their mathematical structure. Before carrying out any calculation, determine what is required, the base of each percentage, which quantities change, and which relationship remains constant. Then convert the wording into a clear

mathematical expression and check whether the result has the correct unit, direction, and order of magnitude.

The fundamental rule is:

Do not start with the numbers. Start with the relationship described in the question.

4.6 Data Interpretation

Data interpretation is the ability to read a table, chart, or graph correctly, identify the information relevant to the question, and turn it into a valid numerical conclusion. The difficulty does not always lie in the calculations. It often lies in selecting the correct row, column, time period, category, or unit of measurement.

A correct calculation based on the wrong data will inevitably lead to the wrong answer. Before carrying out any calculation, candidates must therefore check what the data show, which quantity is required, and exactly which figures are needed.

The basic process is:

1. **Check the title and source.** What exactly is being presented?
2. **Check the units and scale.** Are the figures expressed in units, thousands, millions, percentages, or index values?
3. **Identify the category and period.** Which country, company, group, or year does the question concern?
4. **Identify what is required.** Is the question asking for an absolute value, difference, percentage, change, share, average, or indicator?
5. **Select the necessary data.** Use only the rows and columns required.
6. **Calculate and check.** Confirm the unit, direction, and order of magnitude of the result.

The fundamental rule is:

Read the question first; then look for the data you need.

◆ The Correct Reading Method

Effective data-interpretation problem solving requires structured reading before calculation. Speed is important, but it is of no value if the candidate selects the wrong row, time period, or unit. A consistent reading process reduces such errors and makes it possible to process even dense tables and charts more quickly.

First, check the title and units. Are the values expressed in units, thousands, or millions? Do they represent euros, percentages, tonnes, or numbers of people? Next, identify the categories and time period referred to in the question. A table may contain several countries, years, and variables, although only two specific figures are needed to answer the question.

Then determine exactly what is being compared and which quantity is required. If a chart shows exports for five countries, the question may ask for the highest absolute value, the largest absolute increase, the largest percentage increase, or the change in one country's share. These are different requirements and may therefore call for different data and different mathematical relationships.

Once the relevant figures have been identified, perform only the calculation required. Where the answer options allow it, a reliable estimate can save time. Finally, check whether the result is consistent with the data: does it have the correct unit, is it of a reasonable order of magnitude, and does the direction of change agree with the table or chart?

EPSO Pitfall: The most common problem is not a difficult arithmetic operation, but applying the correct operation to the wrong data.

◆ Examples and Interpretations

Consider the following table:

Country	GDP (€ billions)
Greece	190
Italy	1,700
Spain	1,200
Portugal	250

The table shows the economies of four countries: Greece, 190; Italy, 1,700; Spain, 1,200; and Portugal, 250 billion euros. If the question asks, "What percentage of total GDP does Greece represent?", first calculate the total:

$$190 + 1,700 + 1,200 + 250 = 3,340$$

Then calculate Greece's share:

$$(190 \div 3,340) \times 100 \approx 5.7\%$$

The required relationship is part to whole, and the phrase *of total GDP* points to the correct calculation.

When asked for one category's share of a total, first identify the relevant total and then divide the category value by that total.

In a second example, suppose a company’s sales rose from €480 million to €600 million. If the question asks for the percentage increase, first find the difference:

$$600 - 480 = 120$$

Then compare it with the original value:

$$(120 \div 480) \times 100 = 25\%$$

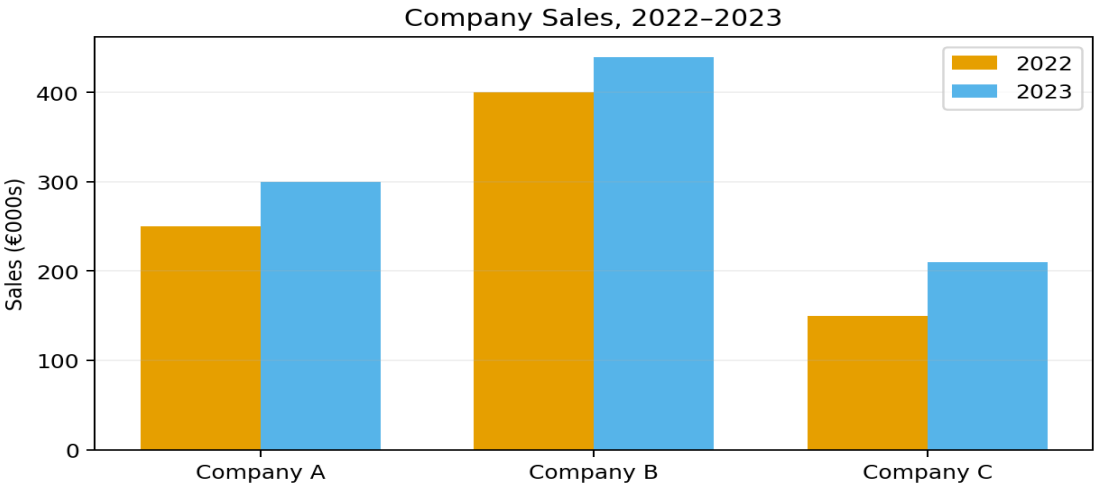
The phrase *percentage increase* calls for the relative-change formula.

In practice, questions become more complex not because of the calculations, but because of the amount of information. A table with many columns may provide data for different years, countries, and indicators. Success then depends on concentration: read the question to the end and identify the exact row you need. A phrase such as *in 2023* or *in Spain* may completely change the answer.

EPSO Tip: Do not rely solely on the visual impression created by a chart. Check the scale, units, and actual numerical values before drawing a conclusion.

The following five applications use different forms of data display: a bar chart, pie chart, line chart, histogram, and cumulative-frequency graph. The aim is not to perform complicated calculations, but to practise reading each form correctly, selecting the appropriate figures, and identifying the mathematical relationship required.

◆ Bar Chart – Company Sales (€000s)



Company Sales, 2022–2023

Company Sales, 2022–2023

Which company recorded the largest percentage increase from 2022 to 2023?

- A. Company A
- B. Company B

- C. Company C
- D. All recorded the same increase

ANSWER

The chart presents sales for Companies A, B, and C in 2022 and 2023, expressed in thousands of euros. Company A’s sales rose from €250,000 to €300,000, an increase of €50,000 or 20%. Company B’s sales rose from €400,000 to €440,000, an increase of €40,000 or 10%. Company C’s sales rose from €150,000 to €210,000, an increase of €60,000 or 40%. Although Company B still had the highest total sales in 2023, Company C recorded both the largest absolute increase and the largest percentage increase.

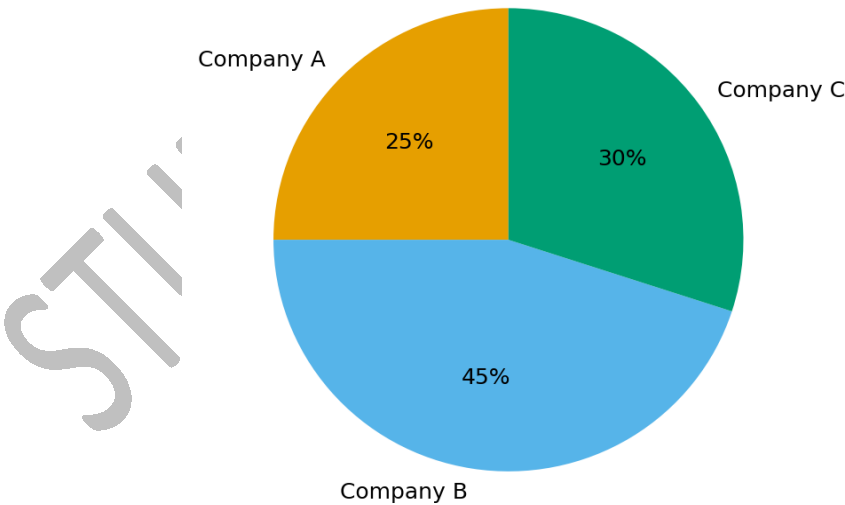
Percentage increase = ((2023 value – 2022 value) ÷ 2022 value) × 100

Company	2022	2023	Increase (€000s)	Increase (%)
A	250	300	+50	20%
B	400	440	+40	10%
C	150	210	+60	40%

Correct answer: C. Company C

◆ Pie Chart – Market Share, 2024

Market Share, 2024



Market Share, 2024

Market Share, 2024

If total sales are €200 million, how many million euros correspond to Company C?

