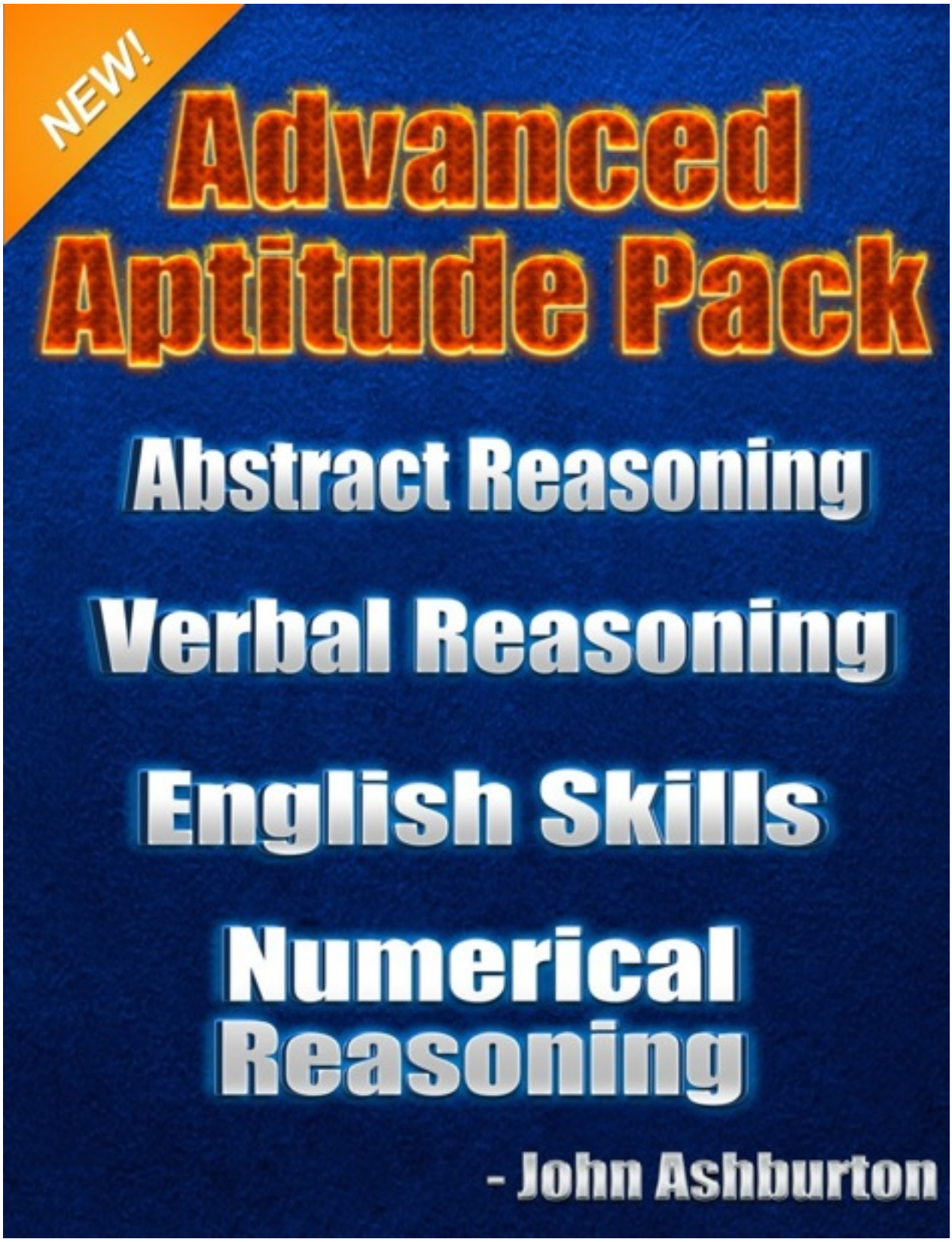

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PREFACE

Welcome to the Advanced Aptitude Pack and congratulations on making this commitment to significantly enhance your chances of succeeding in your career goal of becoming a police officer.

The purpose of this book is to give you some additional insight into the types of cognitive testing questions you will face during police selection.

Please note if you are applying in Western Australia or New South Wales the chapters on Numerical Reasoning are not applicable as these type of questions have recently been removed from their respective entrance examinations.

I would be thrilled if you thought someone else might also benefit from reading this eBook. Please consider the time I have taken to prepare this book and do not share or distribute your copy of this book without my permission. The most up to date version will always be available at:

www.policeprep.com.au

Finally, please feel free to email info@policeprep.com.au to let us know what you found most useful and whether this book helped you make it through your own police exam preparation.

Good luck!

John Ashburton

The information contained in this guide is for information and preparation only. All questions, lessons and information are the advice and opinion of the author and do not reflect the policy or procedures of any particular police service.

The information provided is based on the authors own experience. You should always seek further advice before acting on something that the author published or recommended. The reader should always act in accordance with their own formal police training.

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CHAPTER ONE

SHORT INTRODUCTION

Welcome to your advanced aptitude training pack. This eBook contains dozens of questions in each category of cognitive testing (or aptitude testing).

They are organised into separate chapters so that you can move directly to the type of questions you feel are most important to practice.

Alternatively you may choose to work through the eBook form beginning to end.

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CHAPTER TWO

VERBAL REASONING

Question 1.
Speech and Dumb match which following word pair:

a) Language and Limb
b) Hearing and Deaf
c) Tongue and Taste
d) Language and Deaf

Question 2.
ONE
TWO
THREE
FOUR
FIVE

Which of these numbers listed above is three numbers after the number that is two numbers before the number that is three numbers after the number ONE?

a) TWO
b) THREE
c) FOUR
d) FIVE

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Question 3.

Ornaments is to Gold as Paper is to

a) Tree b) Wood c) Pulp d) Bamboo

Question 4.

Choose the odd one out from the group:

a) Astounded b) Amazed c) Amused d) Flabbergasted

Question 5.

Mike cries when Andrea is hurt. Jonno smiles when Mike cries. If these two sentences are true, then it follows that the sentence, “Jonno smiles when Andrea is hurt,” is:

a) True

b) False

c) Either True or False.

Question 6.

Melt is to Liquid as:

a) Freeze is to Ice

b) Freeze is to Condense

c) Freeze is to Solid

d) Freeze is to Crystal

Question 7.

Conference is to Chairman as:

a) Newspaper is to Reporter

b) Newspaper is to Distributer

c) Newspaper is to Editor

d) Newspaper is to Painter

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Question 8.

Foot is to Socks as Head is to

a)Hair b) Cap c) Scalp d) Skull

Questions 9. 10. 11. 12.

Read the following paragraph carefully and then answer the following questions:

A family has a total of 6 members named: A, B, C, D, E and F. There is an engineer, teacher, doctor, cricketer, a salesman and a student in the family. There are two married couples. B is an engineer and is the son of E. F is the grandmother of A and is a teacher. C is the daughter-in-law of D and is a doctor.

Question 9. Who is the husband of C?

a) A b) B c) D d) E e) F

Question 10. Which of the following are two married couples?

a) AC, EF b) EC, FD c) ED, FC d) ED, AC

Question 11. Who is most likely student in the family?

a) A b) F c) D d) Data insufficient

Question 12. Who are the siblings in the family?

a) AC b) AB c) ED d) None of these

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Question 13.

John is the football team captain of his school. This year, all captains of each different sport are being awarded by the school. Considering these first two sentences are true, the statement “John is being awarded by the school,” is:

a) True b) False c) Cannot be determined

Question 14.

Select the appropriate sequence to fill the following blanks:

Y X _ Z X _ Y _ Y X Y _

a) X Z Y Y
b) Y X Z Z
c) Y Z X X
d) Z X Y Y

Question 15.

In a mathematics exam, Sarah gets more marks than Buster. Buster got more marks than Tom. Considering both the first statements are true, the statement “Tom is the highest scoring in the mathematics exam,” is:

a) True b) False c) Cannot be determined

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Questions 16. 17. 18.

In each of the following questions, there are two statements. One is marked as Assertion (A) and the other is as Reason (R). Mark your answer as per the codes given below:

a) A is true but R is false

b) A is false but R is true

c) Both A and R are true and R is correct explanation of A

d) Both A and R are true but R is not the correct explanation of A

e) Both A and R are false

Question 16.

Assertion (A): Although an atom contains charged particles it is still neutral.

Reason (R): There are equal number of protons and electrons in the atom.

Question 17.

Assertion (A): The Appendix is a vestigial organ.

Reason (R): It helps in the absorption of minerals in the body.

Question 18.

Assertion (A): Lightning is seen before thunder.

Reason (R): The velocity of sound is less than that of light.

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Question 19.

Pilot is to airplane as driver is to:

a) Motorcycle

b) Car

c) Wheels

d) Wing

Question 20.

Which word means nearly the same as ‘fatigued’:

a) Camouflaged

b) Tired

c) Responsive

d) Restless

Question 21.

Airplane is to wing as Boat is to:

a) Pilot

b) Captain

c) Sail

d) Wheels

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Question 22.

Which of the following two statements provide best indication that Sarah is not Aaron's girlfriend:

a) Aaron is dating Jane

b) Sarah is dating Brian

c) Brian is dating Jane

d) Brian is dating two girls

e) Aaron is dating only one girl

Question 23.

Four of the following words are alike in some way. Which is the odd one out?

a) Timid

b) Weak

c) Shy

d) Introvert

e) Extrovert

Question 24.

Skydiver is to parachute as race car driver is to:

a) Racing Car

b) Race track

c) Helmet

d) Steering wheel

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Question 25.

Find the word which means nearly the same as ‘affinity’:

a) infinite

b) kinship

c) aesthetic

d) inverted

Question 26.

Find the word that means nearly the same as ‘clandestine’:

a) overt

b) interesting

c) concealed

d) irreparable

Question 27.

Birds are to feather as fish are to:

a) water

b) river

c) eyes

d) scales

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Question 28.

Michael always eats his meals in the same order. He eats his vegetables after his meat and eats his salad after finishing his water. He also eats his salad before his meat. What is the last thing that Michael eats or drinks if his meal contains all of the above items?

a) Meat

b) Vegetables

c) Salad

d) Water

Question 29.

Which word is closest in meaning to ‘empathetic’:

a) Contrived

b) Compassionate

c) Consultant

d) Energetic

Question 30.

Tom and Jane have a blue car and a yellow car. Which of the following two statements prove that Tom usually drives the red car?

a) Sarah prefers to drive the red car.

b) The blue car is bigger than the red car.

c) The red car is older than the blue car.

d) Tom usually drives the smaller car.

e) Tom likes to drive fast.

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Question 31.

What word is most alike in definition to ‘enigma’?

a) Edible

b) Enemy

c) Inexplicable

d) Incomplete

Question 32.

Which pair of words have a similar relationship as the words ‘Jacket : Sleeve’?

a) Trousers : Shoes

b) Pistol : Knife

c) Body : Arm

d) Quiet : Loud

Question 33.

Which pair of words have a similar relationship as the words ‘Marketer : Advertisement’

a) Musician : Song

b) Magician : Costume

c) Stripper : Money

d) Police : Law

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Question 34.

Which pair of words have a similar relationship as the words 'Artist : Paintbrush'

a) Musician : Song

b) Teacher : Whiteboard

c) Farmer : House

d) Fire : Heat

Question 35.

On a hypothetical space station, humans can talk to venetians, but not to martians or neptunians. Martians can't talk to humans but can talk to venetians and neptunians. Neptunians can talk to martians but not to venetians or humans. Venetians can only talk to neptunians.

If a human wants to get a message to a martian, what chain of communication would fit the above rules?

Question 36.

The word 'incognito' is most similar in meaning to which word below:

a) Inside

b) Persistent

c) Incongruous

d) Disguised

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Question 37.

The word ‘grow’ is to ‘enlarge’ as ‘assimilate’ is to:

a) Learn

b) Shrink

c) Accelerate

d) Think

Question 38.

Which two statements prove that Molly has five white cars?

a) Molly has seven red cars.

b) Molly has five green cars.

c) Molly has two less white cars than she has red cars.

d) Molly has red cars, white cars and green cars.

e) Molly has less white cars than red cars.

Question 39.

Which three statements prove that Lauren exercises before work?

a) Lauren exercises at 7.00am every morning.

b) Lauren always exercises for one hour exactly.

c) Lauren often exercises at the gym at her workplace.

d) Lauren starts work after taking a shower.

e) Lauren takes one shower a day.

f) Lauren takes a shower after exercising.

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Question 40.

There are two logical pairs of words below. Which word does not form one of the pairs?

a) Lunch

b) Ball

c) Sandwich

d) Foot

e) Box

END VERBAL REASONING SECTION

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VERBAL REASONING - ANSWERS AND EXPLANATIONS

Question 1.

Speech and Dumb match which following word pair:

a) Language and Limb
b) Hearing and Deaf
c) Tongue and Taste
d) Language and Deaf

The correct answer is b) Hearing and Deaf. A dumb person cannot speak as a deaf person cannot hear.

Question 2.

ONE
TWO
THREE
FOUR
FIVE

Which of these numbers listed above is three numbers after the number that is two numbers before the number that is three numbers after the number ONE?

a) TWO
b) THREE
c) FOUR
d) FIVE

The correct answer is d) FIVE. The quickest way to solve problems like this is to isolate the instructions into chunks and then work backwards from the initial clue (which comes at the end of the question). In this case we start at the number ONE.

First clue: Three numbers after the number ONE = FOUR

Second clue: Two numbers before this number (FOUR) = TWO

Third Clue: Three numbers after this number (TWO) = FIVE

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Question 3.

Ornaments is to Gold as Paper is to

a) Tree b) Wood c) Pulp d) Bamboo

The correct answer is (c). Ornaments are made from gold and paper is made from pulp.

Question 4.

Choose the odd one out from the group:

a) Astounded b) Amazed c) Amused d) Flabbergasted

The correct answer is (c) Amused. The other three are synonyms.

Question 5.

Mike cries when Andrea is hurt. Jonno smiles when Mike cries. If these two sentences are true, then it follows that the sentence, “Jonno smiles when Andrea is hurt,” is:

a) True

b) False

c) Either True or False.

The correct answer is a) True. If Andrea is hurt then Mike cries. Mike crying makes Jonno smile. So it follows that Jonno smiles when Andrea is hurt.

Question 6.

Melt is to Liquid as:

a) Freeze is to Ice

b) Freeze is to Condense

c) Freeze is to Solid

d) Freeze is to Crystal

The correct answer is c) Freeze is to Solid. A substance that melts forms a liquid. Similarly a substance that freezes forms a solid.

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Question 7.

Conference is to Chairman as:

a) Newspaper is to Reporter

b) Newspaper is to Distributer

c) Newspaper is to Editor

d) Newspaper is to Painter

The correct answer is c) Newspaper is to Editor. The head of a conference is a chairman and the head of a newspaper is an editor.

Question 8.

Foot is to Socks as Head is to

a) Hair b) Cap c) Scalp d) Skull

The correct Answer is (b) Cap. Second is used to cover the first.

Questions 9. 10. 11. 12.

Read the following paragraph carefully and then answer the following questions:

A family has a total of 6 members named: A, B, C, D, E and F. There is an engineer, teacher, doctor, cricketer, a salesman and a student in the family. There are two married couples. B is an engineer and is the son of E. F is the grandmother of A and is a teacher. C is the daughter-in-law of D and is a doctor.

Question 9. Who is the husband of C?

a) A b) B c) D d) E e) F

Question 10. Which of the following are two married couples?

a) AC, EF b) EC, FD c) ED, FC d) ED, AC

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Question 11. Who is most likely student in the family?

a) A b) F c) D d) Data insufficient

Question 12. Who are the siblings in the family?

a) AC b) AB c) ED d) None of these

Explanation:

E is the father of B.

F being the grandmother of A is thus E's mother.

That means A and B are the children in the family and are siblings.

B being the engineer, thus A is most likely to be the student in the family.

C being the only daughter-in-law in the family is E's wife and mother of A and B.

D is thus the father of E, husband of F and grandfather of A and B.

So the two married couples in the family are DF and EC.

The answers are therefore:

Question 9. Who is the husband of C?

a) A b) B c) D d) E e) F

Answer: (d) E is the husband of C

Question 10. Which of the following are two married couples?

a) AC, EF b) EC, FD c) ED, FC d) ED, AC

Answer: (b) EC and FD

Question 11. Who is most likely student in the family?

a) A b) F c) D d) Data insufficient

Answer: (a) A

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Question 12. Who are the siblings in the family?

a) AC b) AB c) ED d) None of these

Answer: (b) AB

Question 13.

John is the football team captain of his school. This year, all captains of each different sport are being awarded by the school. Considering these first two sentences are true, the statement "John is being awarded by the school," is:

a) True b) False c) Cannot be determined

The correct answer is a) True. If all captains are being awarded, then this includes the football team captain. Therefore John is to be awarded.

Question 14.

Select the appropriate sequence to fill the following blanks:

Y X _ Z X _ Y _ Y X Y _

a) X Z Y Y
b) Y X Z Z
c) Y Z X X
d) Z X Y Y

The correct answer is c) Y Z X X as shown below:

Y X Y Z X Z Y X Y X Y X

This presents a sequence of triplets where the first and last letter of each set of three is the same. If you don't immediately see a pattern in these questions, but are presented limited options, the quickest way to solve it is to sketch each option down and look for a pattern in each option. Trial and error approach. You will likely have scrap paper on which to do this.

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Question 15.

In a mathematics exam, Sarah gets more marks than Buster. Buster got more marks than Tom. Considering both the first statements are true, the statement "Tom is the highest scoring in the mathematics exam," is:

a) True b) False c) Cannot be determined

The correct answer is b) False. The first two sentences show that both Sarah and Buster scored higher marks than Tom. Tom is therefore the lowest scoring.

Questions 16. 17. 18.

In each of the following questions, there are two statements. One is marked as Assertion (A) and the other is as Reason (R). Mark your answer as per the codes given below:

a) A is true but R is false

b) A is false but R is true

c) Both A and R are true and R is correct explanation of A

d) Both A and R are true but R is not the correct explanation of A

e) Both A and R are false

Question 16.

Assertion (A): Although an atom contains charged particles it is still neutral.

Reason (R): There are equal number of protons and electrons in the atom.

The correct answer is (c). The atom is neutral because the positively charged protons are balanced by equal number of negatively charged electrons. The neutrons in the atom are neutral. So an atom is neutral.

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Question 17.

Assertion (A): The Appendix is a vestigial organ.

Reason (R): It helps in the absorption of minerals in the body.

The correct answer is (a). The appendix is a functionless organ in the human body so the Assertion (A) is correct but the Reason (R) is false.

Question 18.

Assertion (A): Lightning is seen before thunder.

Reason (R): The velocity of sound is less than that of light.

The correct answer is (c). Since light travels faster than sound so lightning is seen before we hear the sound of thunder.

Question 19.

Pilot is to airplane as driver is to:

a) Motorcycle

b) Car

c) Wheels

d) Wing

The correct answer is Car. A Pilot controls an airplane and a driver controls a car.