- A. 45
- B. 50
- C. 55
- D. 60

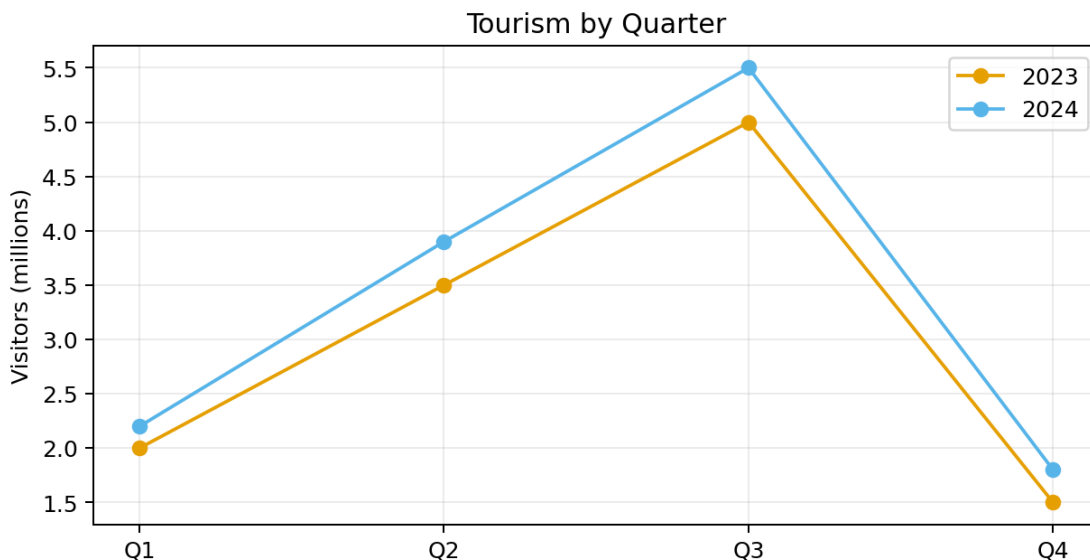
ANSWER

The pie chart shows the distribution of market share in 2024 among Companies A, B, and C. Company B has the largest share, at 45%, followed by Company C at 30%. Company A has the smallest share, at 25%. Company B therefore controls almost half of the market and leads Company C by 15 percentage points and Company A by 20 percentage points.

$$\text{Company C's sales} = 30\% \times 200 = (30 \div 100) \times 200 = \text{€60 million}$$

Correct answer: D. 60

◆ Line Chart – Tourism by Quarter (Millions of Visitors)



Tourism by Quarter

Tourism by Quarter

Which year recorded more visitors in total, and by how many?

- A. 2023, by 0.8 million
- B. 2024, by 0.8 million
- C. 2024, by 1.0 million
- D. 2024, by 1.4 million

ANSWER

The chart shows tourist visitors by quarter in 2023 and 2024. In 2023, visitor numbers rose from 2.0 million in Q1 to 3.5 million in Q2 and peaked at 5.0 million in Q3, before falling sharply to 1.5 million in Q4. In 2024, they rose from 2.2 million in Q1 to 3.9 million in Q2 and reached 5.5 million in Q3, before declining to 1.8 million in Q4.

Overall, 2024 recorded more visitors in every quarter. Both years also display the same seasonal pattern, with a peak in Q3 and a pronounced fall in Q4.

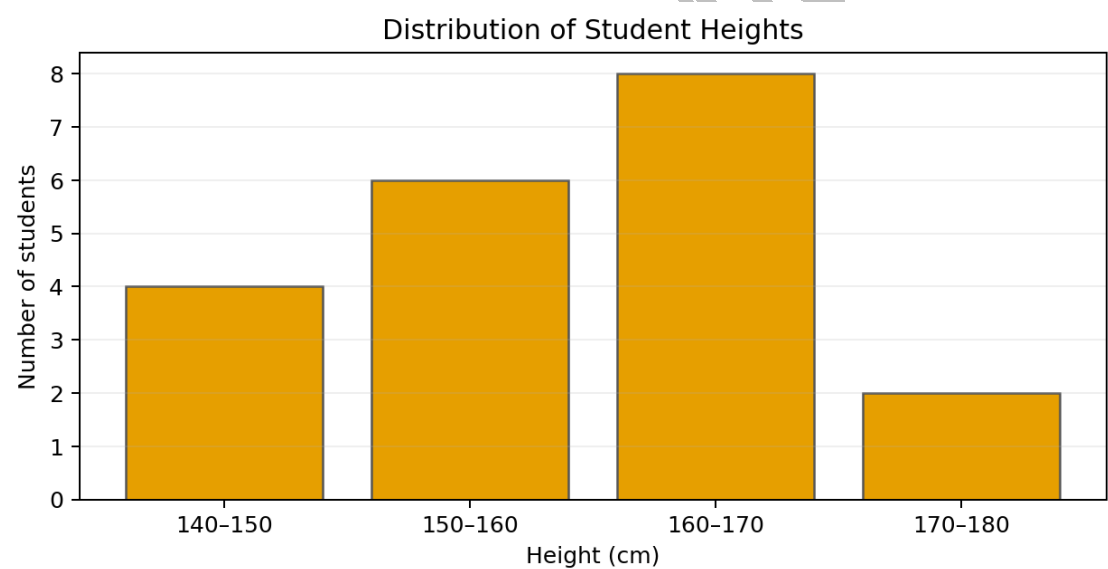
2023: $2.0 + 3.5 + 5.0 + 1.5 = 12.0$ million

2024: $2.2 + 3.9 + 5.5 + 1.8 = 13.4$ million

Difference: $13.4 - 12.0 = 1.4$ million

Correct answer: D. 2024, by 1.4 million visitors

◆ Histogram – Student Heights (cm)



Distribution of Student Heights

Distribution of Student Heights

How many students are less than 170 cm tall?

- A. 10
- B. 12
- C. 14
- D. 18

ANSWER

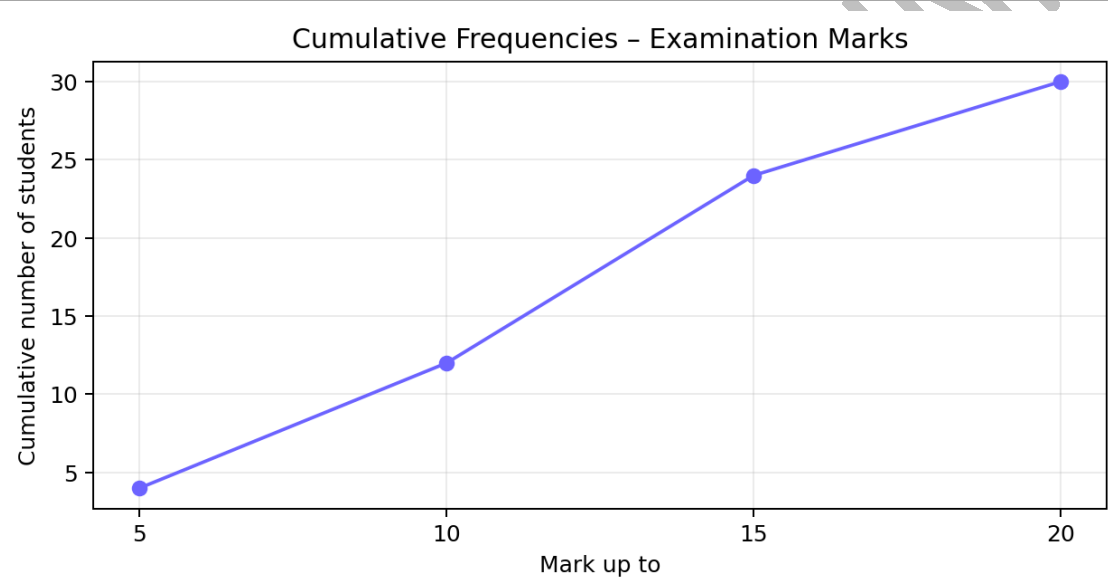
The histogram shows the distribution of students across height intervals. Four students are between 140 and 150 cm tall, six are between 150 and 160 cm, eight are between 160 and 170 cm, and two are between 170 and 180 cm. The most common interval is therefore 160–170 cm, while 170–180 cm has the lowest frequency.