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Question 20.

Which word means nearly the same as ‘fatigued’:

a) Camouflaged

b) Tired

c) Responsive

d) Restless

The correct answer is ‘Tired’. Fatigued means worn out. For example “I was fatigued after running after the suspect”

Question 21.

Airplane is to wing as Boat is to:

a) Pilot

b) Captain

c) Sail

d) Wheels

The correct answer is ‘Sail’. An airplane has wings as a boat has sails.

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Question 22.

Which of the following two statements provide best indication that Sarah is not Aaron's girlfriend:

a) Aaron is dating Jane

b) Sarah is dating Brian

c) Brian is dating Jane

d) Brian is dating two girls

e) Aaron is dating only one girl

The correct answer is (a) and (e). If Aaron is only dating one girl (e) and he is dating Jane (a), then these two statements indicate that he is not Sarah's boyfriend and vice versa.

Question 23.

Four of the following words are alike in some way. Which is the odd one out?

a) Timid

b) Weak

c) Shy

d) Introvert

e) Extrovert

The correct answer is 'Extrovert'. This describes a loud and outspoken person. The other four words describe a quiet person that often keeps to themselves.

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Question 24.

Skydiver is to parachute as race car driver is to:

a) Racing Car

b) Race track

c) Helmet

d) Steering wheel

The correct answer is 'Helmet'. A skydiver wears a parachute and a race car driver wears a helmet.

Question 25.

Find the word which means nearly the same as 'affinity':

a) infinite

b) kinship

c) aesthetic

d) inverted

The correct answer is 'kinship'. Affinity and kinship both indicate a natural attraction between people or things.

Question 26.

Find the word that means nearly the same as 'clandestine':

a) overt

b) interesting

c) concealed

d) irreparable

The correct answer is 'concealed'. Clandestine refers to activities conducted in secret and needing to be concealed.

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Question 27.

Birds are to feather as fish are to:

a) water

b) river

c) eyes

d) scales

The correct answer is ‘scales’. Birds are covered in feathers (mostly) and fish are covered in scales.

Question 28.

Michael always eats his meals in the same order. He eats his vegetables after his meat and eats his salad after finishing his water. He also eats his salad before his meat. What is the last thing that Michael eats or drinks if his meal contains all of the above items?

a) Meat

b) Vegetables

c) Salad

d) Water

The correct answer is ‘vegetables’. According to the description above Michael consumes his meal in the following order:
1st: Water
2nd: Salad
3rd: Meat
4th: Vegetables

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Question 29.

Which word is closest in meaning to ‘empathetic’:

a) Contrived

b) Compassionate

c) Consultant

d) Energetic

The correct answer is ‘compassionate’. Both these words imply being considerate and caring of someone else’s circumstances.

Question 30.

Tom and Jane have a blue car and a yellow car. Which of the following two statements prove that Tom usually drives the red car?

a) Sarah prefers to drive the red car.

b) The blue car is bigger than the red car.

c) The red car is older than the blue car.

d) Tom usually drives the smaller car.

e) Tom likes to drive fast.

The correct answer is (b) and (d). The key statement is that Tom usually drives the smaller car (d) and statement (b) indicates the smaller car is the red car.

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Question 31.

What word is most alike in definition to ‘enigma’?

a) Edible

b) Enemy

c) Inexplicable

d) Incomplete

The correct answer is ‘Inexplicable’. Enigma refers to an unexplainable or very puzzling event or challenge.

Question 32.

Which pair of words have a similar relationship as the words ‘Jacket : Sleeve’?

a) Trousers : Shoes

b) Pistol : Knife

c) Body : Arm

d) Quiet : Loud

The correct answer is ‘Body : Arm’. A sleeve is part of a jacket just as an arm is part of a body.

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Question 33.

Which pair of words have a similar relationship as the words ‘Marketer : Advertisement’

a) Musician : Song

b) Magician : Costume

c) Stripper : Money

d) Police : Law

The correct answer is ‘Musician : Song’. A Marketer creates advertisements as a musician creates songs.

Question 34.

Which pair of words have a similar relationship as the words ‘Artist : Paintbrush’

a) Musician : Song

b) Teacher : Whiteboard

c) Farmer : House

d) Fire : Heat

The correct answer is ‘Teacher : Whiteboard’. An artist uses a paintbrush to create art as a teacher uses a whiteboard to teach.

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Question 35.

On a hypothetical space station, humans can talk to venetians, but not to martians or neptunians. Martians can't talk to humans but can talk to venetians and neptunians. Neptunians can talk to martians but not to venetians or humans. Venetians can only talk to neptunians.

If a human wants to get a message to a martian, what chain of communication would fit the above rules?

a) Human to Martian

b) Human to Neptunian to Martian

c) Human to Venetian to Neptunian to Martian

d) Human to Neptunian to Venetian to Martian

The correct answer is (c). This can quickly be answered as it is the only option that satisfies the very first statement that humans can only talk to venetians. We can then check the rest of the rules fit to double check the full chain of communication!

Question 36.

The word 'incognito' is most similar in meaning to which word below:

a) Inside

b) Persistent

c) Incongruous

d) Disguised

The correct answer is 'Disguised'. Incognito means to conceal or disguise one's identity.

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Question 37.

The word ‘grow’ is to ‘enlarge’ as ‘assimilate’ is to:

a) Learn

b) Shrink

c) Accelerate

d) Think

The correct answer is ‘learn’. Grow and enlarge are both words that imply getting bigger. They have a common *meaning*. Assimilate and learn are also both words similar in meaning. They imply understanding new information.

Question 38.

Which two statements prove that Molly has five white cars?

a) Molly has seven red cars.

b) Molly has five green cars.

c) Molly has two less white cars than she has red cars.

d) Molly has red cars, white cars and green cars.

e) Molly has less white cars than red cars.

The correct answer is statements (a) and (c). By these two statements we can see that the total of white cars equals seven minus two. This equals five. In questions like this, look for the statements that are proving the exact NUMBERS. Statement (e) for example, certainly indicates less cars but has no real information on numbers - so is therefore not relevant to our purpose.

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Question 39.

Which three statements prove that Lauren exercises before work?

a) Lauren exercises at 7.00am every morning.

b) Lauren always exercises for one hour exactly.

c) Lauren often exercises at the gym at her workplace.

d) Lauren starts work after taking a shower.

e) Lauren takes one shower a day.

f) Lauren takes a shower after exercising.

The correct answer is (d) (e) and (f). These last three statements prove that Lauren exercises, then takes a shower and then starts work. So therefore she always exercises before work. In this question, the statement (a) is a red herring. This certainly indicates that Lauren exercises at the beginning of the day. However, with no information on what time Lauren starts work, this statement is irrelevant to our purpose in determining the order of her schedule.

Question 40.

There are two logical pairs of words below. Which word does not form one of the pairs?

a) Lunch

b) Ball

c) Sandwich

d) Foot

e) Box

The correct answer is (c). The other words form the pairs: Lunchbox and Football.

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CHAPTER THREE

ENGLISH SKILLS

Questions 1 and 2.

Read the following paragraph carefully and answer questions 1 and 2.

In 1997, the Kent forest ranger reported a dramatic increase in animal boldness. It was observed that the once timid deer now roam the roads built into the forest which may have resulted in a rise in animal related accidents. Dr. Smith, an expert in wild animal behaviour was called in to investigate the reason for this anomaly. Further studies conducted by Dr. Smith resulted in his conclusion that the ever decreasing animal habitat is due to human encroachment.

Based on the above, answer the following questions:

Question 1. The nearest meaning of the word *encroachment* is

a. Independence
b. Intrusion
c. Infusion
d. Induction

Question 2. The following statement – Deer have caused more accidents than any other wild animals – is

a. True
b. False
c. Not enough data to know

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Question 3.

The word ‘ironic’ means:

a) Made of iron
b) An amusing coincidence
c) The opposite outcome of what was expected
d) A time period between 1200 BC and 1000 BC

Question 4.

“Not ready for the task ahead.” Which of the following words best suits this definition?

a) FULSOME
b) UNPREPARED
c) VULNERABLE
d) FEARFUL

Question 5.

Inaugurate and End have:

a) Similar meanings
b) Contradictory meanings
c) Neither similar or contradictory meanings

Question 6.

Which of the following words is out of place:

a) Reserved
b) Reticent
c) Boisterous
d) Quiet

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Question 7, 8, 9 ,10.

Read the following passage and then choose the best answer in the following four questions:

"Parenting is a highly contentious issue. There is no shortage of books, blogs, experts and opinions on how to parent. One recently published book, "Parentonomics', by Joshua Gans, offers a refreshing perspective on this popular theme. Gans is an economist and his views on parenting a closely tied to his training in addressing economic challenges and problems. Among other topics, Gans cautions against reliance on incentives and the potential risks when children attempt to manipulate events. One example of this being an older sister helping to toilet train her younger brother. As she received rewards when her brother made a successful toilet stop, she then started giving him additional drinks of water! One of the more controversial implications in the book is that many things we do as parents may not have the impact we think."

Question 7.

Parenting is described as 'highly contentious'. This means it is:

a) that when people talk about it, other people want to talk about it too.
b) a complicated topic
c) likely to cause arguments
d) boring to most people

Question 8.

Why is the older sister giving her younger brother additional drinks of water?

a) To make him go to the toilet more.
b) To reward him for going to the toilet.
c) Because he is going to the toilet.
d) There is no way to tell.

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Question 9.

The article implies there is how much advice available on the topic on parenting?

a) None
b) A little bit
c) A lot
d) There is no information on this.

Question 10.

The last sentence in the article implies that:

a) Everything parents do contributes to a child's development.
b) Actions parents take can have little or unintended consequences.
c) Parents don't think about the impact they have on children.
d) Parents don't think about their actions enough.

Question 11.

Which word in the following sentence is spelled with an incorrect meaning:

"If that's not there car, I'll be very surprised and they'll be even more surprised."

a) that's
b) there
c) surprised
d) they'll

Question 12.

Which word in the following sentence is spelled with an incorrect meaning:

"I'd like to try all the different flavours of ice-cream accept for macadamia"

a) I'd
b) different
c) flavours
d) accept

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Question 13.

Which word in the following sentence is spelled with an incorrect meaning:

"If your not sure about the enrolment procedure, my advise is to ask the school counsellor."

a) enrolment
b) procedure
c) advise
d) counsellor

Question 14.

Which part in this sentence is incorrect?

"Do you want to come with Jane and I down to the station?"

a) Do you want
b) to come with
c) Jane and I
d) down to the station?

Question 15.

Which word in the following sentence is spelled with an incorrect meaning:

"I know you didn't have time to finish writing your account. Can you just tell me long has it been since you arrived at the seen?"

a) didn't
b) since
c) account
d) seen

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Question 16.

Choose which word should fill in the blank:

"Tim and Gretel are flying _____ tomorrow night."

a) oversees
b) overseas
c) oversize
d) overtly

Question 17.

Choose which word should fill in the blank:

"I want you to provide a _____ of your actions to me in writing"

a) summer
b) summery
c) summarise
d) summary

Question 18.

Choose which word should fill in the blank:

"I looked around the house and quickly located the _____ in the front window"

a) hole
b) whole
c) brake
d) broken

Question 19.

"I saw the car drive over the curb and towards the house. I could tell that a collision was _____ ."

a) imminent
b) eminent
c) concluded
d) determined

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Question 20.

Replace the underlined component of this sentence with the appropriate word from the four choices presented.

"I thought that Hercules was full of great ideas in his plan to become stronger."

a) ingenuous
b) ingenious
c) inadvertent
d) accidental

Question 21.

Replace the underlined component of this sentence with the appropriate word from the four choices presented.

"Running increases the pain in my ankle joint if I don't warm up properly."

a) annoys
b) aggregates
c) aggravates
d) aggrivates

Question 22.

Michael's girlfriend warned him that if he kept sending messages to his ex-girlfriend on Facebook, she would give him the flick.

a) slap him on the face
b) end the relationship
c) give a rude gesture
d) stop warning him

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Question 23.

Abdul's job was to criticise strongly any actions taken that were unbecoming of a police recruit at the academy.

a) censure
b) censor
c) sensor
d) centre

Question 24.

Consider the following two sentences:
1) At 'Slick Raceway' the safety of motorcycle racers is of utmost importance.
2) 'Slick Raceway' offers a free motorcycle safety course to all competitors on the race track.

What does the second sentence do?
a) It shows that motorcycle safety is important.
b) It explains why motorcycle safety is important at 'Slick Raceway'.
c) It disproves the first sentence.
d) It gives evidence of the statement in the first sentence.

Question 25.

Consider the following two sentences:
1) Stacey has a keen interest in aviation.
2) Stacey loves to fly helicopters.

What does the second sentence do?
a) It offers further detail on the first sentence.
b) It has no link to the first sentence.
c) It explains the first sentence.
d) It shows that helicopters are part of aviation.

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Question 26.

Consider the following two sentences:

1) Michael unholstered his firearm.

2) Michael assessed the threat being made to his life as life-threatening.

What does the second sentence do?

a) It authenticates the first sentence.

b) It offers justification for the action in the first sentence.

c) It shows that Michael was scared.

d) It shows that Michael always pulls out his firearm when threatened.

Question 27.

Consider the following two sentences:

1) Andrew is taking additional english lessons after school.

2) Andrew is excellent at maths and science, but his english skills are poor.

What does the second sentence do?

a) It explains the first sentence

b) It proves the first sentence

c) It is explained by the first sentence.

d) It shows that Andrew is getting better at english.

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Questions 28, 29, 30, 31, 32.

Read the following paragraph and then answer the multiple choice questions that follow:

A research group in Geelong called the HALEY FOUNDATION conducted a study four years ago that monitored the crime rate of the Sunny Hill during the entire years of 2008 and 2009. The researchers noticed that Ripton Street endured prolific rates of traffic offences compared with the rest of the area. Additionally, they found that most offences were detected during the hours 7pm till 2am each night of the week.

In regards to the incidents of burglary in the area, researchers found no pattern within the area. All streets were marginally affected by such crimes. Mark Barry, a who lives on Burton Street, stated, “I think it is good that there are more young families moving in to the area and people are more active exercising around the neighbourhood. It seems a very safe place to live.”

Assaults in the Sunny Hill area occurred most frequently on Thursday, Friday and Saturday nights. Demographically, the majority of offenders and victims were aged between 18 and 25 years. In 2009 there were less assaults reported but a higher number of people were charged with circumstances of aggravation. This was, in almost all cases, due to weapons such as smashed bottles and belts being used. Sarah Thompson stated, “I think it’s due to all the drugs people are taking these days. They feel like they really need to hurt someone and so they pick up whatever they can find.”

The HALEY FOUNDATION intend to conduct another study for a similar period of time commencing in 2014.

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Question 28.

In 2010 police reviewed this information and took action to address the most frequently occurring offences. It is likely that police:

a) Increased police traffic patrols during morning and afternoon rush hour.

b) Increased police traffic patrols during the evenings.

c) Placed signs around the neighbourhood advising people to “Keep their houses locked and to report suspicious behaviour.”

d) Continued with existing patrol patterns.

Question 29.

What length of time is the next study anticipated to be?

a) Four years.

b) Two years.

c) One year.

d) Not possible to determine..

Question 30.

The assaults occurring on Friday night were likely to happen at:

a) NIghtclubs.

b) In persons homes.

c) On the street as a result of road rage.

d) Not possible to determine.

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Question 31.

Sarah Thompson thinks that:

a) People are going out on Friday night to get into fights.

b) People are using objects as weapons because they are taking drugs.

c) There were less assaults because of drug use.

d) None of the above.

Question 32.

Burglary effects the majority of Sunny Hill residents.

a) True

b) False

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ENGLISH SKILLS - ANSWERS AND EXPLANATIONS

Questions 1 and 2.

Read the following paragraph carefully and answer questions 1 and 2.

In 1997, the Kent forest ranger reported a dramatic increase in animal boldness. It was observed that the once timid deer now roam the roads built into the forest which may have resulted in a rise in animal related accidents. Dr. Smith, an expert in wild animal behaviour was called in to investigate the reason for this anomaly. Further studies conducted by Dr. Smith resulted in his conclusion that the ever decreasing animal habitat is due to human encroachment.

Based on the above, answer the following questions:

Question 1. The nearest meaning of the word *encroachment* is

a. Independence
b. Intrusion
c. Infusion
d. Induction

This type of question involves the reader's ability to get the meaning of a word from context. Take note that the word encroachment as used in the sentence was the reason for a decrease in the animal habitat. In this sense, we try to evaluate the given choices.

Would *independence* cause the decrease in the animal habitat? No.
Would *intrusion*? Probably.
Would *infusion*? No.
Would *induction*? No.

Only choice **b. Intrusion** gave us the probable meaning of the word encroachment so it is our answer.

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Question 2. The following statement – Deer have caused more accidents than any other wild animals – is

a. True
b. False
c. Not enough data to know

We should base our answer in what is contained in the paragraph. Take note that there was no comparison between deer and other wild animals so we can safely say that the given statement is neither true nor false and our answer is (**c).**

Question 3.
The word 'ironic' means:

a) Made of iron
b) An amusing coincidence
c) The opposite outcome of what was expected
d) A time period between 1200 BC and 1000 BC

The correct answer is c) The opposite outcome of what was expected. It would be ironic for a traffic policeman to have his license cancelled because he didn't pay a speeding fine.

Question 4.
"Not ready for the task ahead." Which of the following words best suits this definition?

a) FULSOME
b) UNPREPARED
c) VULNERABLE
d) FEARFUL

The correct answer is b) UNPREPARED. FULSOME means insincere, VULNERABLE means susceptible to damage and FEARFUL means to be afraid.

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Question 5.

Inaugurate and End have:

a) Similar meanings
b) Contradictory meanings
c) Neither similar or contradictory meanings

The correct answer is b). Contradictory meanings. Inaugurate means to open or start. End means to close or finish.

Question 6.

Which of the following words is out of place:

a) Reserved
b) Reticent
c) Boisterous
d) Quiet

The correct answer is c) Boisterous. All other words are similar. If you don't understand a certain word in these type of questions, you can usually work out the answer with what you do know. In this case, you can see that 'Reserved' and 'Quiet' are similar and that 'Boisterous' is the opposite of these. So even if the word 'Reticent' is new to you, you have already isolated 'Boisterous' as the answer.

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Question 7, 8, 9 ,10.

Read the following passage and then choose the best answer in the following four questions:

"Parenting is a highly contentious issue. There is no shortage of books, blogs, experts and opinions on how to parent. One recently published book, "Parentonomics', by Joshua Gans, offers a refreshing perspective on this popular theme. Gans is an economist and his views on parenting a closely tied to his training in addressing economic challenges and problems. Among other topics, Gans cautions against reliance on incentives and the potential risks when children attempt to manipulate events. One example of this being an older sister helping to toilet train her younger brother. As she received rewards when her brother made a successful toilet stop, she then started giving him additional drinks of water! One of the more controversial implications in the book is that many things we do as parents may not have the impact we think."

Question 7.