To find the number below 170 cm, add the frequencies of the first three groups:

$4 + 6 + 8 = 18$ students

Correct answer: D. 18 students

◆ Cumulative Frequencies – Examination Marks



Cumulative Frequencies – Examination Marks

Cumulative Frequencies – Examination Marks

How many students have a mark between 10 and 15?

- A. 8
- B. 10
- C. 12
- D. 14

ANSWER

The graph presents the cumulative frequencies of examination marks for 30 students. The horizontal axis shows marks up to a given threshold, while the vertical axis shows the total number of students

whose mark is no higher than that threshold. Four students have a mark up to 5, 12 up to 10, 24 up to 15, and all 30 up to 20.

To find how many students have a mark between 10 and 15, subtract the cumulative frequencies:

$$24 - 12 = 12$$

Correct answer: C. 12

◆ Common Errors and How to Avoid Them

Most candidates do not fail because of the calculations, but because of how they read the data. They overlook units, such as thousands rather than millions; confuse rows for different years; or add percentages belonging to different categories. Others calculate changes without using the original value as the base or compare percentages without considering the size of the underlying total.

Always check the title and axis units. If the data are shown *in € millions*, the values represent millions, not individual euros. If a chart displays *percentage share*, all categories should add up to 100%. Careful reading before calculation saves both time and errors.

◆ The Art of Estimation

Many questions do not require an exact calculation immediately. A quick mental estimate can help identify the correct answer or eliminate incorrect options. If a share is about one fifth of the total, you know it is close to 20%. If a value rises from about 100 to 150, you can immediately estimate that the increase is close to 50%. Similarly, an option far outside the expected order of magnitude can often be eliminated without a full calculation.

Estimation does not always replace exact calculation. It is a tool for speed, checking, and eliminating answer options—especially when time is limited.

Effective data interpretation follows a disciplined sequence: check the title and units, identify what is required, select the relevant figures, apply the correct relationship, and perform a final check. The aim is not to process every item of data shown, but to identify quickly what is needed for the specific question.

Key rule: Do not calculate until you are certain that you are using the correct data.

■ Mini Test

Time allowed: 18–20 minutes

Objective: To test your ability to read, select, and interpret numerical information from tables and charts.

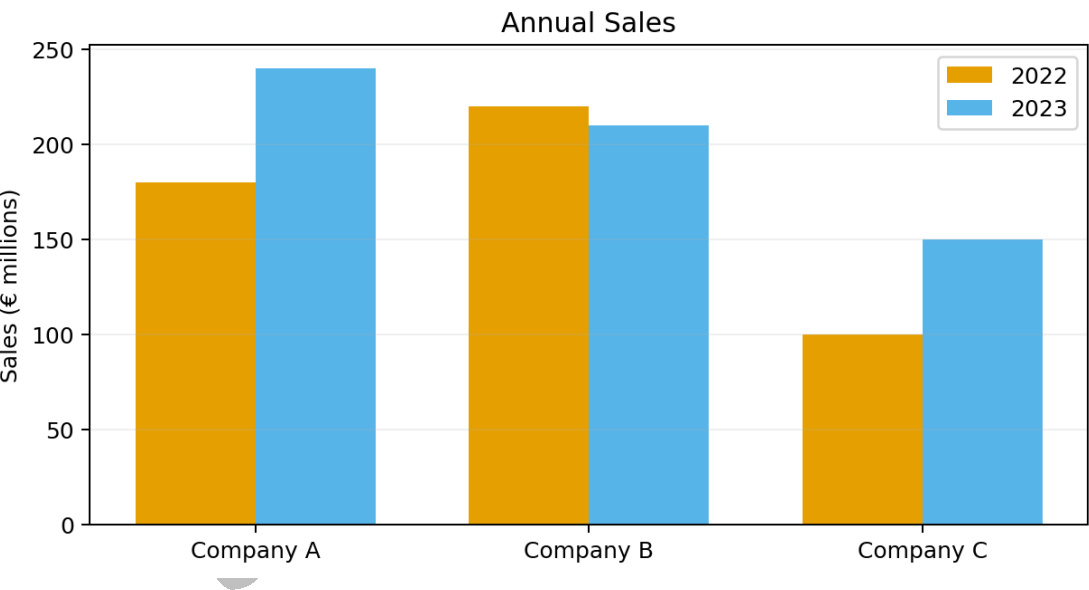
◆ 1. Country Economic Data

Country	GDP (€ billions)	Population (millions)
Spain	1,200	47
Portugal	250	10
Greece	190	11
Italy	1,700	60

Approximately how much higher is Italy’s GDP per capita than Greece’s GDP per capita?

- A. 39%
- B. 52%
- C. 64%
- D. 78%

◆ 2. Annual Sales (€ millions)



Annual Sales

Annual Sales

By how many percentage points does the percentage change in Company C’s sales exceed the corresponding percentage change in Company A’s sales from 2022 to 2023?

- A. 12.5 percentage points
- B. 16.7 percentage points

- C. 20.0 percentage points
- D. 25.0 percentage points

◆ 3. Population Data (Thousands)

Region	Population	Births
A	80	640
B	120	960
C	100	800

Which region has the highest birth rate per 1,000 inhabitants?

- A. A
- B. B
- C. C
- D. The rate is the same in all three

◆ 4. Imports and Exports (€ billions)

Country	Exports	Imports
Greece	40	55
Italy	480	420
Spain	350	370

Which country has the largest trade deficit as a percentage of the combined value of its imports and exports?

- A. Greece
- B. Italy
- C. Spain
- D. Greece and Spain have the same percentage deficit

◆ 5. Output of Three Factories (Thousands of Units)

Year	Factory A	Factory B	Factory C
2022	240	180	300
2023	260	210	310

Which factory recorded the largest percentage increase in output from 2022 to 2023?