Parenting is described as 'highly contentious'. This means it is:

a) that when people talk about it, other people want to talk about it too.
b) a complicated topic
c) likely to cause arguments
d) boring to most people

The answer is c). Contentious means that people have different opinions and viewpoints and these differences can clash and cause friction.

Question 8.

Why is the older sister giving her younger brother additional drinks of water?

a) To make him go to the toilet more.
b) To reward him for going to the toilet.
c) Because he is going to the toilet.
d) There is no way to tell.

The answer is a). She is giving him water with the intent of making him go to the toilet. As she receives a reward when he successfully goes to the toilet.

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Question 9.

The article implies there is how much advice available on the topic on parenting?

a) None
b) A little bit
c) A lot
d) There is no information on this.

The answer is c). The article states "*There is no shortage of books, blogs, experts and opinions on how to parent."* This sentence means there are a lot of different types of advice available on parenting.

Question 10.

The last sentence in the article implies that:

a) Everything parents do contributes to a child's development.
b) Actions parents take can have little or unintended consequences.
c) Parents don't think about the impact they have on children.
d) Parents don't think about their actions enough.

The answer is b). The end of the sentence is "*many things we do as parents may not have the impact we think."* This means that the impact of parenting on children has less impact or a different impact that what is expected by parents.

Question 11.

Which word in the following sentence is spelled with an incorrect meaning:

"If that's not there car, I'll be very surprised and they'll be even more surprised."

a) that's
b) there
c) surprised
d) they'll

The correct answer is b). The sentence is referring to possession / ownership of a car. So the correct spelling should be 'their'. The spelling 'there' is used when something is 'over there'.

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Question 12.
Which word in the following sentence is spelled with an incorrect meaning:

"I'd like to try all the different flavours of ice-cream accept for macadamia"

a) I'd
b) different
c) flavours
d) accept

The correct answer is d). Accept means "to agree to" and the correct spelling here is the word 'except' as in to make an exception. To exclude macadamia.

Question 13.
Which word in the following sentence is spelled with an incorrect meaning:

"If your not sure about the enrolment procedure, my advise is to ask the school counsellor."

a) enrolment
b) procedure
c) advise
d) counsellor

The correct answer is c). You can 'advise' someone to do something, but you give 'advice'. So the correct spelling is 'advice'. The word enrolment is a red herring in the question. Enrolment is spelled with two 'l's in America but with one 'l' in Australia.

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Question 14.

Which part in this sentence is incorrect?

“Do you want to come with Jane and I down to the station?”

a) Do you want
b) to come with
c) Jane and I
d) down to the station?

The correct answer is c). When to use “Jane and I” and “Jane and me” is often confused. The simplest way to be grammatically correct is to imagine the sentence with only yourself. So for example, if you took Jane out of the sentence above it would say:

“Do you want to come with **I** down to the station?”

Hopefully, this stands out to you as incorrect! In this it should read:

“Do you want to come with **me** down to the station?”

Here is an example of when “Jane and I” would be correct:

“**Jane and I** are going down to the station. Do you want to come too?”

(“**I am** going down to the station. Do you want to come too?”)

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Question 15.

Which word in the following sentence is spelled with an incorrect meaning:

"I know you didn't have time to finish writing your account. Can you just tell me long has it been since you arrived at the seen?"

a) didn't
b) since
c) account
d) seen

The correct answer is d). We are talking about a physical 'scene'. The spelling 'seen' refers to "Have you seen the movie?"

Question 16.

Choose which word should fill in the blank:
"Tim and Gretel are flying _____ tomorrow night."

a) oversees
b) overseas
c) oversize
d) overtly

The correct answer is b). This is the spelling of overseas as in traveling 'over the sea'. The closest word 'oversees' means to be viewing a project or event. For example, "Anya will oversee the new development project."

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Question 17.

Choose which word should fill in the blank:

"I want you to provide a _____ of your actions to me in writing"

a) summer
b) summery
c) summarise
d) summary

The correct answer is d). 'provide a summary'.
The first two incorrect options refer to the season of summer. The third incorrect choice 'summarise' is the correct context but does not fit the sentence. As 'summarise' is the verb.

Question 18.

Choose which word should fill in the blank:

"I looked around the house and quickly located the _____ in the front window"

a) hole
b) whole
c) brake
d) broken

The correct answer is a). 'The hole in the front window.' The other incorrect choices are:
'whole' - Something in its entirety. The whole window.
'brake' - The front brake on the bike.
'broken' - The window was broken.

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Question 19.

"I saw the car drive over the curb and towards the house. I could tell that a collision was _____ ."

a) imminent
b) eminent
c) concluded
d) determined

The correct answer is imminent. The sentence is implying a collision is about to happen between the car and another object (possibly the house). The imminent means that it is 'about to happen'.

Question 20.

Replace the underlined component of this sentence with the appropriate word from the four choices presented.

"I thought that Hercules was full of great ideas in his plan to become stronger."

a) ingenuous
b) ingenious
c) inadvertent
d) accidental

The correct answer is b). Ingenious meaning to think of a great idea or display some form of intellectual brilliance.

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Question 21.

Replace the underlined component of this sentence with the appropriate word from the four choices presented.

"Running increases the pain in my ankle joint if I don't warm up properly."

a) annoys
b) aggregates
c) aggravates
d) aggrivates

The correct answer is c) aggravate. This is the correct spelling of "aggravate" that means "to make something worse". This fits the phrase "increases the pain in" the best of all options.

Question 22.

Michael's girlfriend warned him that if he kept sending messages to his ex-girlfriend on Facebook, she would give him the flick.

a) slap him on the face
b) end the relationship
c) give a rude gesture
d) stop warning him

The correct answer is b). The phrase, in the context of a relationship, means to end the relationship. As in flicking something away. To get rid of it. Even if you've not heard this phrase you can garner the likely meaning from the rest of the sentence!

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Question 23.

Abdul's job was to criticise strongly any actions taken that were unbecoming of a police recruit at the academy.

a) censure
b) censor
c) sensor
d) centre

The correct answer is a) censure. This means literally to "criticise strongly". The closely related word "censor" means to remove unacceptable behaviour or material. This is not the meaning of the above statement.

Question 24.

Consider the following two sentences:
1) At 'Slick Raceway' the safety of motorcycle racers is of utmost importance.
2) 'Slick Raceway' offers a free motorcycle safety course to all competitors on the race track.

What does the second sentence do?
a) It shows that motorcycle safety is important.
b) It explains why motorcycle safety is important at 'Slick Raceway'.
c) It disproves the first sentence.
d) It gives evidence of the statement in the first sentence.

The correct answer is (d). Offering a course on safety shows that 'Slick Raceway' is taking tangible action to demonstrate their value on racer safety.

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Question 25.

Consider the following two sentences:

1) Stacey has a keen interest in aviation.

2) Stacey loves to fly helicopters.

What does the second sentence do?

a) It offers further detail on the first sentence.

b) It has no link to the first sentence.

c) It explains the first sentence.

d) It shows that helicopters are part of aviation.

The correct answer is (a). If Stacey is interested in aviation, then the fact she loves flying helicopters shows a more specific component of her interest in aviation. As helicopters are a small component of the larger field of aviation.

Question 26.

Consider the following two sentences:

1) Michael unholstered his firearm.

2) Michael assessed the threat being made to his life as life-threatening.

What does the second sentence do?

a) It authenticates the first sentence.

b) It offers justification for the action in the first sentence.

c) It shows that Michael was scared.

d) It shows that Michael always pulls out his firearm when threatened.

The correct answer is (b). The hypothetical implication is that Michael unholstered his firearm in response to a life-threatening hazard. It is presenting a specific circumstance. So it does not show that Michael was scared of that he always pulls out his firearm. Also, it does not authenticate the first sentence. Authentication would be another sentence that proves the first sentence.

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Question 27.

Consider the following two sentences:

1) Andrew is taking additional english lessons after school.

2) Andrew is excellent at maths and science, but his english skills are poor.

What does the second sentence do?

a) It explains the first sentence

b) It proves the first sentence

c) It is explained by the first sentence.

d) It shows that Andrew is getting better at english.

The correct answer is (a). It is logical that Andrew is taking additional english classes because his english skills are poor. Be careful of similarly worded options. In this case, option (c) sounds very similar but is incorrect as the second sentence is not **explained by** the first. It **explains** the first (option (a)).

Questions 28, 29, 30, 31, 32.

Read the following paragraph and then answer the multiple choice questions that follow:

A research group in Geelong called the HALEY FOUNDATION conducted a study four years ago that monitored the crime rate of the Sunny Hill during the entire years of 2008 and 2009. The researchers noticed that Ripton Street endured prolific rates of traffic offences compared with the rest of the area. Additionally, they found that most offences were detected during the hours 7pm till 2am each night of the week.

In regards to the incidents of burglary in the area, researchers found no pattern within the area. All streets were marginally affected by such crimes. Mark Barry, a who lives on Burton Street, stated, “I think it is good that there are more young families moving in to the area and people are more active exercising around the neighbourhood. It seems a very safe place to live.”

Assaults in the Sunny Hill area occurred most frequently on Thursday, Friday and Saturday nights. Demographically, the majority of offenders and victims were aged between 18 and 25 years. In 2009 there were less assaults reported but a higher number of people were charged with circumstances of aggravation. This was, in almost all cases, due to weapons such as smashed

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bottles and belts being used. Sarah Thompson stated, “I think it’s due to all the drugs people are taking these days. They feel like they really need to hurt someone and so they pick up whatever they can find.”

The HALEY FOUNDATION intend to conduct another study for a similar period of time commencing in 2014.

Question 28.

In 2010 police reviewed this information and took action to address the most frequently occurring offences. It is likely that police:

a) Increased police traffic patrols during morning and afternoon rush hour.

b) Increased police traffic patrols during the evenings.

c) Placed signs around the neighbourhood advising people to “Keep their houses locked and to report suspicious behaviour.”

d) Continued with existing patrol patterns.

The prolific traffic problems between 7pm and 2am indicate that this is a high offender rate. Therefore it is logical that police act during the evenings to target the additional offences during these times.

Question 29.

What length of time is the next study anticipated to be?

a) Four years.

b) Two years.

c) One year.

d) Not possible to determine.

The initial study was during the complete years 2008 and 2009. This equals two years duration. This is what is referred to as a ‘similar period of time.’

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Question 30.

The assaults occurring on Friday night were likely to happen at:

a) NIghtclubs.

b) In persons homes.

c) On the street as a result of road rage.

d) Not possible to determine.

There is no information presented on the location of assaults. The fact that there are a lot of young persons involved does not prove any specific location.

Question 31.

Sarah Thompson thinks that:

a) People are going out on Friday night to get into fights.

b) People are using objects as weapons because they are taking drugs.

c) There were less assaults because of drug use.

d) None of the above.

Sarah's comments follow the sentence talking about people using belts and smashed bottles more often in 2009. It is reasonable that she is talking about the nature of assaults when she talks about people wanting to hurt someone and picking things up.

Question 32.

Burglary effects the majority of Sunny Hill residents.

a) True

b) False

Burglary is referred to as a marginal effect on the community. This means a small effect.

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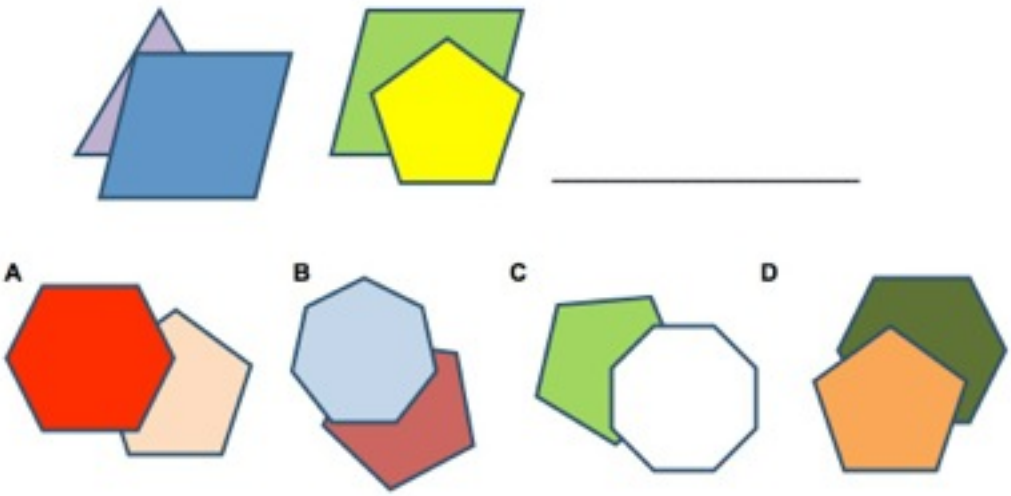
CHAPTER FOUR

ABSTRACT REASONING

Question 1.

What comes next?



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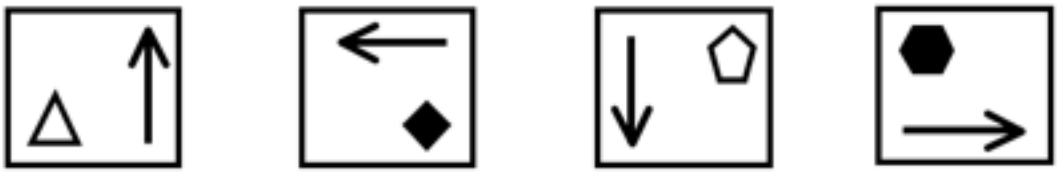
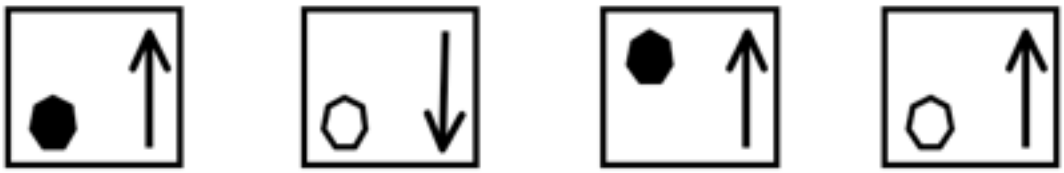
Question 2.

Examine the patterns below.



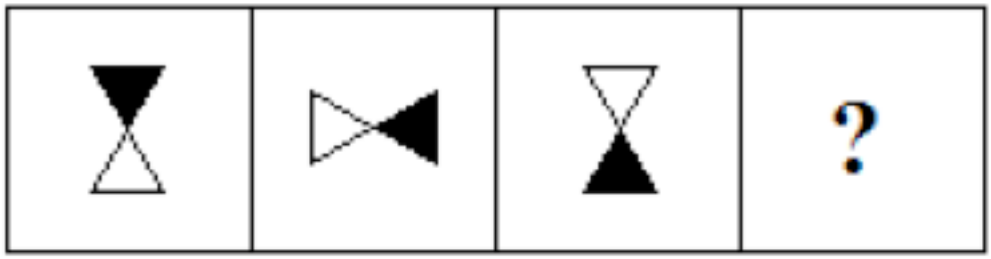
Which of the following boxes is next in the sequence?

(A) (B) (C) (D)



Question 3.

Select the next picture to the following sequence:



a)

b)

c)

d)

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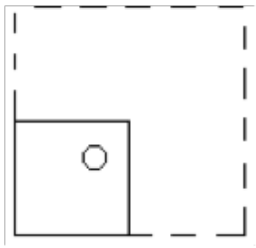
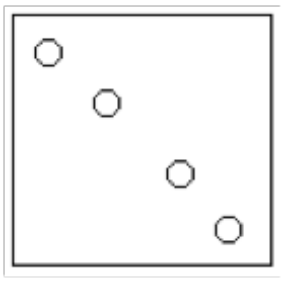
Question 4.

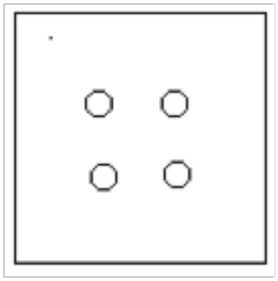
The picture below shows a piece of paper folded down into a quarter of its original size. Select the appropriate option of what this piece of paper would look like unfolded.



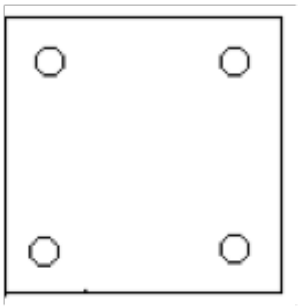
a)



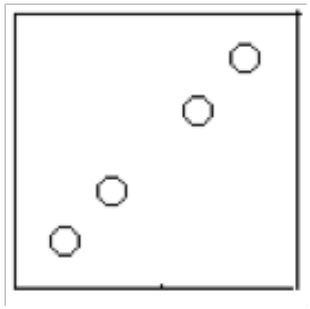
b)



c)



d)



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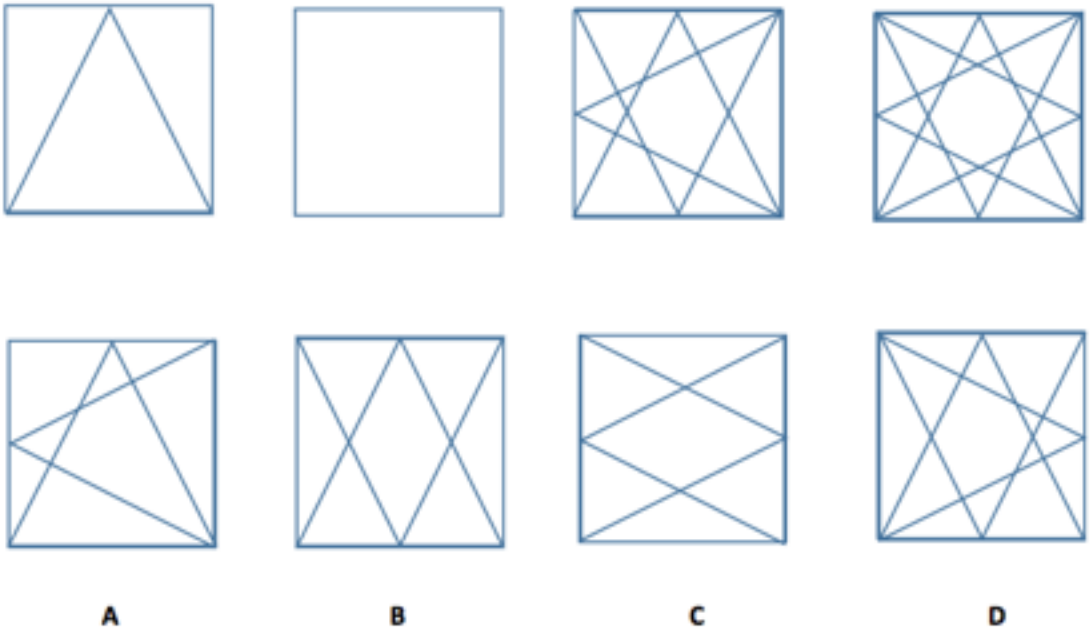
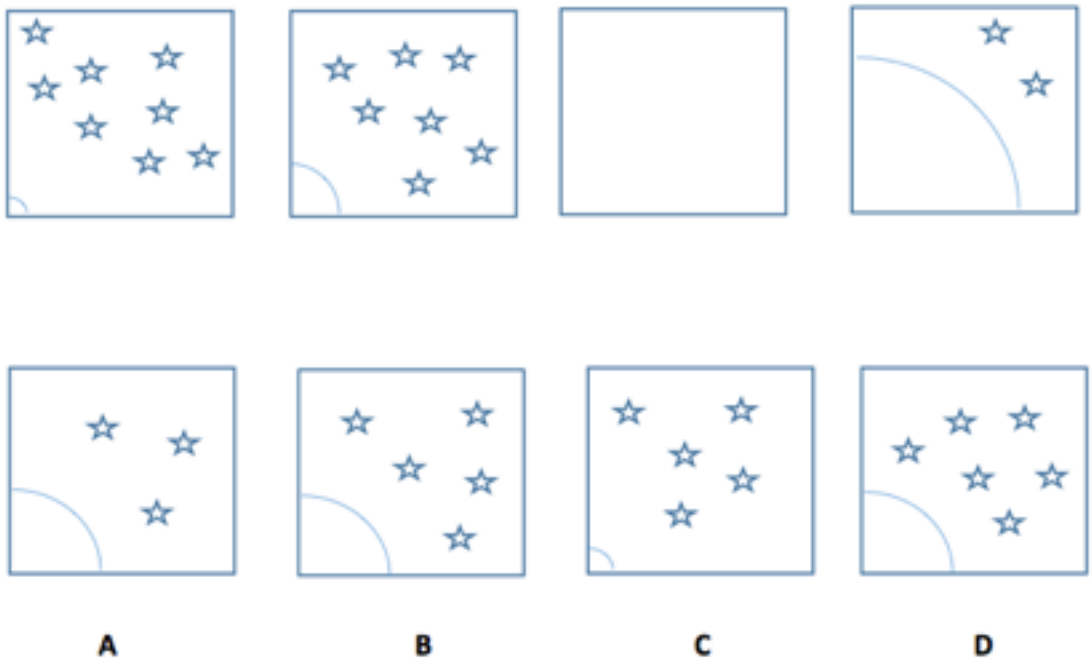
Question 5.