- A. A
- B. B

- C. C
- D. All recorded the same increase

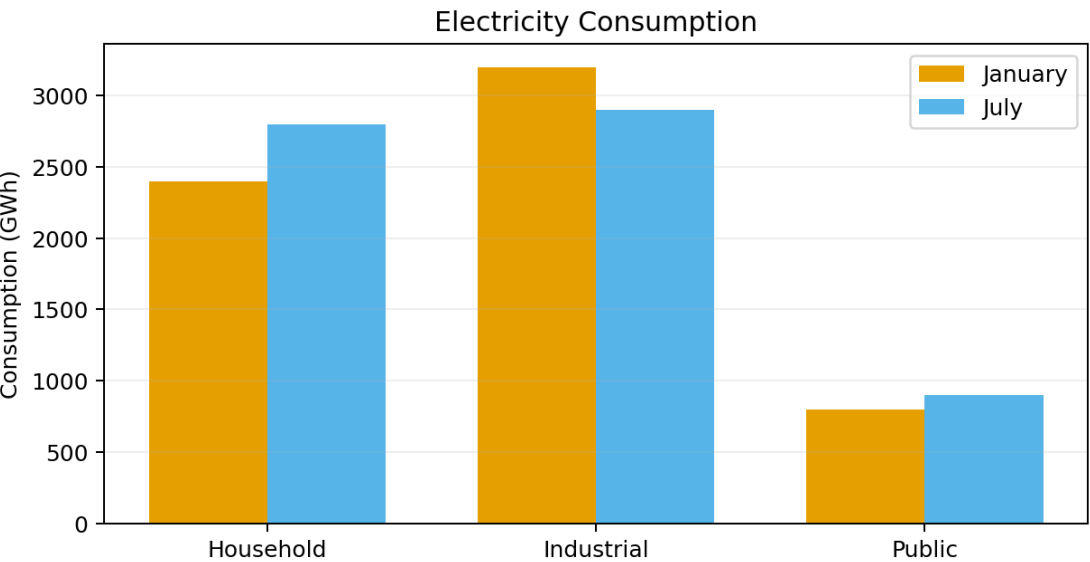
◆ 6. Sales by Product Category (€000s)

Product	Sales 2023	Sales 2024
A	500	550
B	700	630
C	300	390

If total sales of the three products represent 100% of sales in each year, which product recorded the largest increase in its share of total sales from 2023 to 2024?

- A. A
- B. B
- C. C
- D. It cannot be calculated

◆ 7. Electricity Consumption (GWh)



Electricity Consumption

Electricity Consumption

If the three categories represent 100% of consumption in each month, which category recorded the largest change, in percentage points, in its share of total consumption between January and July?

- A. Household
- B. Industrial

- C. Public
- D. All recorded the same change

◆ 8. Departmental Efficiency

Department	Units Produced	Employees
A	4,800	120
B	3,000	75
C	2,400	60

If Department B increases its output per employee by 15%, while the number of employees remains unchanged, how many additional units will it produce?

- A. 300 units
- B. 375 units
- C. 450 units
- D. 600 units

◆ 9. Market Distribution (Share %)

Company	2022	2023
A	35	40
B	45	42
C	20	18

By what percentage did Company A’s market share increase from 2022 to 2023?

- A. 5%
- B. 12.5%
- C. 14.3%
- D. 17.5%

◆ 10. Tourism Statistics (Millions of Visitors)

Country	2022	2023
Greece	28	31
Spain	75	80
Italy	65	68

If tourist numbers in 2024 increased in each country at the same rate as from 2022 to 2023, which country would be expected to record the largest absolute increase between 2023 and 2024?

- A. Greece
- B. Spain
- C. Italy
- D. The increase would be the same

■ Answers and Explanations

◆ 1. Correct answer: C. 64%

Italy: €1,700 billion ÷ 60 million ≈ €28,333 per inhabitant

Greece: €190 billion ÷ 11 million ≈ €17,273 per inhabitant

Percentage difference relative to Greece:

$$((28,333 - 17,273) \div 17,273) \times 100 \approx 64\%$$

◆ 2. Correct answer: B. 16.7 percentage points

Company A: $((240 - 180) \div 180) \times 100 = 33.33\%$

Company C: $((150 - 100) \div 100) \times 100 = 50\%$

Difference: $50\% - 33.33\% = 16.67$ percentage points

◆ 3. Correct answer: D. The rate is the same in all three

Rate per 1,000 = Births ÷ Population × 1,000

A: $640 \div 80,000 \times 1,000 = 8\text{‰}$

B: $960 \div 120,000 \times 1,000 = 8\text{‰}$

C: $800 \div 100,000 \times 1,000 = 8\text{‰}$

◆ 4. Correct answer: A. Greece

Greece: deficit = $55 - 40 = 15$; $15 \div (55 + 40) \times 100 \approx 15.79\%$

Spain: deficit = $370 - 350 = 20$; $20 \div (370 + 350) \times 100 \approx 2.78\%$

Italy has a trade surplus, not a deficit.

◆ 5. Correct answer: B. Factory B

A: $(260 - 240) \div 240 \times 100 = 8.33\%$

B: $(210 - 180) \div 180 \times 100 = 16.67\%$

C: $(310 - 300) \div 300 \times 100 = 3.33\%$

◆ 6. Correct answer: C. Product C

Total 2023: $500 + 700 + 300 = 1,500$

Total 2024: $550 + 630 + 390 = 1,570$

Product	Share 2023	Share 2024	Change
A	33.33%	35.03%	+1.70 percentage points
B	46.67%	40.13%	-6.54 percentage points
C	20.00%	24.84%	+4.84 percentage points

◆ 7. Correct answer: B. Industrial

January total: $2,400 + 3,200 + 800 = 6,400$ GWh

July total: $2,800 + 2,900 + 900 = 6,600$ GWh

Category	January	July	Change
Household	37.50%	42.42%	+4.92 percentage points
Industrial	50.00%	43.94%	-6.06 percentage points
Public	12.50%	13.64%	+1.14 percentage points

The industrial category records the largest change in absolute percentage-point terms.

◆ 8. Correct answer: C. 450 units

Current productivity in Department B:

$3,000 \div 75 = 40$ units per employee

After a 15% increase:

$40 \times 1.15 = 46$ units per employee

New output:

$46 \times 75 = 3,450$ units

Additional output:

$3,450 - 3,000 = 450$ units

◆ 9. Correct answer: C. 14.3%

$((40 - 35) \div 35) \times 100 = 14.28\%$

This is the classic percentage-points versus percentage-change trap:

- The market share increased by 5 percentage points.
- The percentage increase in the market share was 14.3%.

◆ 10. Correct answer: B. Spain

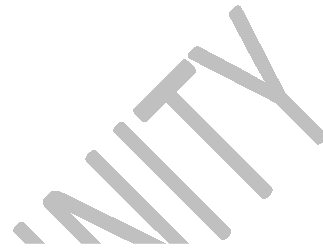
First calculate the growth rate and then apply it to the 2023 base:

Greece: $31 \times (3 \div 28) = 3.32$ million

Spain: $80 \times (5 \div 75) = 5.33$ million

Italy: $68 \times (3 \div 65) = 3.14$ million

Spain would therefore record the largest absolute increase.



Chapter 5 – Numerical Reasoning Practice Sets

EXERCISE SET 1: Basic Exercises in Estimating Partial and Total Amounts

Data (2020)

(amounts in millions of euros)

Country	Exports	GDP	Intra-EU exports	Population (million)
A	4,125	48,256	25%	5
B	988	7,585	75.8%	3.9
C	31,025	252,000	9.7%	38.25
D	12,400	98,750	49%	15.4

✓ 1. What is the value of Country A's intra-EU exports (in thousands of euros)?

- A. 931,250
- B. 1,000,000
- C. 1,031,250
- D. 1,125,000
- E. 1,250,000

Analysis

- Country A exports: **4,125 million euros**
- Intra-EU percentage: **25%**

Calculate **25%** of 4,125:

$$4,125 \times 0.25 = 1,031.25 \text{ million euros}$$

This is expressed in **millions**.

To express it in **thousands**:

$$1.03125 \text{ billion euros} = 1,031.25 \text{ million euros} = 1,031,250 \text{ thousand euros}$$

Therefore:

✓ **Correct answer: C. 1,031,250 (in thousands of euros)**

✓ **2. What is the value of Country A's extra-EU exports (in millions of euros)?**

- A. 825
- B. 1,031
- C. 3,094
- D. 4,125
- E. 5,156

 Analysis

The **extra-EU exports** are the remainder:

$$100\% - 25\% = 75\%$$

Therefore:

$$\text{Extra-EU} = 4,125 \times 0.75 = 3,093.75 \text{ million euros}$$

Round to **3,094 million euros**.