In the top row there should be four squares arranged in order, but one square has moved one row down. Which square has left its place?



Question 6.

In the top row there should be four squares arranged in order, but one square has moved one row down. Which square has left its place?



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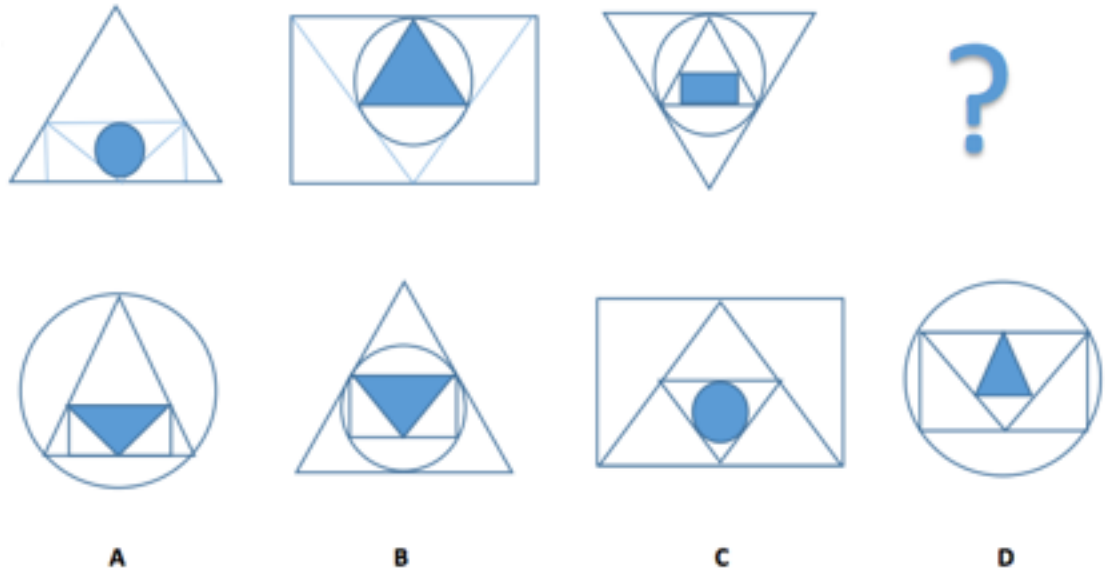
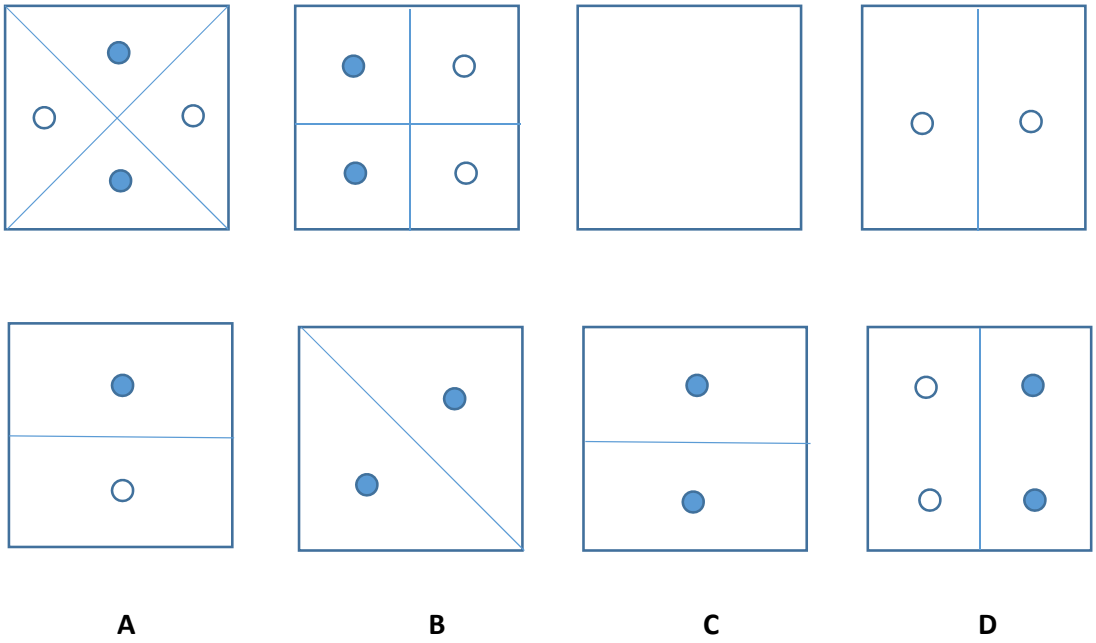
Question 7.

In the top row there should be four squares arranged in order, but one square has moved one row down. Which square has left its place?



Question 8.

All the shapes on the first row have a few common characteristics. Which shape on the second row is best fit to fill the gap?



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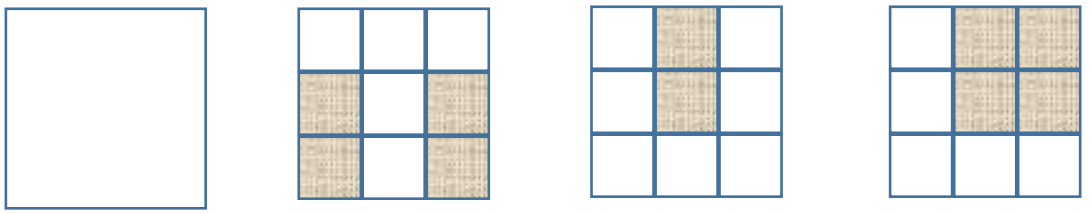
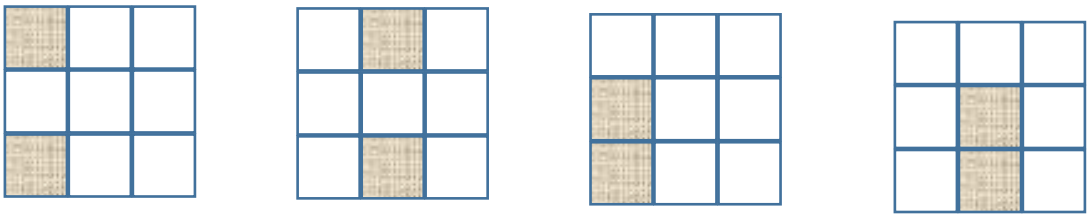
Question 9.

All the shapes on the first row have a few common characteristics. Which shape on the second row is best fit to fill the gap?

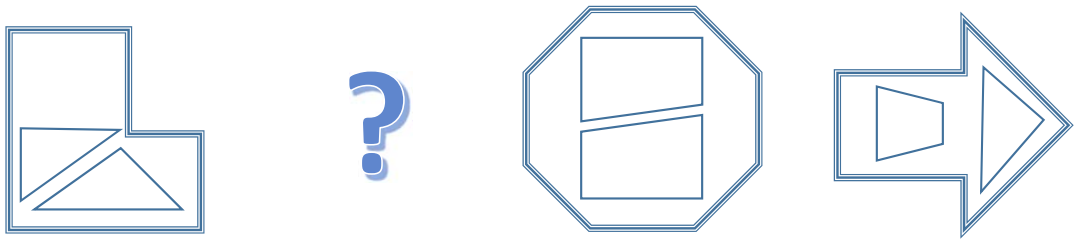


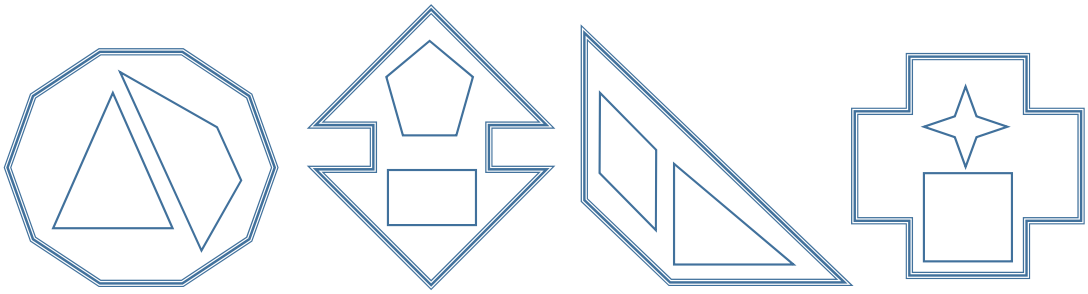


A B C D

Question 10.

All the shapes on the first row have a few common characteristics. Which shape on the second row is best fit to fill the gap?





A B C D

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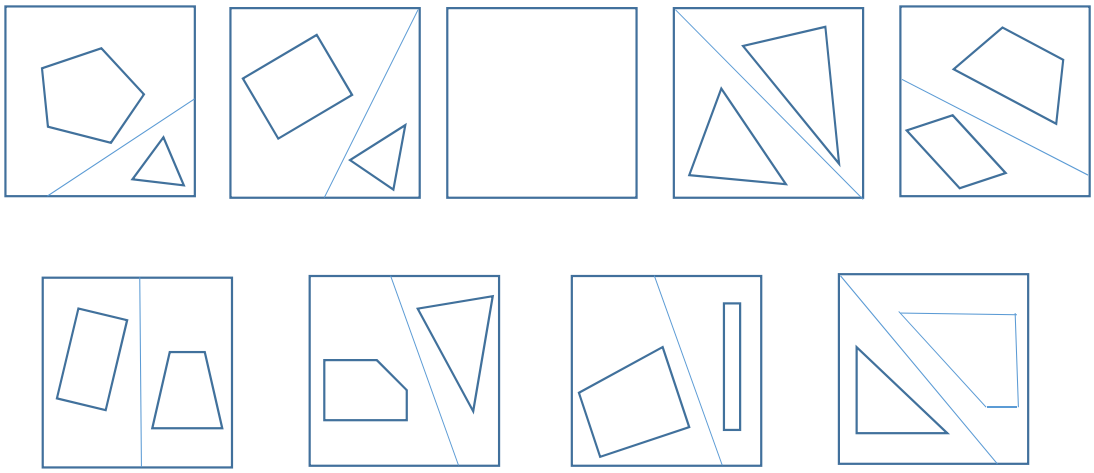
Question 11.

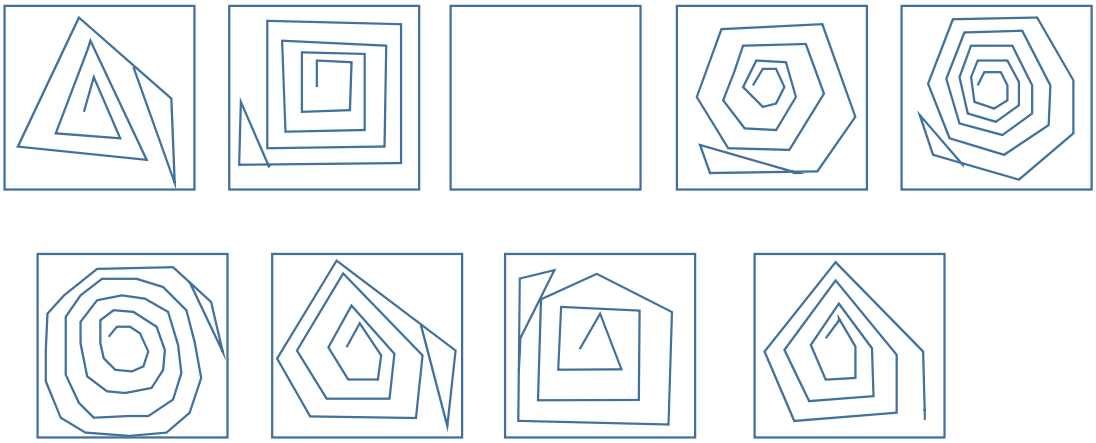
All the shapes on the first row have a few common characteristics. Which shape on the second row is best fit to fill the gap?



A B C D

Question 12.

All the shapes on the first row have a few common characteristics. Which shape on the second row is best fit to fill the gap?



A B C D

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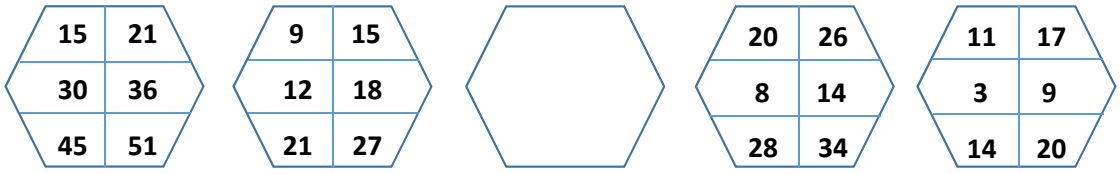
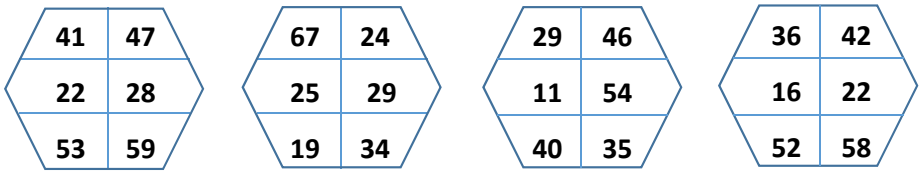
Question 13.

All the shapes on the first row have a few common characteristics. Which shape on the second row is best fit to fill the gap?

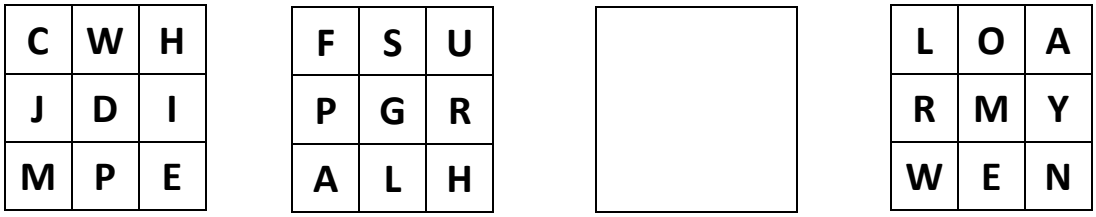


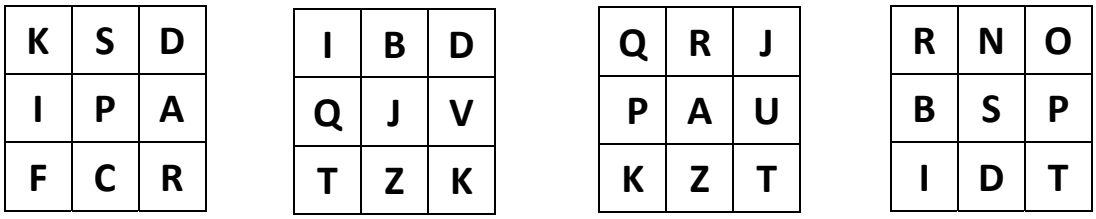


A B C D

Question 14.

Discover the rule and complete the sequence with the appropriate shape.





A B C D

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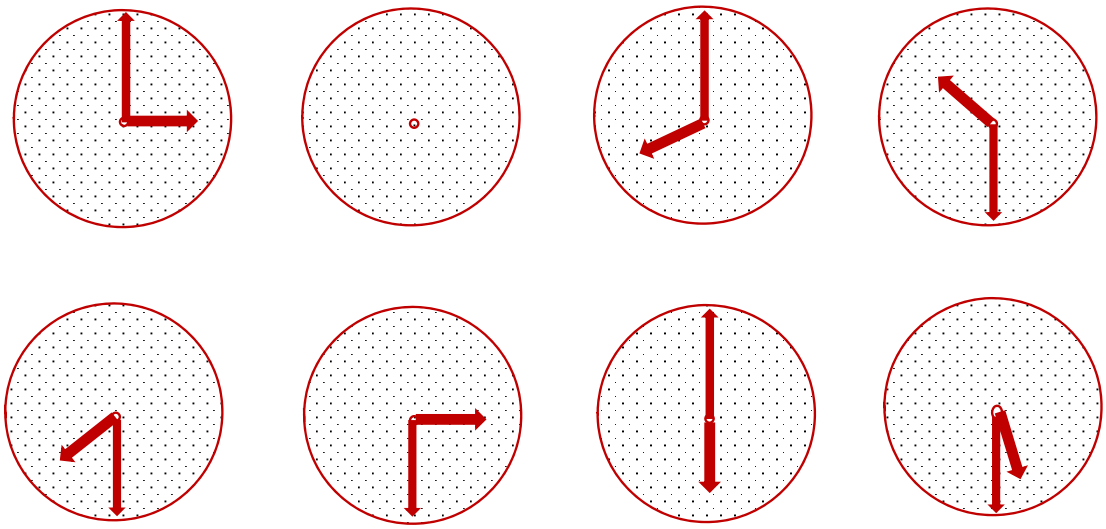
Question 15.

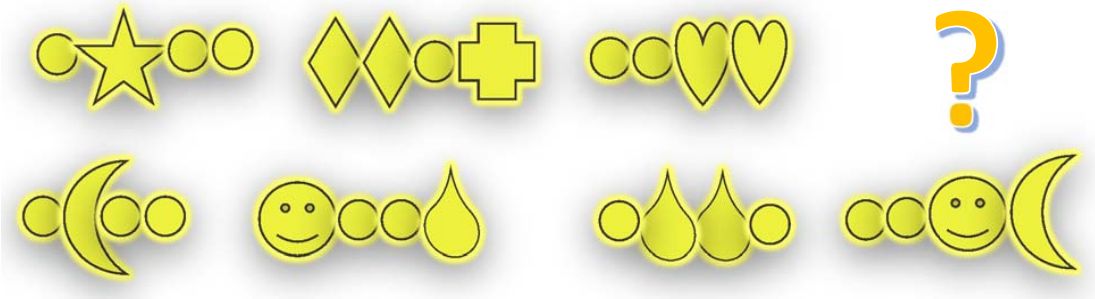
Discover the rule and complete the sequence with the appropriate shape.



A B C D

Question 16.

Discover the rule and complete the sequence with the appropriate shape.



A B C D

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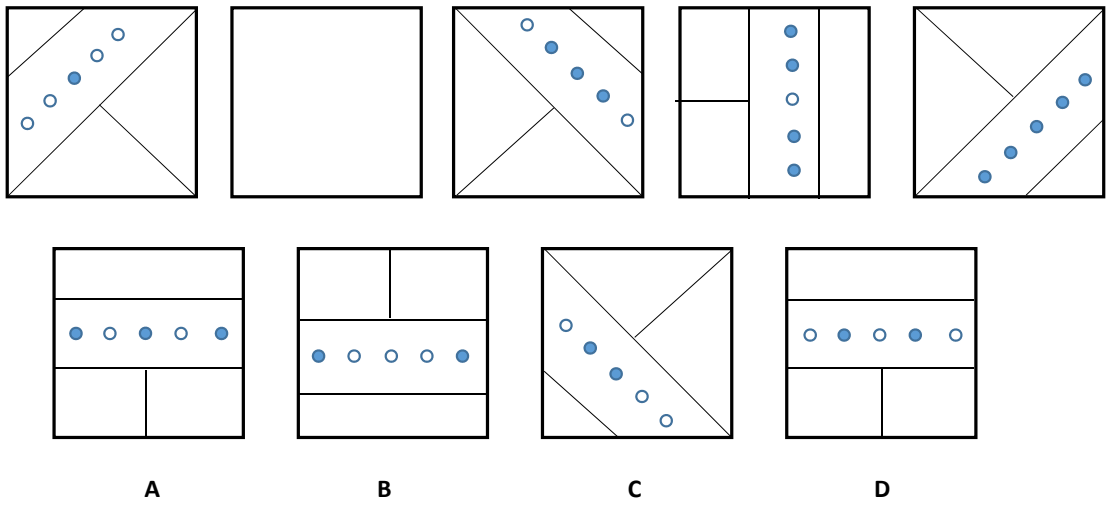
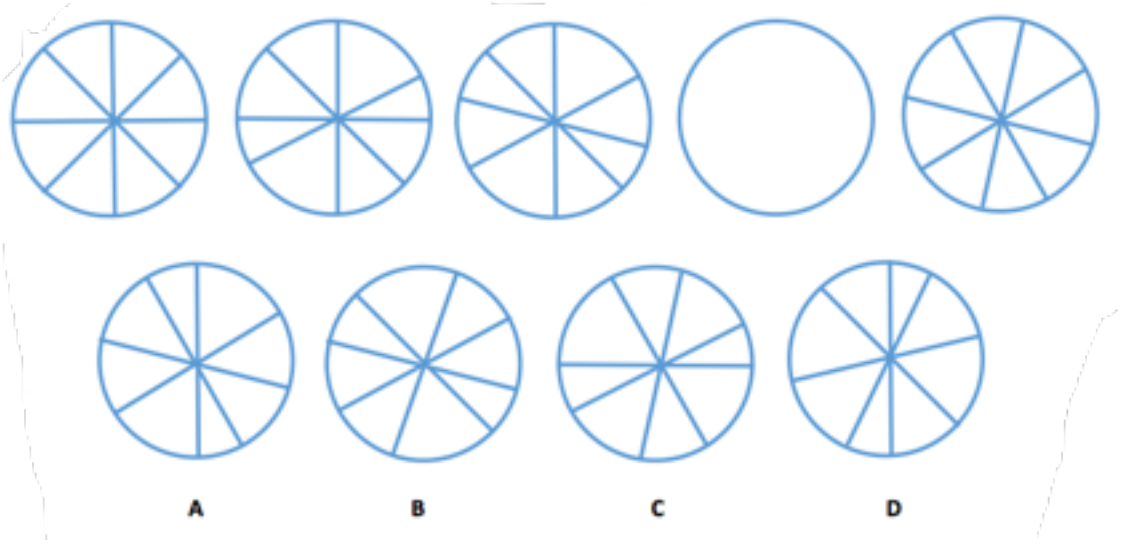
Question 17.

Discover the rule and complete the sequence with the appropriate shape.



Question 18.

Discover the rule and complete the sequence with the appropriate shape.



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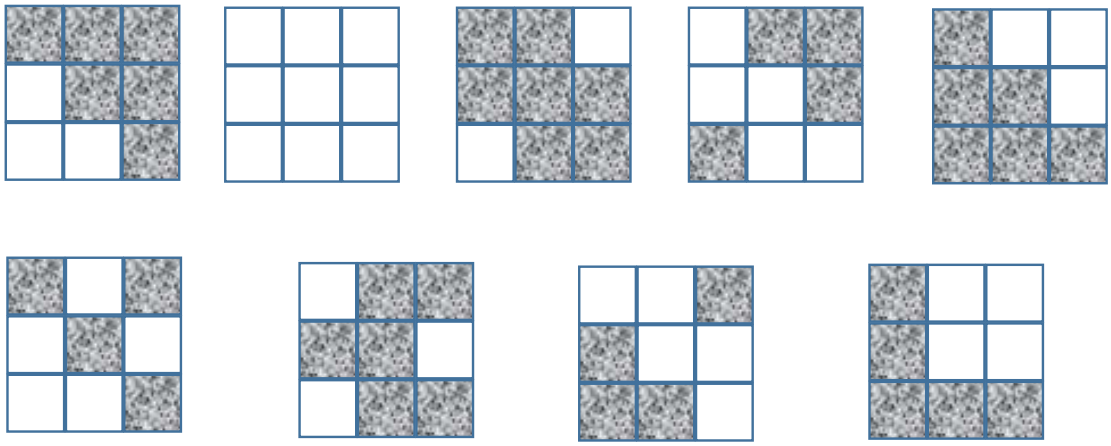
Question 19.

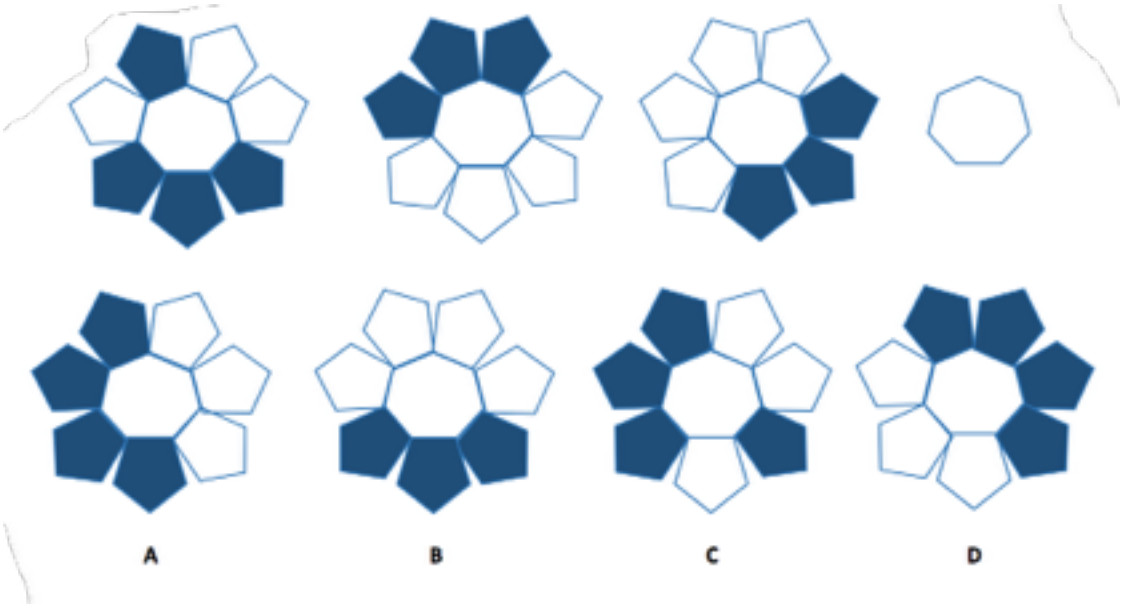
Discover the rule and replace the blank grid in the sequence with the appropriate shape.



A B C D

Question 20.

Identify the movement pattern of the coloured figures on the upper row, then complete the sequence with the right choice from the bottom row.



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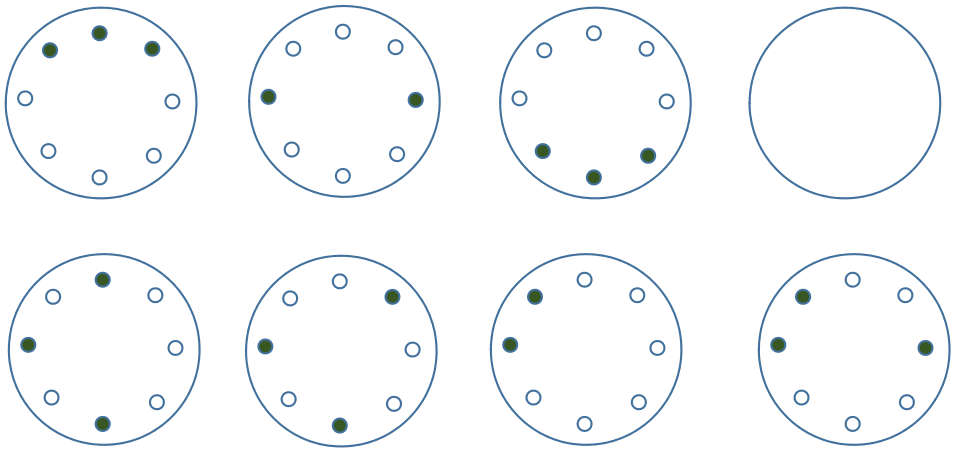
Question 21.

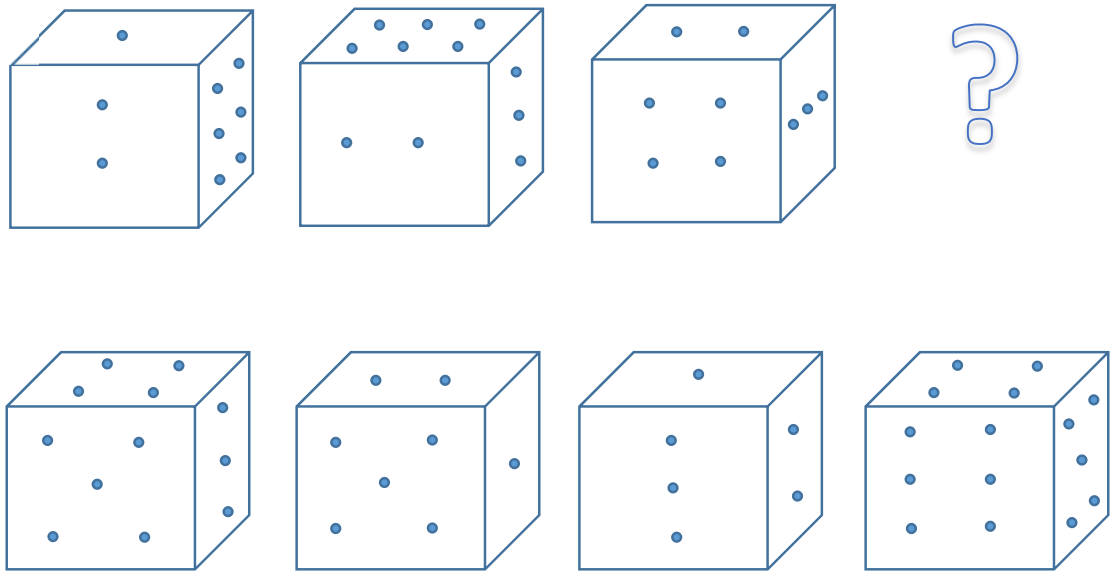
Identify the movement pattern of the coloured figures on the upper row, then complete the sequence with the right choice from the bottom row.



A B C D

Question 22.

The images on the top row show the same die, seen from different angles. Which of the images on the bottom row is also an angle of that die?



A B C D

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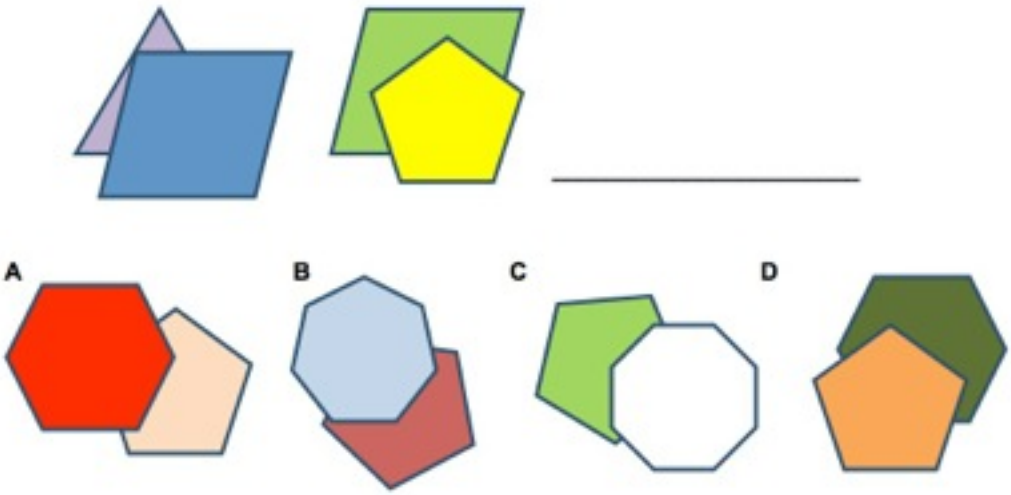
ABSTRACT REASONING - ANSWERS AND EXPLANATIONS

Question 1.

What comes next?



This is a simple abstract reasoning problem. We have shapes that continue to have more sides as we go on the series. With problems of this type we also have to look at other patterns such as colours, rotation, and placement of the figures that may have a bearing on our choice.

The first two figures are a triangle and a parallelogram. The next two figures are a pentagon and a parallelogram. We now have an obvious pattern and we need a pentagon and a hexagon for our next figures. We can now eliminate choices **B** and **C** because the other figures aside from the pentagon are a heptagon in **B** and an octagon in **C.**

The choices left for us are **A** and **D;** both with the needed figures of a pentagon and a hexagon. We now look for other patterns that will fit the series. It appears that there is no colour or rotation pattern. The other pattern we can use is the placement of the figures. We note that the figures with fewer sides are placed behind the figure with more sides. Using this other pattern, we get (**A)** as our answer.

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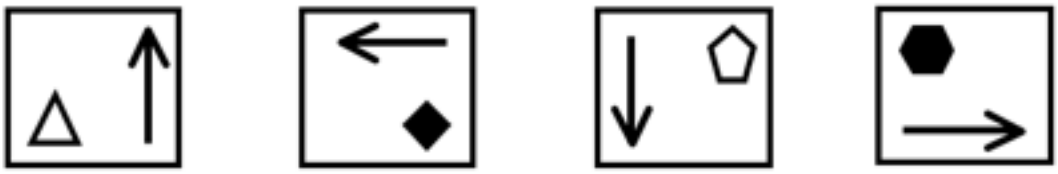
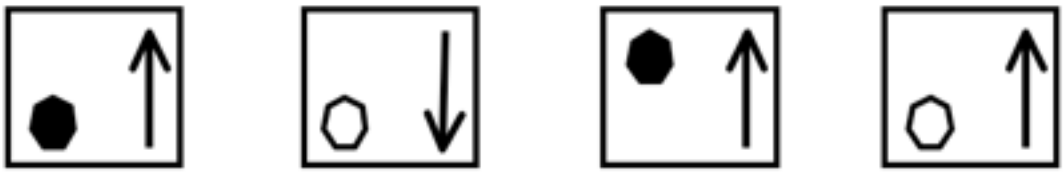
Question 2.

Examine the patterns below.



Which of the following boxes is next in the sequence?

(A) (B) (C) (D)



The correct answer is (D). Both the arrow and the shape are moving anti-clockwise in the sequence. The shape is hollow and filled alternatively, so a hollow shape follows.

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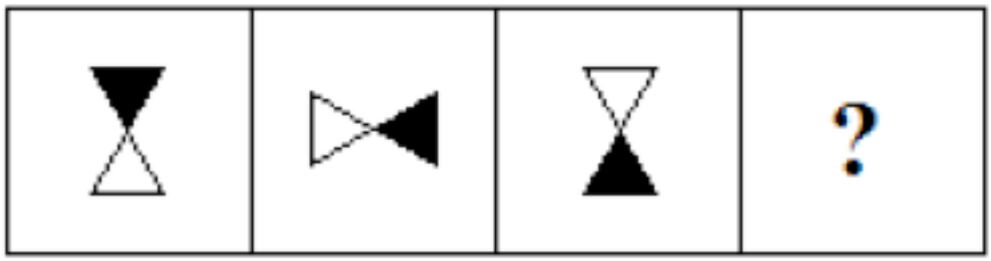
Question 3.

Select the next picture to the following sequence:



a)

b)

c)

d)

The correct answer is d). The image is rotating clockwise.

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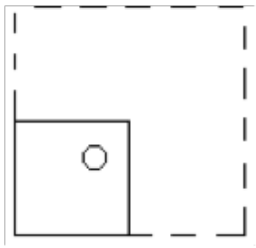
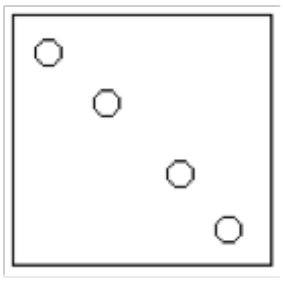
Question 4.

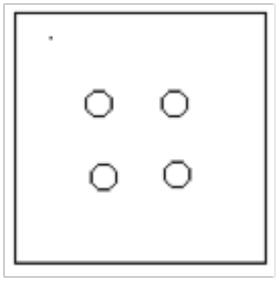
The picture below shows a piece of paper folded down into a quarter of its original size. Select the appropriate option of what this piece of paper would look like unfolded.