✓ **Correct answer: C. 3,094 million euros**

✓ **3. What is the value of Country B's intra-EU exports (in millions of euros)?**

- A. 650
- B. 700
- C. 725
- D. 749
- E. 925

 Analysis

- Country B exports: **988 million euros**
- Intra-EU: **75.8%** → as a decimal: **0.758**

Calculation:

$$988 \times 0.758 = 749.0 \text{ (approximately) million euros}$$

Therefore:

✓ **Correct answer: D. 749 million euros**

✓ **4. What is the value of Country B's extra-EU exports (in millions of euros)?**

- A. 188
- B. 239
- C. 275
- D. 749
- E. 812

 Analysis

Extra-EU = 100% – 75.8% = **24.2%**

As a decimal: **0.242**

$$988 \times 0.242 = 239.0 \text{ (approximately) million euros}$$

Alternatively:

$$988 - 749 = 239 \text{ (same result).}$$

✓ **Correct answer: B. 239 million euros**

✓ **5. What is the total value of the intra-EU exports of Countries A and D (in millions of euros)?**

- A. 6,900.00
- B. 7,000.00
- C. 7,107.25
- D. 7,250.00
- E. 7,500.00

 Analysis

Step 1: Country A's intra-EU exports

- Exports A: **4,125 million euros**
- Intra-EU percentage: **25% = 0.25**

Calculation:

$$4,125 \times 0.25 = 1,031.25 \text{ million euros}$$

Step 2: Country D's intra-EU exports

- Exports D: **12,400 million euros**

- Intra-EU percentage: **49% = 0.49**

$$12,400 \times 0.49 = 6,076 \text{ million euros}$$

Step 3: Total intra-EU exports (A + D)

$$1,031.25 + 6,076 = 7,107.25 \text{ million euros}$$

This corresponds exactly to the following option:

✓ **Correct answer: C. 7,107.25 million euros**

✓ **6. What is the total value of exports of the four countries (in millions of euros)?**

- A. 45,000
- B. 46,000
- C. 47,000
- D. 48,538
- E. 49,000

 Analysis

Add the exports of all four countries:

- Country A: 4,125
- Country B: 988
- Country C: 31,025
- Country D: 12,400

$$\begin{aligned} 4,125 + 988 &= 5,113 \\ ; 5,113 + 31,025 &= 36,138 \\ ; 36,138 + 12,400 &= 48,538 \text{ million euros} \end{aligned}$$

✓ **Correct answer: D. 48,538 million euros**

✓ **7. What is the value of Country C's intra-EU exports (in billions of euros)?**

- A. 2.5
- B. 2.75

- C. 3.01
- D. 3.5
- E. 4.2

Analysis

- Country C exports: 31,025 million euros
- Intra-EU: 9.7% → 0.097

Calculate the intra-EU exports:

$$31,025 \times 0.097 = 3,009.425 \text{ million euros}$$

Now convert from **millions** into **billions**:

$$3,009.425 \div 1,000 \approx 3.009 \text{ billion euros} \approx 3.01 \text{ billion euros}$$

 **Correct answer: C. 3.01 billion euros**

 **8. What is the total value of the extra-EU exports of Countries B and C (in millions of euros)?**

- A. 2,800
- B. 35,000
- C. 2.8254
- D. 28,255
- E. 3,250,000

Analysis

Remember:

Extra-EU exports = (100% – intra-EU percentage) of total exports.

1 Country B – extra-EU exports

- Country B exports: 988 million euros
- Intra-EU: 75.8%
- Extra-EU exports:

$$100\% - 75.8\% = 24.2\% = 0.242$$

Calculation:

$$988 \times 0.242 = 239.096 \text{ million euros}$$

2 Country C – extra-EU exports

- Country C exports: 31,025 million euros
- Intra-EU: 9.7%
- Extra-EU exports:

$$100\% - 9.7\% = 90.3\% = 0.903$$

$$31,025 \times 0.903 = 28,015.575 \text{ million euros}$$

B Total extra-EU exports (B + C)

$$239.096 + 28,015.575 = 28,254.671 \text{ million euros}$$

Round to the nearest million:

$$28,254.67 \approx 28,255 \text{ million euros}$$

This corresponds exactly to the following option:

 **Correct answer: D. 28,255 million euros**

 **9. Which country has the highest absolute value of intra-EU exports?**

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

 Analysis

We calculate (approximately, in millions of euros):

- **A:** $4,125 \times 0.25 = 1,031.25$
- **B:** $988 \times 0.758 \approx 749$
- **C:** $31,025 \times 0.097 \approx 3,009$
- **D:** $12,400 \times 0.49 = 6,076$

Compare:

- Country D: $\sim 6,076$ (the highest)
- The other values are considerably lower.

✓ **Correct answer: D. Country D**

✓ **10. If Country D's intra-EU exports increased by 10%, what would the new value be (in millions of euros)?**

- A. 6,100
- B. 6,300
- C. 6,500
- D. 6,684
- E. 7,000

Analysis

First calculate the **original** value of Country D's intra-EU exports:

- Country D exports: 12,400
- Intra-EU percentage: 49% $\rightarrow 0.49$

$$12,400 \times 0.49 = 6,076 \text{ million euros}$$

This amount now increases by **10%**:

A 10% increase means:

New amount = original amount $\times 1.10$

$$6,076 \times 1.10 = 6,683.6 \text{ million euros}$$

Rounding: $\approx$ **6,684 million euros**

✓ **Correct answer: D. 6,684 million euros**

✓ 11. What percentage do the combined intra-EU exports of Countries B and D represent of the total exports of Countries A, B and D?

- A. 28.6%
- B. 32.1%
- C. 35.7%
- D. 39%
- E. 41.2%

 Analysis

Step 1: Calculate the intra-EU exports of B and D

Country B

$$988 \times 0.758 = 749.0 \text{ million euros}$$

Country D

$$12,400 \times 0.49 = 6,076 \text{ million euros}$$

Total intra-EU exports (B + D):

$$749 + 6,076 = 6,825 \text{ million euros}$$

Step 2: Total exports of Countries A, B and D

$$4,125 + 988 + 12,400 = 17,513 \text{ million euros}$$

Step 3: Calculate the percentage

$$\frac{6,825}{17,513} \times 100 = 38.97\%$$

✓ **Correct answer: D. 39%**

✓ 12. Which country has the highest per capita EXTRA-EU export value (€ per inhabitant)?

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

 Analysis

Calculate for each country:

$$\text{EXTRA-EU exports} \div \text{population}$$

Country A

Extra-EU exports = 75%

$$4,125 \times 0.75 = 3,093.75 \text{ million euros}$$

Population: 5 million

$$\frac{3,093.75}{5} = 618.75 \text{ € per inhabitant.}$$

The units in millions cancel out.

Country B

Extra-EU exports = 24.2%

$$988 \times 0.242 = 239.1 \text{ million euros}$$

Population: 3.9 million

$$\frac{239.1}{3.9} \approx 61.3\text{€}$$

Country C

Extra-EU exports = 90.3%

$$31,025 \times 0.903 = 28,015.58 \text{ million euros}$$

Population: 38.25 million

$$\frac{28,015.58}{38.25} \approx 732.6\text{€}$$

Country D

Extra-EU exports = 51%

$$12,400 \times 0.51 = 6,324 \text{ million euros}$$

Population: 15.4 million

$$\frac{6,324}{15.4} \approx 410.6\text{€}$$

Comparison

- A: $\approx 619 \text{ €}$
- B: $\approx 61 \text{ €}$
- C: $\approx 733 \text{ €}$ (highest)
- D: $\approx 411 \text{ €}$

✓ Correct answer: C. Country C

✓ 13. For which country is the ratio

$$\frac{\text{intra-EU exports}}{\text{GDP}}$$

the highest?