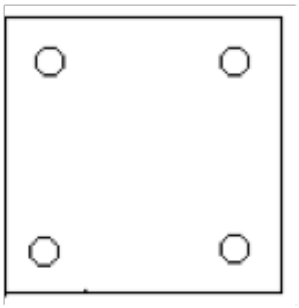
a)



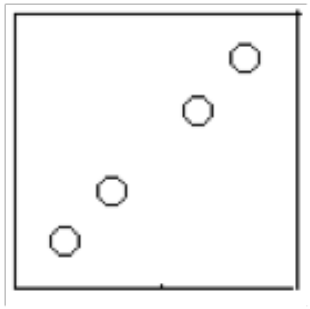
b)



c)



d)



The correct answer is the picture displayed at b). Any corner quarter of this picture would show the paper folded into a quarter of its size.

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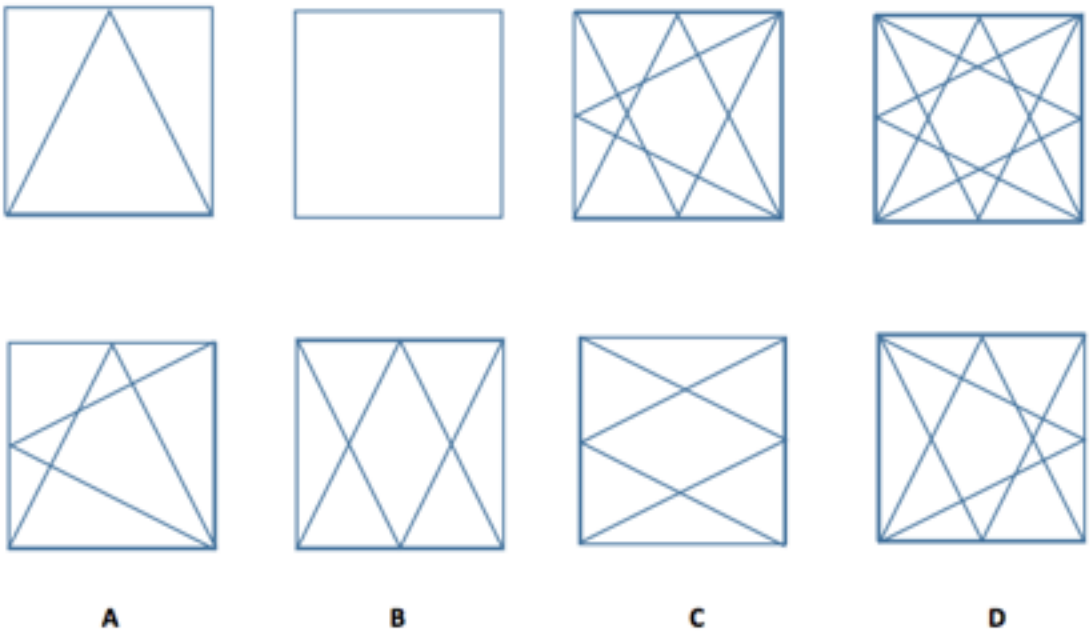
Question 5.

In the top row there should be four squares arranged in order, but one square has moved one row down. Which square has left its place?



The answer is A.

Each square in the upper row contains a number of triangles. In the first square there is a triangle, in the third there are three, in the fourth there are four. Consequently, in the second one there should be two triangles, which leaves us with A, B and C as possible answers. However, we notice that each triangle is added counter-clockwise, positioned at 90 degrees from the previous one. This means the second square should contain a triangle pointing at 0 degrees and another one pointing at 270 degrees. Only A fulfils these criteria, so it is the correct answer.

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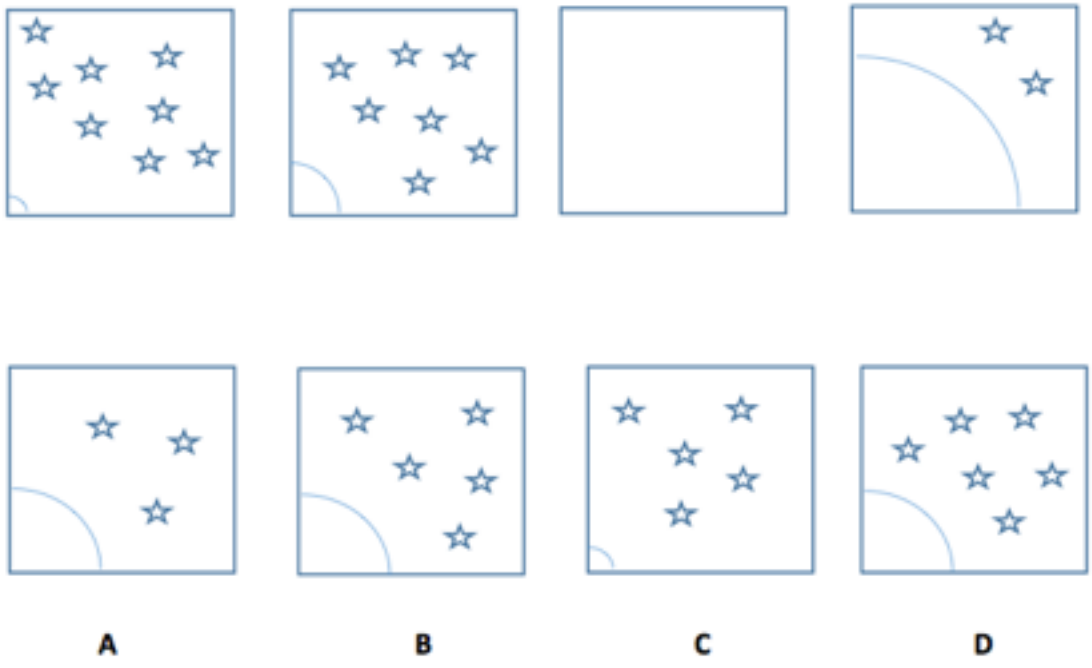
Question 6.

In the top row there should be four squares arranged in order, but one square has moved one row down. Which square has left its place?



The answer is B.

In the upper row, the sun is rising and the stars are disappearing. The disk should be increasingly

visible, so the missing square can be A, B or D. However, we must notice a pattern in the number

of disappearing stars. In the first square there are 8, in the second one there are 7, while the

fourth contains only 2 stars. The only possible pattern is that the number of disappearing stars

increases by one with each square. We start with 8 stars in the first square.

8-1=7 (the number of stars in the second square)

7-2=5 (the number of stars in the third square)

5-3=2 (the number of stars in the fourth square)

So the third square should contain 5 stars, which means that the correct answer is B.

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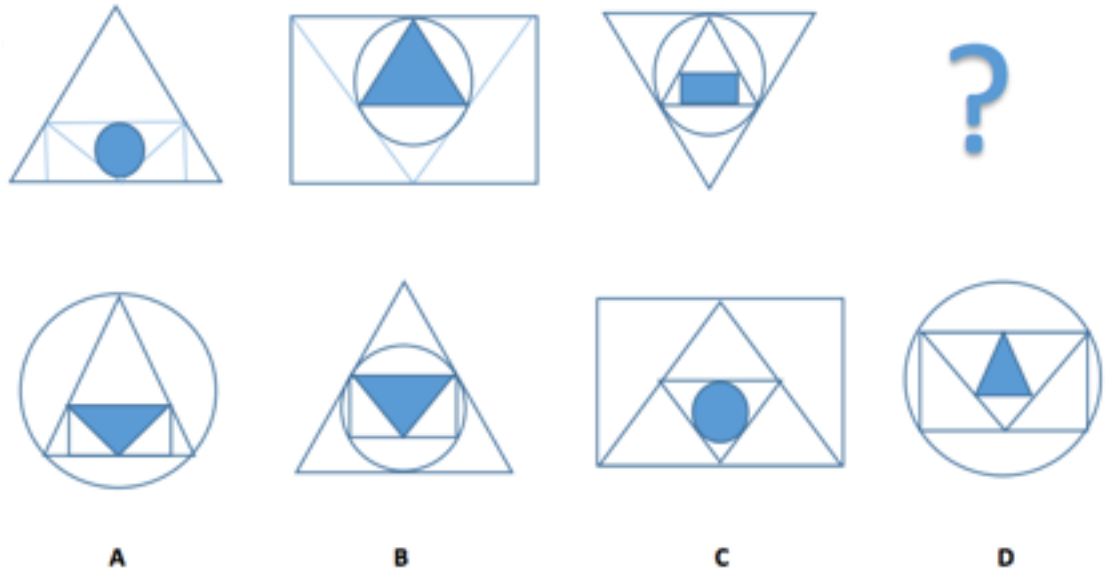
Question 7.

In the top row there should be four squares arranged in order, but one square has moved one row down. Which square has left its place?



The answer is A.

The secret to solving this question lays in the order of the shapes in each image, from large to small. If we look at the first image, we will notice that the order is triangle △, rectangle ▭, upside down triangle ▽, circle ○. Each shape moves one step forward, while the first, largest shapes goes to the back of the string. So, the next order will be rectangle ▭, upside down triangle ▽, circle ○and then triangle △. Following this pattern, the fourth image should start with a circle and end with an upside down triangle, which means that the solution is A.

Another way we could approach this question is by observing the order of the large shapes, respectively that of the small shapes in each image. The large shapes are triangle, rectangle, upside down triangle, which means the fourth one should be a circle, so the possible answers are A and D. Additionally, the small, filled shapes are circle, triangle, rectangle, so only the upside down triangle is missing. Only A contains a filled upside down triangle, so A is the correct answer.

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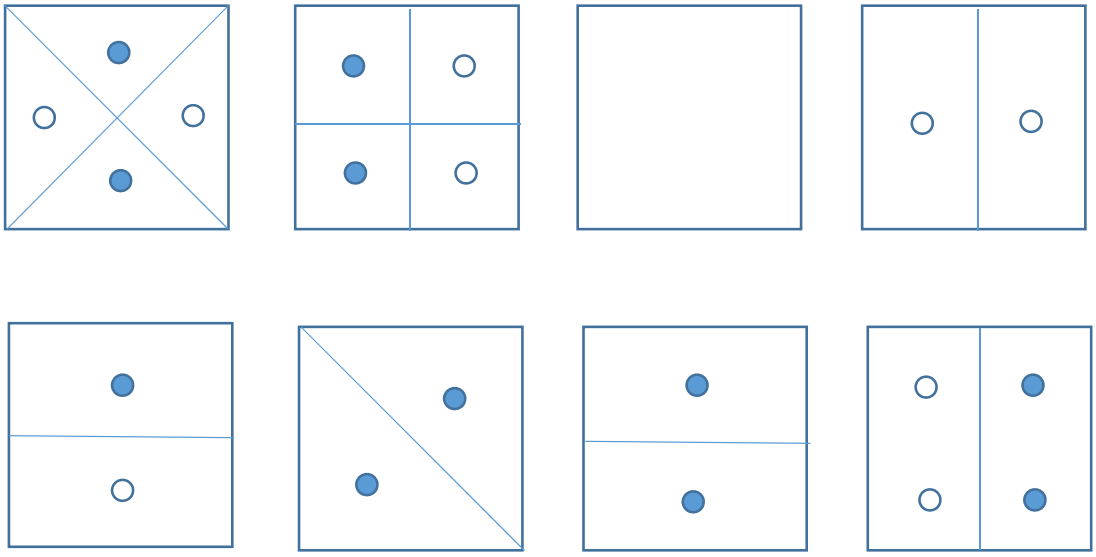
Question 8.

All the shapes on the first row have a few common characteristics. Which shape on the second row is best fit to fill the gap?



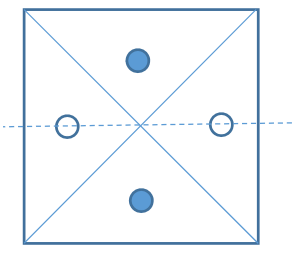
A B C D

The answer is C.

The main common feature of the shapes on the upper row is symmetry. All the squares are symmetrical across their horizontal axis (that is, if you fold the square across that axis, you will have two identical halves).

However, not all of them are symmetrical in respect to their vertical or diagonal axes. Only C and D are symmetrical in a similar way to the squares on the upper row.

Moreover, each compartment of a square must contain only one dot, while D contains two, so it cannot be the right shape. That leaves us with C as the correct answer.



(Horizontal mirror symmetry shown above; the dash represents the horizontal (or *x*–) axis of symmetry.)

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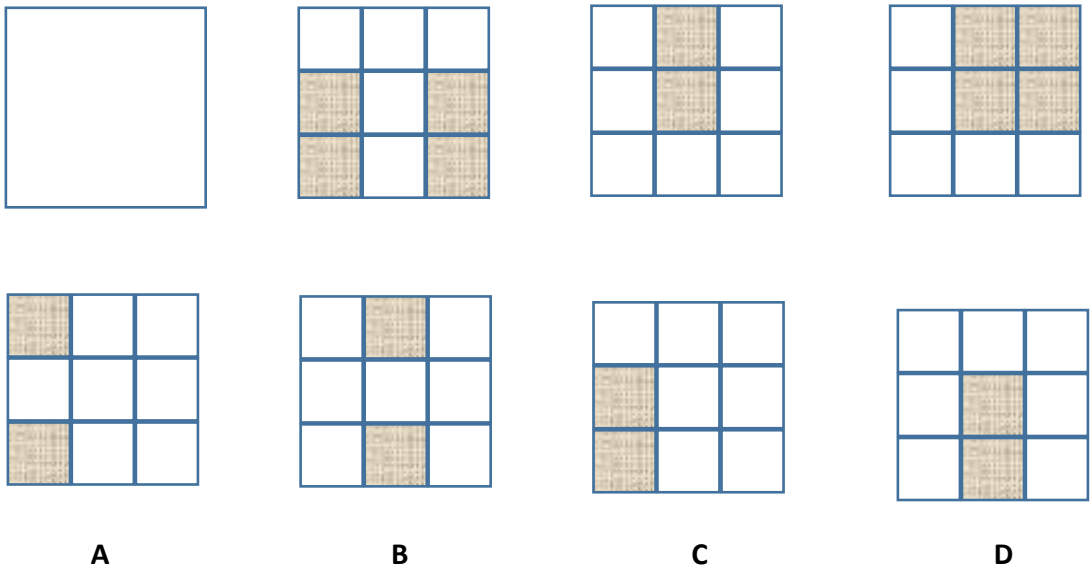
Question 9.

All the shapes on the first row have a few common characteristics. Which shape on the second row is best fit to fill the gap?



A B C D

The answer is B.

This question is very easy to solve once you observe what the three shapes on the first row have in common; that is, the empty small squares form capital letters. The second shape is a 'T', the third is a 'U' and the fourth is 'L'. Among the options, only B is also a letter – 'H' – so it is the correct answer.

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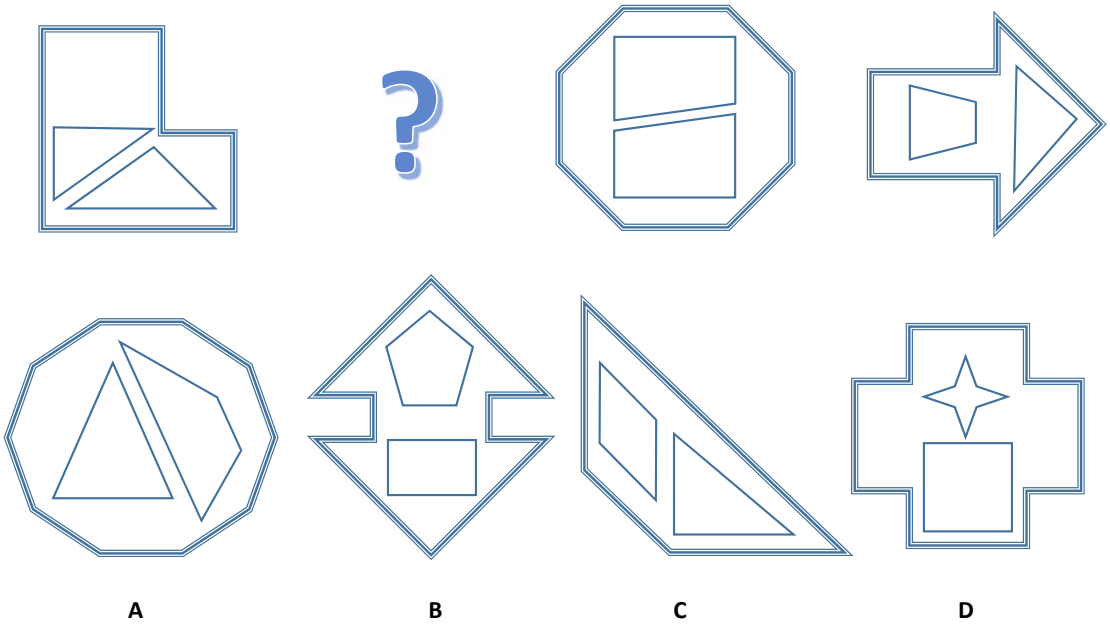
Question 10.

All the shapes on the first row have a few common characteristics. Which shape on the second row is best fit to fill the gap?



The answer is D.

Weird as these shapes may seem, the ones on the top row have one thing in common: each big shape has the same number of sides as the little shapes inside together. For example, the first shape has six sides, and it contains two triangles – three sides each, so six sides together. This applies to all the other.

However, on the second row only one shape fulfils this condition, and that is D. The cross has 12 sides, and it contains an 8–side star and a square. 8 + 4 = 12, so D is the correct answer.

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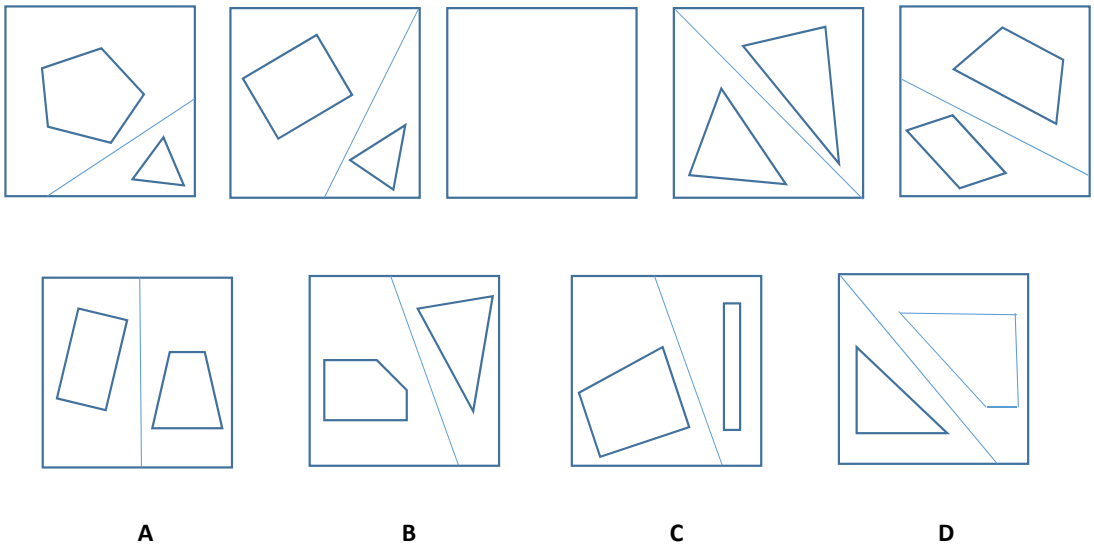
Question 11.