- A. A
- B. B

- C. C
- D. D

Analysis

Calculate for each country:

$$\text{Ratio} = \frac{\text{intra-EU exports}}{\text{GDP}}$$

(all amounts are in millions of euros, so the units are compatible)

Country A

$$\frac{1,031.25}{48,256} \approx 0.0214 \text{ (2.14\%)}$$

Country B

$$\frac{749}{7,585} \approx 0.0987 \text{ (9.87\%)}$$

Country C

$$\frac{3,009.43}{252,000} \approx 0.0119 \text{ (1.19\%)}$$

Country D

$$\frac{6,076}{98,750} \approx 0.0616 \text{ (6.16\%)}$$

Comparison

- A: 2.14%
- B: **9.87% (highest)**
- C: 1.19%
- D: 6.16%

✓ **Correct answer: B. Country B**

Data

	Gross Domestic Product (GDP)	Travel receipts as a percentage of GDP	Receipts from US tourists
Country A	12.400	8.3%	0.458
Country B	3.512	7.5%	0.289
Country C	0.789	10.23%	0.009

*Amounts are in billions of euros

✓ **14. What is the value of travel receipts in Country B, in millions of euros?**

- A. 234.0 million euros
- B. 251.8 million euros
- C. 263.4 million euros
- D. 289.0 million euros

Analysis

Travel receipts are calculated as:

GDP × travel-receipts percentage

Country B

GDP: €3.512 billion

Travel-receipts percentage: 7.5%

$$3.512 \times 0.075 = 0.2634 \text{ billion euros}$$

Convert to millions of euros:

$$0.2634 \times 1,000 = 263.4 \text{ million euros}$$

✓ Correct answer: C. 263.4 million euros

✓ 15. What are receipts from US tourists as a percentage of GDP for Country B?

- A. 7.50%
- B. 8.23%
- C. 8.90%
- D. 10.23%

 Analysis

Required:

$$(\text{Receipts from US tourists} \div \text{GDP}) \times 100$$

Country B

Receipts from US tourists: €0.289 billion

GDP: €3.512 billion

$$\frac{0.289}{3.512} \times 100 \approx 8.23\%$$

✓ Correct answer: B. 8.23%

✓ 16. What are receipts from US tourists as a percentage of total travel receipts for Country C?

- A. 9.00%
- B. 10.23%
- C. 11.15%
- D. 14.30%

 Analysis

Steps:

1. Calculate **total travel receipts** for Country C.
2. We calculate:
$$(\text{Receipts from the US} \div \text{Total travel receipts}) \times 100$$

Step 1: Total travel receipts for Country C

Country C GDP: €0.789 billion

Travel receipts: 10.23% of GDP

$$0.789 \times 0.1023 = 0.0807 \text{ billion euros (approximately)}$$

Step 2: Percentage of receipts from the US

Receipts from the US: €0.009 billion

$$\frac{0.009}{0.0807} \times 100 \approx 11.15\%$$

✓ Correct answer: C. 11.15%

✓ 17. If Country B's GDP were €5 billion, what would travel receipts be as a percentage of GDP (assuming that total travel receipts remained unchanged)?

- A. 5.27%
- B. 6.00%
- C. 7.50%
- D. 8.23%

Analysis

1. Use the **same travel receipts** for Country B as before.
2. Calculate the new percentage:
(Travel receipts ÷ New GDP) × 100

Step 1: Country B's travel receipts (from Question 14)

Original GDP: €3.512 billion

Travel-receipts percentage: 7.5%

$$3.512 \times 0.075 = 0.2634 \text{ billion euros}$$

This amount **remains unchanged**.

Step 2: New percentage with GDP = €5 billion

$$\frac{0.2634}{5} \times 100 = 5.268\% \approx 5.27\%$$

✓ Correct answer: A. 5.27%

7.3 Patterns and Operations

Having examined the basic elements that make up abstract reasoning tests and the way in which these tests are designed, the next important step is to understand the patterns and operations that appear most frequently in this type of exercise. The ability to recognise these patterns is a key factor in solving the questions quickly and effectively.

In abstract reasoning tests, figures do not change randomly from one step to the next. Instead, they follow specific logical changes or processes that are applied systematically throughout the series. These changes may involve rotating a figure, moving elements within the frame, adding or removing shapes, changing the shading, or even alternating between different geometric shapes.

These changes are often referred to as operations because they function as rules that transform one figure into the next. For example, an operation may involve rotating a figure by 90 degrees at each step of the series. Another may involve moving an element from one position in the frame to another in a particular order. In more complex exercises, more than one operation may be applied simultaneously, increasing the level of difficulty.

Patterns arise from the repeated application of these operations. In other words, a pattern is the overall logical structure created when the same changes are repeated consistently across a series of figures. Once test-takers manage to recognise this pattern, they can predict what the next image in the sequence will be.

Naturally, the range of possible shapes and combinations that may appear in a test is extremely broad. It would be practically impossible to record and present every possible form of pattern that a candidate might encounter. In practice, however, certain categories of pattern occur much more frequently than others.

For this reason, the following sections provide a systematic overview of the most common types of patterns and operations used in abstract reasoning tests. Through examples and analysis, we will examine how each type of change works and how it can be identified quickly during the test.

Familiarity with these recurring patterns enables candidates to develop a more organised observation strategy. Instead of approaching each exercise from scratch without a specific method, they can check the most common possible operations in sequence. In this way, the solving process becomes faster, more systematic and ultimately more effective.

7.3.1 Combined Patterns and Rules

In more demanding abstract reasoning exercises, the transition from one frame to the next is not determined by a single rule. Two or more operations may be applied simultaneously or successively to different elements of the image.

For example, an object may:

- move to a different position;
- rotate through a specific angle;
- change colour or shading;
- increase or decrease in size;
- be replaced by a different shape;
- be added or removed;
- be affected when it touches or passes through another object.

To identify a combined rule, examine each characteristic separately:

- Position: Where does each object move?
- Orientation: Does it rotate or undergo reflection?
- Form: Does it remain the same shape or is it replaced?
- Colour and shading: Does it become black, white, grey or hatched?
- Size: Does it increase, decrease or alternate?
- Number: Are objects added or removed?
- Interaction: Does contact with, or passage through, another area cause a change?

Do not look for a rule that explains only part of the image. The correct solution must consistently account for all the changes observed throughout the sequence.

Basic principle:

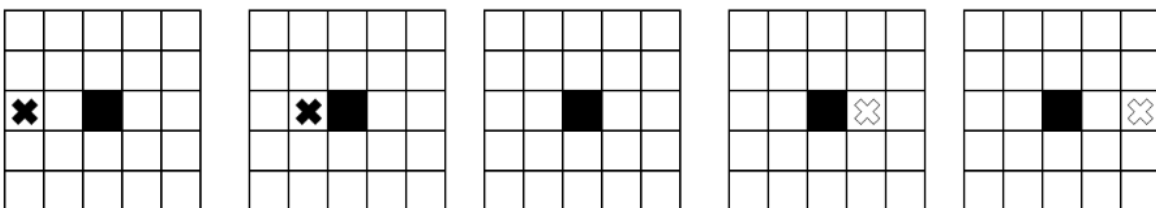
A MOVEMENT may trigger one or more CHANGES.