All the shapes on the first row have a few common characteristics. Which shape on the second row is best fit to fill the gap?



The answer is C.

Let's jot down a few common characteristics of the shapes on the first row.

1. The bottom of the line in each square moves to the right and then up. The shapes that fulfil this criterion are B, C and D.

2. The top of the line moves counter-clockwise. In the empty square, the top of the line should be at less than 45^{o} (as it is in the second square), but more than 315^{o} (as it appears in the fourth square). The shapes that fulfil this criterion are A, B and C.

3. Each compartment of the square contains a shape that has the same number of sides as the compartment itself. The shapes that fulfil this criterion are A, C and D.

Only square C fulfils all the criteria above, so it is the correct answer.

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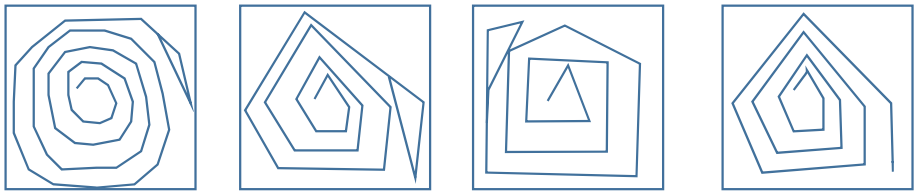
Question 12.

All the shapes on the first row have a few common characteristics. Which shape on the second row is best fit to fill the gap?



A B C D

The answer is B.

Here are the common characteristics of the shapes on the upper row:

1. – They are helicoidal shapes that make use of a single geometrical pattern – they start from either a square, or a triangle, or a hexagon, but not multiple of them at a time – so variant C, which uses multiple patterns, cannot be the answer.

2. – Also, they come in ascendant order, according to the number of sides the original shape has. The order is 3, 4, 5, 6 and 7, so in the third square we need a helix whose base is a pentagonal form. This means image A is not an option.

3. – Finally, all the shapes end in a triangle. The only pentagon-like image that also end in a triangle is B, so this is the correct answer.

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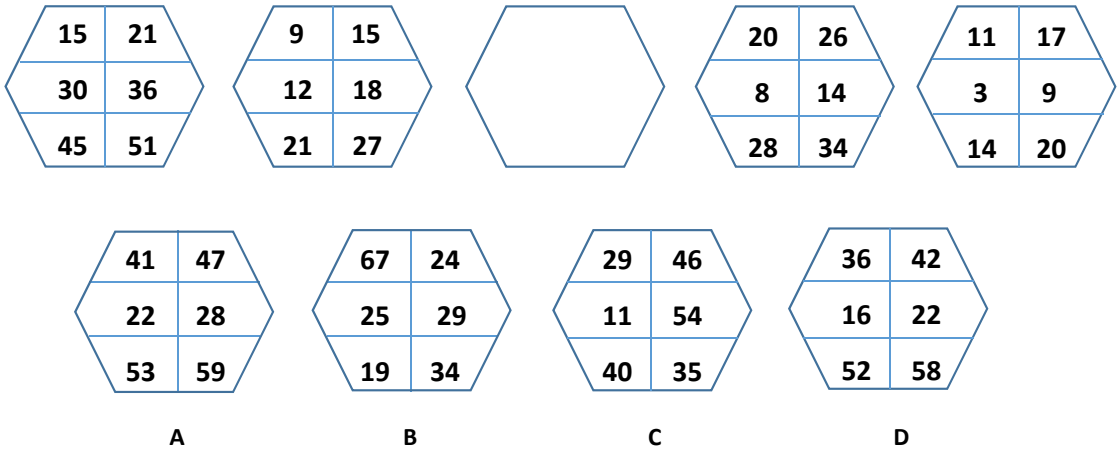
Question 13.

All the shapes on the first row have a few common characteristics. Which shape on the second row is best fit to fill the gap?



The answer is D.

What the shapes on the first row have in common is the relationship between their numbers. The first column in each hexagon contains two numbers and their sum: 15 + 30 = 45, 9 + 12 = 21 etc. The second column contains the numbers obtained by adding 6 to the ones on the first column: 15 + 6 = 21, 30 + 6 = 36, 45 + 6 = 51 etc.

On the second row, hexagons C and D fulfil the first condition: when added, the first two numbers on their left column give the third number: 29 + 11 = 40, 36 + 16 = 52.

Also, A and D meet the second criterion: the numbers on the second column are the ones on the first column plus 6: 41 + 6 = 47, 36 + 6 = 42 etc.

We can see that only D fulfils both criteria, so it is the correct answer.

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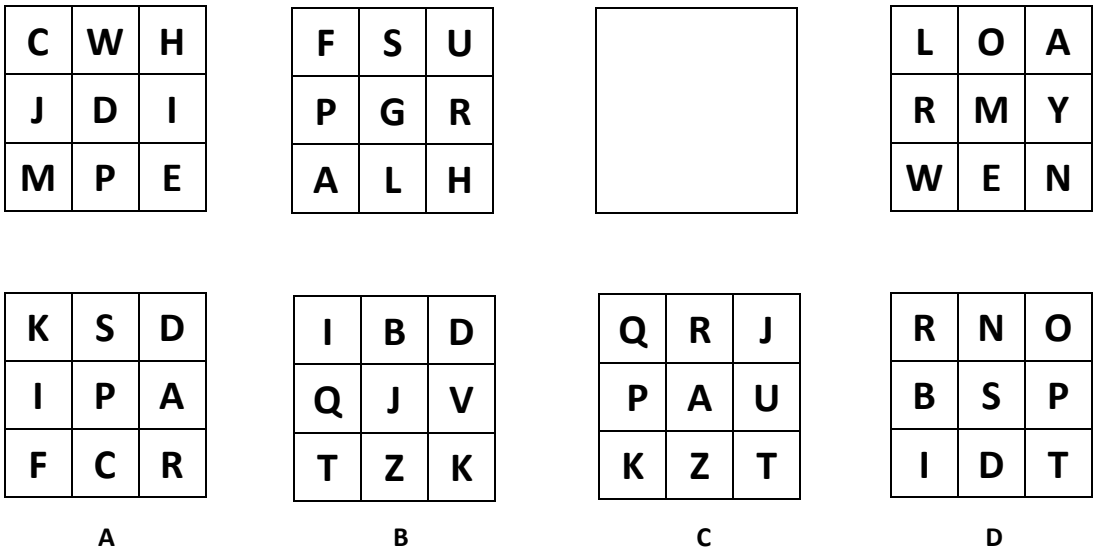
Question 14.

Discover the rule and complete the sequence with the appropriate shape.



The answer is B.

Solving this question requests the ability to find a rule in chaos. Each grid on the upper row contains mixed up letters. However, some of the letters are in alphabetical order: the ones on the top–to–bottom, left–to–right diagonal. The first grid reads CDE, the second one, FGH, and the third one contains the letters LMN.

If we look on the bottom row, we see that B and D also have alphabetically ordered letters on the said diagonal. But only the letters in B are also in order with the letters on the other grids. Consequently, the order would be CDE–FGH–IJK–LMN. So B is the correct answer.

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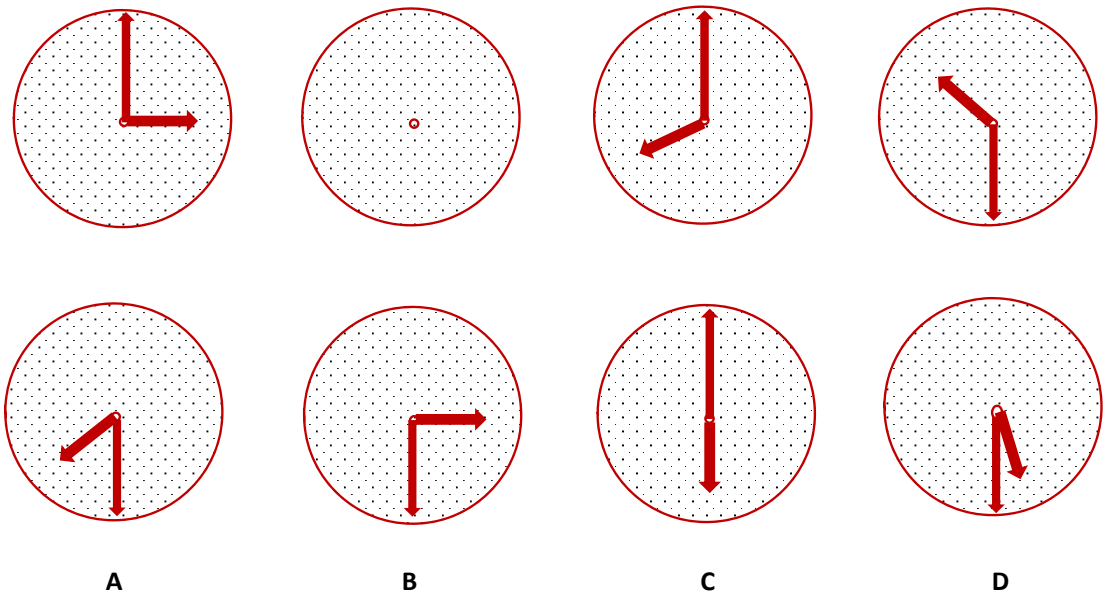
Question 15.

Discover the rule and complete the sequence with the appropriate shape.



The answer is D.

In order to solve this question, you must be able to read the clock accurately with no need for numbers or symbols on the screen, considering only the position of the hands.

The first clock shows 3:00, while the third one shows 8:00. We notice a difference of five hours, so we can assume that the difference between the first and the second, respectively the second and the third, should be of two and a half hours. We can check that by reading the fourth clock, which shows 10:30. Indeed, between the third clock (8:00) and the fourth one (10:30) is also a difference of two and a half hours, so our assumption was correct.

Consequently, the second clock should show 5:30 (3:00 + 2:30 = 5:30). Only D shows this time, so it is the correct answer.

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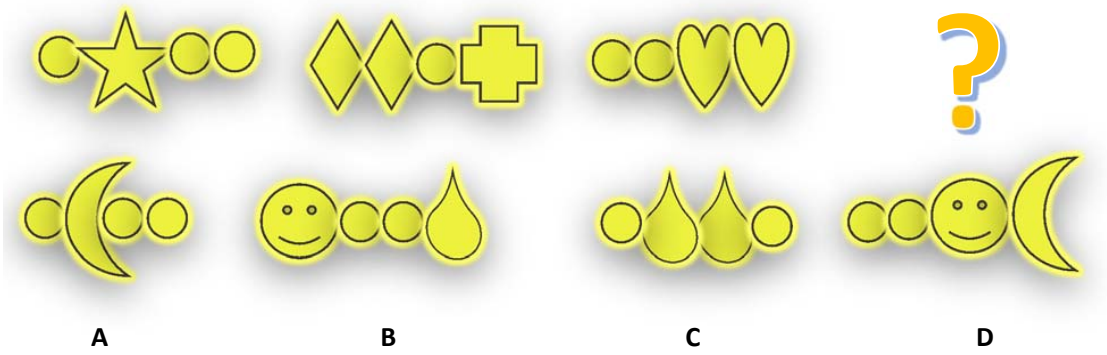
Question 16.

Discover the rule and complete the sequence with the appropriate shape.



A **B** **C** **D**

The answer is A.

To understand the sequence on the upper row, think of the shapes as if they were jewels ready to be strung on thread. The pattern used is one marble, one new shape, two marbles, two new shapes, and repeat.

On the third image we have two marbles and two hearts, which means that next there should be a single marble and a single shape, then two marbles and two shapes. The only image on the bottom row that matches this order is A – one marble, one moon, two marbles – so this is the correct answer.

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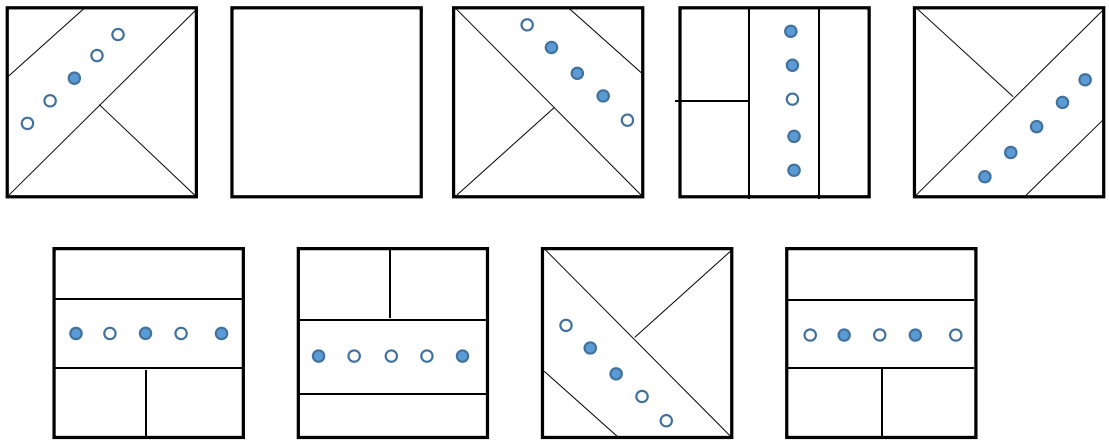
Question 17.

Discover the rule and complete the sequence with the appropriate shape.



The answer is D.

The shapes in the upper row squares move 45^{o} at a time. We can check this by watching the half diagonal which is initially positioned at 135^{o}. In the third square, it is at 225^{o}, in the fourth it is at 270^{o}, and in the fifth, at 315^{o}. (Following this rule, a sixth image would have shown it at 0^{o} (as it appears in variant B.) This means that in the second square, the line should be at 180^{o}, because 135 + 45 = 180. Therefore, the possible answers are A and D.

However, the five dots have a pattern of their own: in each image, one more dot is filled, and not anyhow, but keeping a symmetry of filled and empty dots. While A maintains the symmetry, it does not maintain the order, as only two dots should be filled in the second image. Consequently, the missing image is D.

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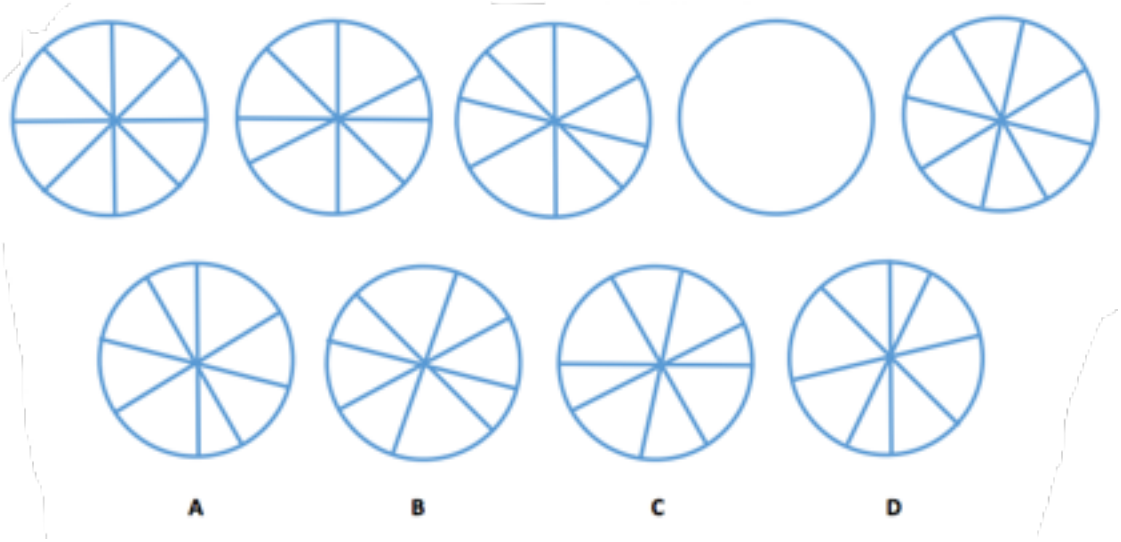
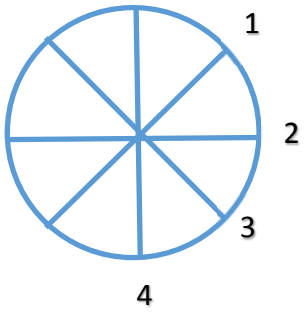
Question 18.

Discover the rule and complete the sequence with the appropriate shape.



The answer is A.

In order to make it easier to understand the pattern in this sequence of shapes, let us number the axes of the circle, as follows:



(This image numbers the axis in clockwise direction.)

In the first image, all axes are in position at 45^{o}, 90^{o}, 135^{o} and 180^{o} respectively. Now we can easily notice that in the second image axis 1 moves a few degrees clockwise, while the other three axes keep their positions. In the third image, it is axis 2's turn to move clockwise, while the others stay still. Logically, in the fourth image the axes will be the same as in the third one, with the sole difference that axis 3 has moved clockwise. In the fifth image, axis 4 moves the same number of degrees and in the same direction as the others, so that now we obtained the original image, only rotated a few degrees clockwise.

The only image that moves axis 3 in the right direction while at the same time keeping the rest of the axes as they were in the third image is A, so this is the correct answer.

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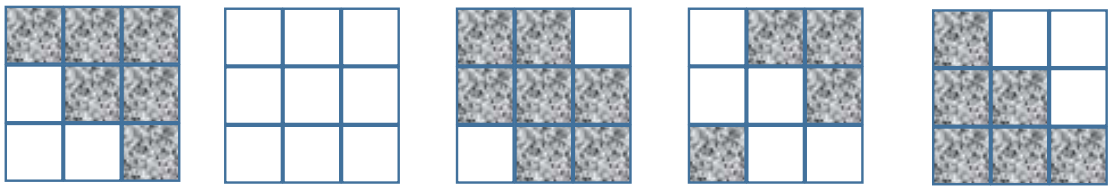
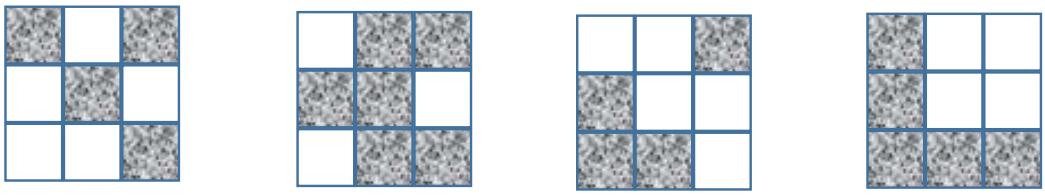
Question 19.

Discover the rule and replace the blank grid in the sequence with the appropriate shape.