For example, an object may move to the right and change colour when it enters a shaded area. In this case, two rules are operating:

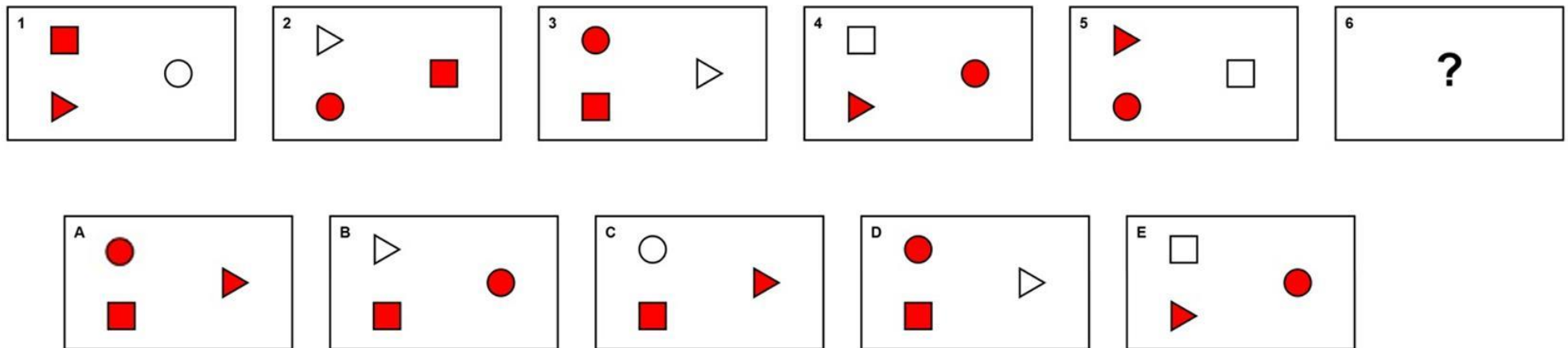
- one rule determines the movement;
- a second rule determines the effect of entering that particular area.

Example

When the black cross leaves the central black square, it changes colour and becomes white. This is a simple example of interaction. You may also see an object pass through or touch another object and then change shape or size.



Question 1



Each frame contains 3 shapes: ■ Square — ▲ Triangle — ● Circle.

Each shape:

✓ changes position

✓ changes or retains its colour (red or white)

No new shape ever appears and none is missing. All three are always present.

The correct answer is C. The rules governing the sequence are as follows:

First rule – cyclical movement of the shapes

The three shapes—the square, circle and triangle—move cyclically clockwise within the frame each time. In other words, each shape moves to the next position on the same circular path. The position occupied by one shape in one frame is occupied in the next frame by the shape that preceded it along the path.

Second rule – constant number and form of the shapes

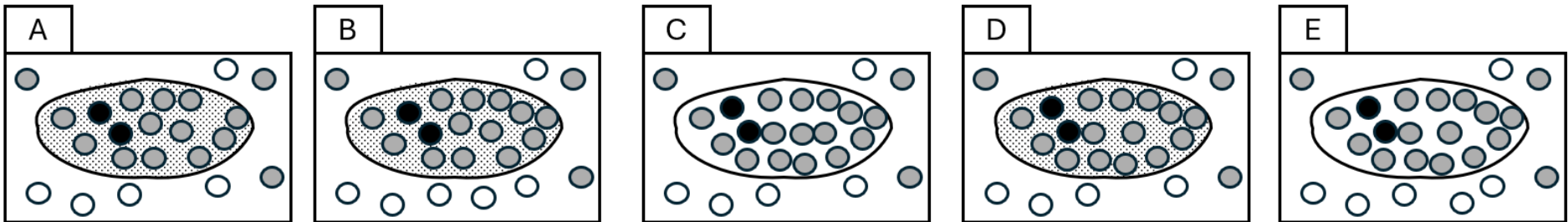
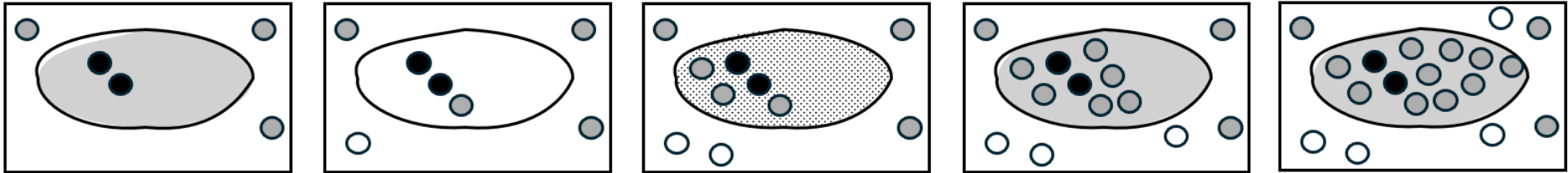
The same three shapes always appear in every frame: one circle, one square and one triangle. The number of shapes never changes, nor does their type.

Third rule

The colours white and red alternate successively in positions 1 and 2.

Applying these rules to the fifth frame, the next frame must show the new cyclical positions of the shapes together with the correct colour pattern. The only option that satisfies both the correct movement and the correct colour rule is C.

Question 2



The correct option is C. It is obtained by examining two independent rules: the increase in the circles inside the figure and the increase in the circles around its perimeter.

First rule – circles inside the figure

Inside the large figure, the number of grey circles increases progressively. The increase is not constant: it is by 1, then 2, then 3, and so on. In other words, every new frame adds more grey circles than the preceding frame. The black circles inside the figure remain approximately constant and simply act as a fixed point of reference. The arrangement or exact colour of the remaining circles inside may appear random, but the fundamental pattern is that the total number of grey circles increases progressively; in the sixth figure, the number of small grey circles will increase by 5.

Second rule – circles around the perimeter

The number of white circles around the figure increases by one in each frame. Thus, the first frame contains a small number of peripheral circles, the next contains one more, the following frame contains one more again, and so on. Therefore, the sixth figure has five small white circles.

Third rule – independence of colour inside the figure

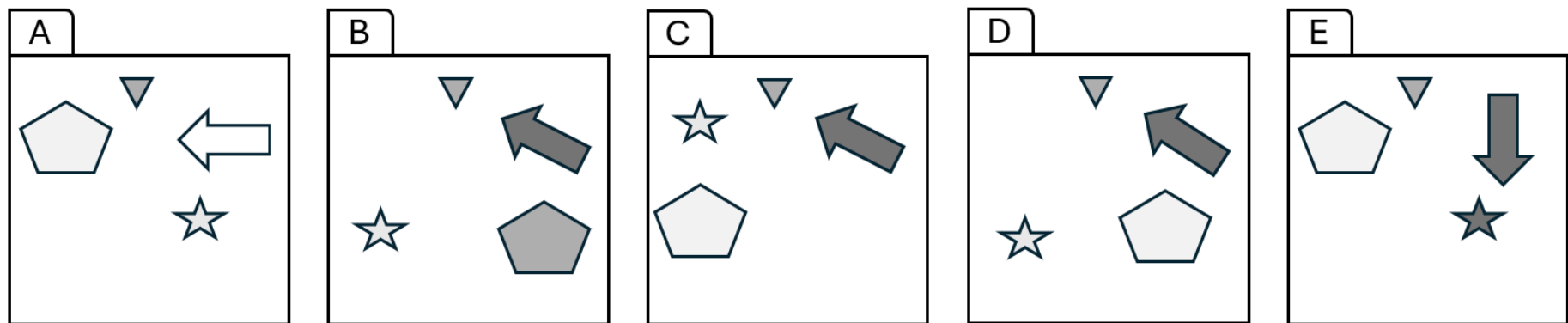
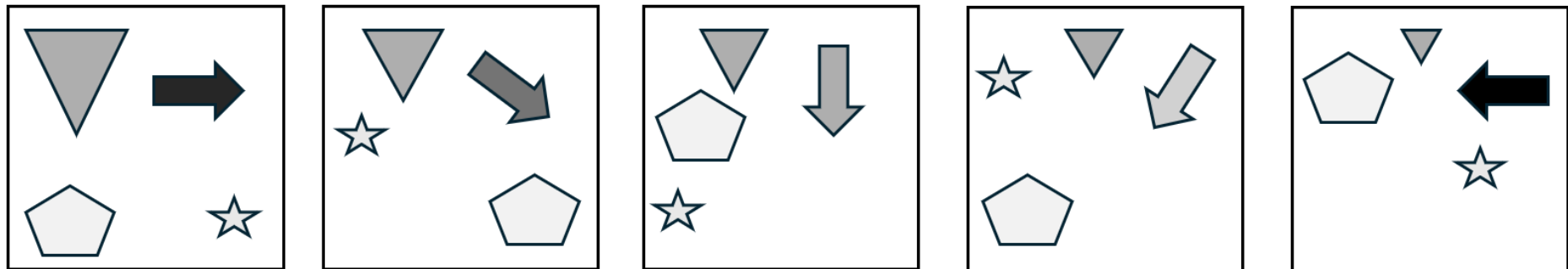
In the inner area, the colour is random.

Therefore, in the next frame we must have:

- + 5 grey circles inside the circle compared with the preceding frame;
- one additional white circle around the perimeter compared with the preceding frame.

The only option that satisfies both rules simultaneously is C.

Question 3



Initial observations

I first look at what appears in each frame and what remains constant:

Four shapes always appear in every image:

- a triangle at the top;
- a pentagon;
- a star;
- an arrow.

The number and type of shapes never change from one frame to the next.

The triangle:

- has a constant colour and angle—its point always faces downwards;
- changes size.

The star and the pentagon change position inside the square.

The arrow is the most “active” element:

- it changes direction;
- it also changes colour (shading).

Therefore, the pattern in the exercise appears to be based mainly on:

1. the orientation of the arrow;
2. the colour of the arrow;
3. the movement of the pentagon and the star;
4. the size of the triangle;
5. the fact that the colour of every shape other than the arrow remains constant.

Rule 1 – rotation of the arrow (45° clockwise)

In each frame, I observe the direction in which the arrow points:

1. First frame: it points to the right ($\rightarrow$).
2. Second frame: it turns diagonally down and to the right ($\searrow$).
3. Third frame: it now points downwards ($\downarrow$).
4. Fourth frame: it turns diagonally down and to the left ($\swarrow$).
5. Fifth frame: it points to the left ($\leftarrow$).

From one stage to the next, it always covers the same angle: each time it turns 45° clockwise, like the hand of a clock.

The complete cyclical sequence would be: $\rightarrow, \searrow, \downarrow, \swarrow, \leftarrow, \nwarrow, \uparrow, \nearrow, \dots$

Since the arrow points to the left ($\leftarrow$) in the fifth frame, the next step in the same sequence is $\nwarrow$ (diagonally up and to the left).

I examine options A–E:

- B: arrow $\nwarrow$
- C: arrow $\nwarrow$
- D: arrow $\nwarrow$

Therefore, on the basis of Rule 1 alone, three possible solutions remain: B, C and D. I need additional rules to distinguish which one is correct.

Rule 2 – development of the arrow’s colour

I now examine the shading of the arrow from one frame to the next:

1. First frame $\rightarrow$ black
2. Second $\rightarrow$ dark grey
3. Third $\rightarrow$ medium grey
4. Fourth $\rightarrow$ light grey
5. Fifth $\rightarrow$ black

The arrow therefore “fades” steadily from dark to light: black $\rightarrow$ dark grey $\rightarrow$ medium grey $\rightarrow$ light grey, and then starts again from black. A periodic colour pattern is therefore expected. Logically, the arrow in the sixth frame should be dark grey.

I check B, C and D—the only options that passed Rule 1—and the colour is confirmed in all three options.

Rule 3 – movement of the pentagon (relationship with the star)

I now look exclusively at the star and the pentagon:

- At every transition, the pentagon moves to the position occupied by the star in the preceding frame.
- The star, in turn, moves to another position, but the important rule is: Pentagon(n) in frame $n+1$ = position of the star in frame n .

I check what happens from one frame to the next and can see that the rule holds for $1 \rightarrow 2$, $2 \rightarrow 3$, $3 \rightarrow 4$ and $4 \rightarrow 5$.

In the sixth frame, therefore, the pentagon must appear in exactly the position occupied by the star in the fifth frame. This is confirmed by B and D.

Rule 4 – the triangle becomes smaller

The triangle must be even smaller in size. This is confirmed in both frames.

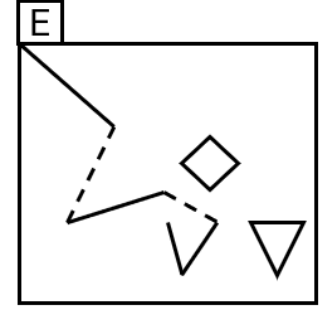
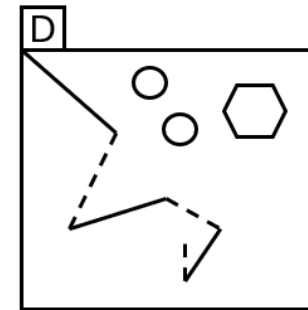
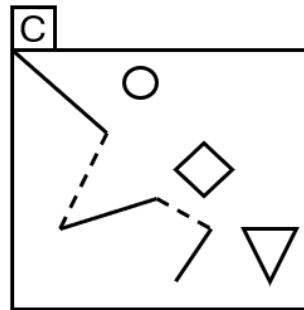
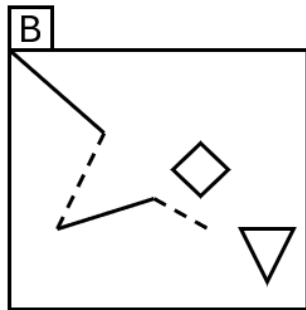
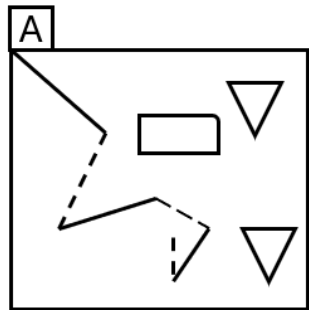
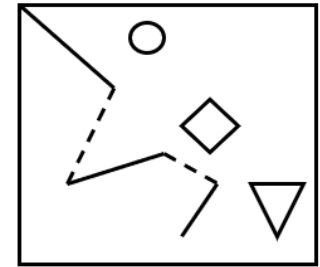
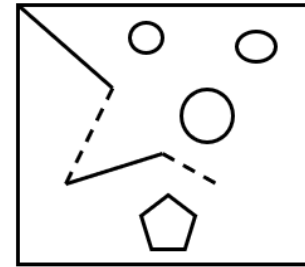
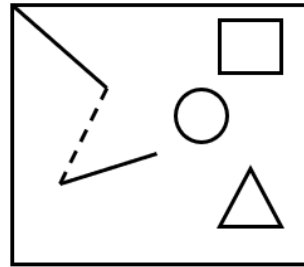
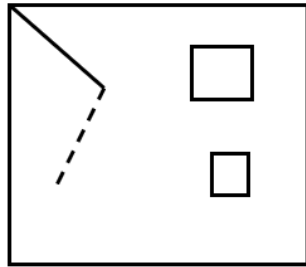
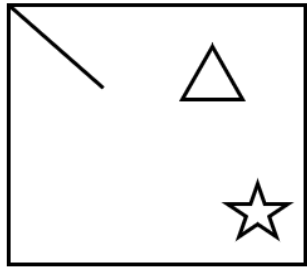
Rule 5 – the colour of the shapes

The colour of the remaining shapes, apart from the arrow, must remain constant. For this reason, figure B is rejected because the pentagon is dark grey.

The only image that satisfies all three rules is option D.

STUDY COMMUNITY

Question 4



Rule 1 – the zigzag line and its final segment

As we move from left to right:

1. in the first frame, there is only one solid diagonal segment;
2. in the second, a second segment is added and is dashed;
3. in the third, a third, solid segment is added;
4. in the fourth, a fourth, dashed segment is added;
5. in the fifth, the line again has four segments and the final segment is solid.

The pattern in the final segment is therefore: solid → dashed → solid → dashed ...

After the fifth frame, whose final segment is solid, the sixth must have a dashed final segment, as a continuation of the fifth figure.

This is confirmed by A and D. The remaining shapes are randomly scattered.

Rule 2 – constant total number of sides

The total number of sides of the other shapes, excluding the zigzag line, is always 8. I regard the circle as having one side.

In A, the total number of sides is 10, whereas in D the sum of the sides is 8.

The correct next frame is D.