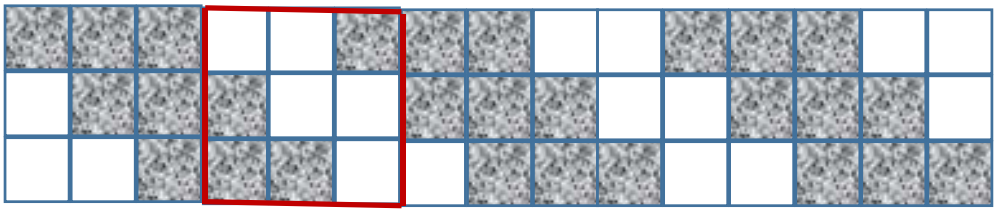




A B C D

The answer is C.

The figure below will make it easy to understand the pattern of the images on the upper row.



The pattern above is obtained by juxtaposing (putting the pictures next to each other) the five shapes on the upper row.

We need to obtain 9–square blocks that come one after another. Each block is made of three shifted rows and each row consists of three squares. The only image that completes both the first and the third image (or, in other words, the first and the second block) is C, so it is the correct answer.

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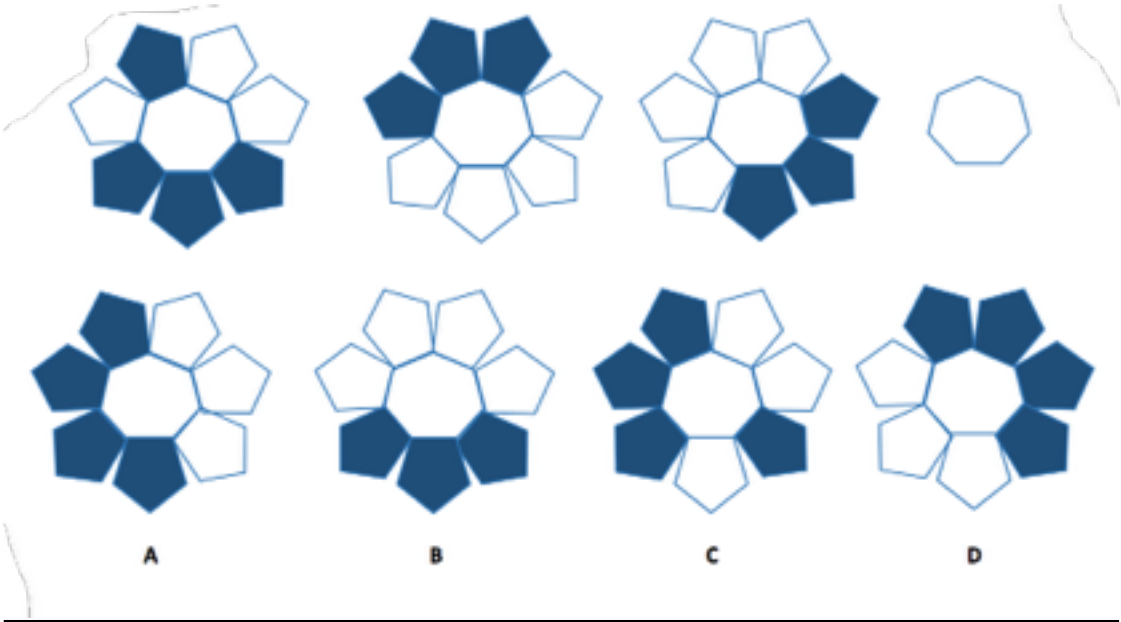
Question 20.

Identify the movement pattern of the coloured figures on the upper row, then complete the sequence with the right choice from the bottom row.

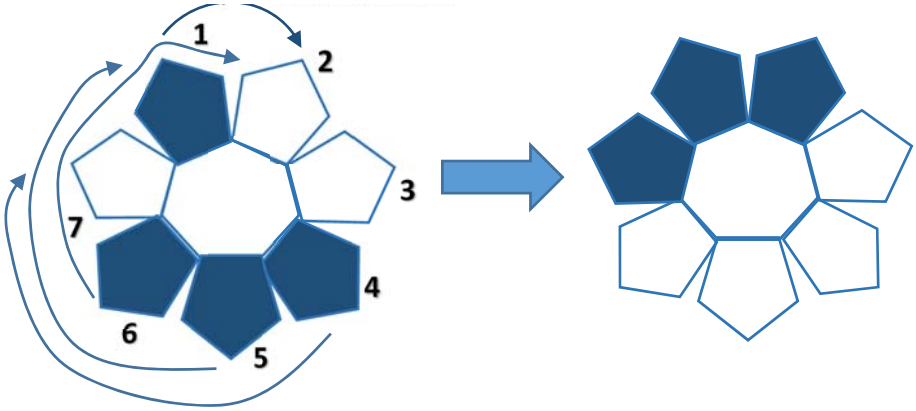


The answer is C.

The coloured petals move in an awkward but still coordinated way. As illustrated in Figure 4, the single petal in the first image moves clockwise, one step at a time, while the group of three coloured petals move in the same direction, three steps at a time. In some cases, the petals overlap, so the single petal gets 'hidden' behind the others.

This way, in the fourth flower, the single filled petal should reach position 4, while the group of three should be in positions 6, 7 and 1, respectively. In conclusion, C is the missing flower.

The diagram below shows how the petals change position between image 1 and image 2.



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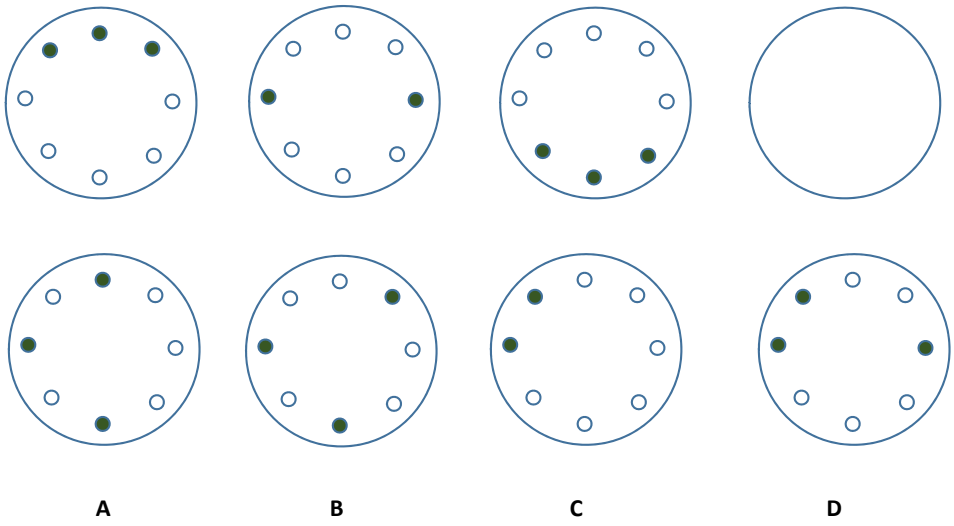
Question 21.

Identify the movement pattern of the coloured figures on the upper row, then complete the sequence with the right choice from the bottom row.



The answer is A.

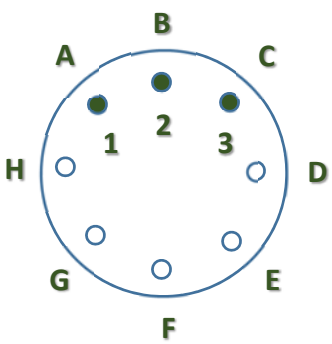
The movement pattern of the coloured dots is as follows (check Figure 5 to see how the dots and spots were marked):

Dot 1 moves one spot counter-clockwise, dot 2 moves two spots clockwise and dot 3 moves three spots counter-clockwise.

In some images, the dots overlap, so it will appear like there are only two of them left.

Therefore, in the second picture dot 1 will move from spot A to spot H, dot 2, from B to D, and dot 3 from C to H. Following this pattern, we see that in the third picture, dots 1, 2 and 3 are positioned in spots G, F and E respectively.

Obviously, in the fourth image dot 1 will be in spot F, dot 2, in spot H, and dot 3 in spot B. This is exactly how the dots are arranged in image A, so this is the correct variant.



This diagram shows dots marked with numbers and spots marked with letters.

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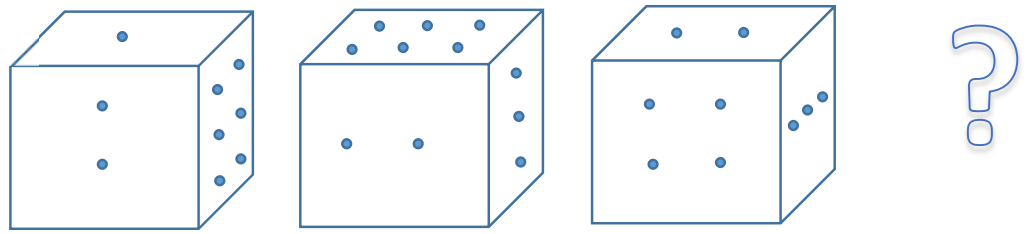
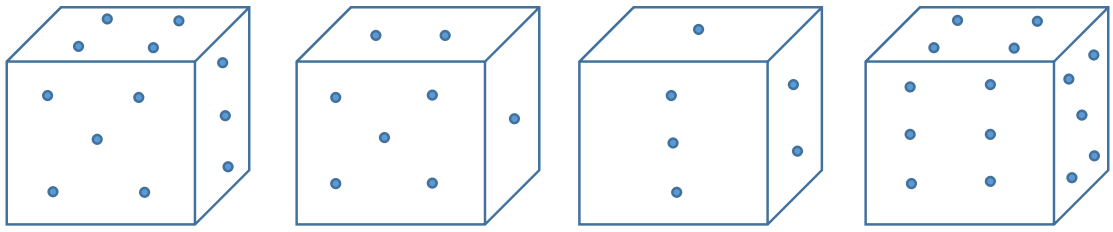
Question 22.

The images on the top row show the same die, seen from different angles. Which of the images on the bottom row is also an angle of that die?





A B C D

The answer is A.

By carefully observing the three dice and the position of the dots, we can figure out how the numbers are positioned on each side of the cube. Therefore, 1 is opposed to 3, 2 is opposed to 5 and 4 is opposed to 6.

This means we can remove B, C and D from the list of options–B has 2 next to 5, C has 1 next to 3 and D shows 6 next to 4 – which leaves us with A as the only option, as it is the only one whose sides are positioned correctly.

So sometimes it is easier to eliminate the incorrect options in order to identify the only remaining (and therefore correct) choice.

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CHAPTER FIVE

NUMERICAL REASONING

Question 1.

The rabbit challenged the turtle to a 1000 metre race. He knew that the turtle could only run at a speed of 400 metres per hour while he could run at twice that speed. He was so confident of beating the turtle that he gave it a 1 1/2 – hour lead. Who won the race?

Question 2.

What comes next? 2, 7, 12, 17, 22, 27, ?

Question 3.

In the figures presented below, which number will replace the question mark?

a) 5

b) 3

c) 8

d) 9

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Question 4.

There are three children in the Carpenter family. The eldest Dan is two years older than his brother Ed and Ed is two years older than their sister Faye. The sum of their ages is 21. How old is Ed?

Question 5.

0.35 x 0.20 =

a) 7.35
b) 0.70
c) 72.0
d) 0.07

Question 6.

Mary needed different coloured balloons for decoration. She had $1.25 and spent it all on a number of white, red, and blue balloons. A white balloon costs $.10, a red one $.15 and a blue one $.05. She bought one white balloon less than the red and the total number of white and red balloons equals the number of blue ones. How many of each colour did Mary buy?

Question 7.

32 x 45 =

a) 1450
b) 1440
c) 1460
d) 1420

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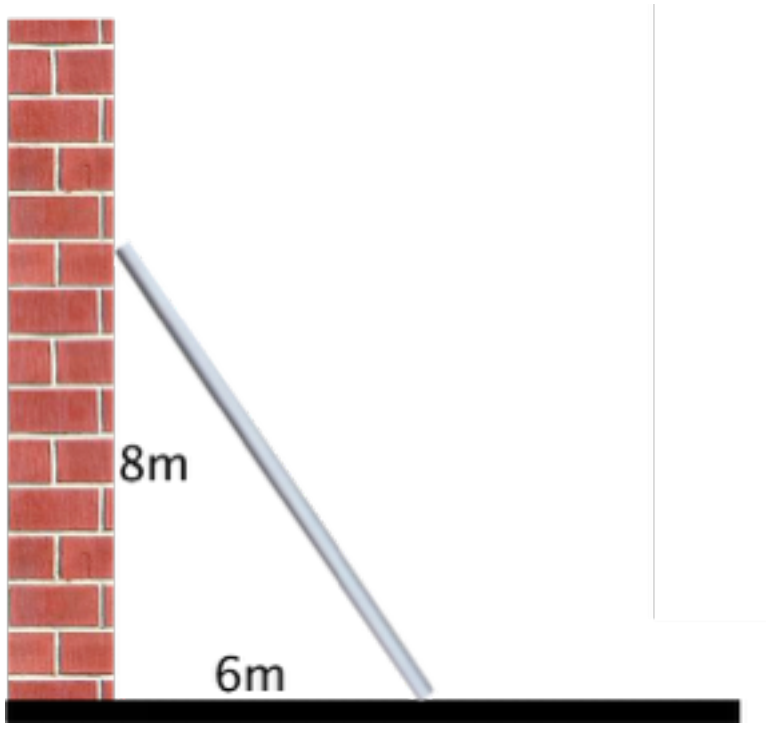
Question 8.

An inclined pole rests against a wall. The pole rests 6 metres from the base of the wall and 8 metres up the wall. How long is the pole?



Question 9.

963 x 9 =

a) 8007
b) 7667
c) 8667
d) 9007

Question 10.

2/3 x 6/8 =

a) 0.5
b) 3/8
c) 1/3
d) 0.6

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Question 11.

Follow the number pattern to find the numbers that should be in the empty squares:

5	4	
12		10
19		17

Question 12.

Daniel has bought a box of ice cream for $10. How many 75-cent ice cream cones could he have got for the same amount of money?

Question 13.

Find the missing number in the following sequence:

2 4 16 65536

Question 14.

Find the missing number in the following sequence:

102 210 328 544

Question 15.

Using number patterns, find the number in the square labeled with an X.

1	8	5
--	10	7
0	X	4

Question 16.

Jill would like to adopt a puppy, but the adoption costs $192. If Jill's parents agree to cover half the cost and Jill earns $12 per week, how many days will it take for Jill to get her puppy?

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Question 17.

Find the missing number in the sequence.

11 10 8 5 ___

Question 18.

Joe took 12 minutes to drive 9 km. At this speed, how many km could he drive in 3 hours?

Question 19.

Fill in the missing number in the sequence.

7 14 28 ___ 112

Question 20.

Adam and Ben are cycling on the same trail. Adam can cycle at a speed of 3 km per hour and Ben can cycle at a speed of 4 km per hour. Adam begins cycling 1 hour before Ben begins. How many km will they each have cycled when Ben catches up to Adam?

Question 21.

Jenny wants to buy a new shirt that normally costs $20 but is on sale for 14% off. However, she also has to pay 10% tax after applying the discount. How much total will Jenny be paying?

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Question 22.

Using number patterns, find the number in the square labeled with an X.

4	6	12
1	3	X
--	5	11

Question 23.

Lisa has a bag of coloured candies. She knows that ¼ of the candies are blue, 10 of the candies are green, and 1/8 of the candies are red. How many candies are there total?

Question 24.

Helen wants to make a quilt. Her quilt will be 2 m by 3 m, and is made up of a number of patches. Each patch will be ½ m by ½ m. How many patches will be on her quilt?

Question 25.

Barbara needs new pencils for the next school term. She knows she uses up two per week, but she also loses one every day of the week (including weekends). How many pencils should she buy for her eight weeks of school term?

Question 26.

Fill in the missing number in the sequence.

2 5 7 12 19 __

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Question 27.

Jerry, Jason, and James are brothers. Jerry is 10 years older than Jason, and Jason is twice as old as James. Their ages add up to 55. How old is James?

Question 28.

Amy wants to make a fruit smoothie, and she always adds ½ cup of blueberries for every 2 cups of juice. If Amy has 5 cups of juice, how many cups of blueberries will she need?

Question 29: Using number patterns, find the number in the square labeled with an X.

--	2	3
5	0	X
9	4	5

Question 30.

Maggie needs to write her research paper, and it has to be 1000 words long. She knows that when she's working hard, she can write 25 words per minute. However, when she's not trying, she can only write 10 words per minute. If Maggie has already been not trying for 20 minutes, and she decides that she will work hard until she finishes the paper. How many minutes total did it take for Maggie to finish writing the paper?

Question 31.

In order to make it to her karate competition, Annie has to drive 20 km to the train station and then ride the train for 60 km. Annie drives an average of 50 km per hour, and train travels at 80 km per hour. Assuming no changeover time, how many minutes will it take for Annie to get to her competition?

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Question 32.

Using number patterns, find the number in the square labeled with an X.

--	5	2
8	7	4
9	X	5

Question 33.

If a tomato weighs 115 grams and a plum weighs 69 grams, how many plums do you need to balance 30 tomatoes, considering all the plums, respectively all the tomatoes have the same weight?

Question 34.

Yesterday, Bob, Sam and Hank started reading the same book. If Bob reads 8 pages a day, Sam reads 18 pages every three days and Hank reads 49 pages a week, which of the boys will finish the book first?

Question 35.

I want to cover my 3.8-meter-long and 3.5-meter-wide kitchen with 20 cm by 15 cm floor tiles. Given that a box of tiles contains 20 pieces, I can only buy full boxes and I don't want to use any leftovers, how many boxes do I need to buy in order to tile my kitchen floor?

Question 36.

Julie ran 9 kilometers in 27 minutes. Supposing her speed was constant, how fast did she run in km/h?

Question 37.

Jackie's cake recipe serves six people. The recipe includes 10 eggs, 150 grams of sugar and 450 grams of flour. If she plans to invite 20 friends to her birthday party, what ingredients would she need for a cake big enough for everyone, including herself?

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Question 38.

Notice the number patterns in the grid and write the missing numbers in the squares marked with '?'.

38	26	14
19	?	7
57	39	?

Question 39.

Notice the number patterns in the grid and write the missing number in the squares marked with '?'.

3	4	5
-	1	?
9	8	-

Question 40.

Notice the number patterns in the grid and write the missing number in the squares marked with '?'.

8	32	56
16	?	64
24	48	72

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Question 41.

Notice the number patterns in the grid and write the missing number in the squares marked with '?'.

24	48	8
192	24	?
N/A	144	N/A

Question 42.

Notice the number patterns in the grid and write the missing numbers in the squares marked with '?'.

3	?	7
9	25	49
27	125	?

Question 43.

Complete the sequence with the missing number.

4 103 15 92 81

Question 44.

Complete the sequence with the missing number.

0 3 8 ..... 24 35 48

Question 45.

Complete the sequence with the missing number.

416 208 104 52 13

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Question 46.

Complete the sequence with the missing number.

8253 2537 5371 3714 ..... 1426 4260

Question 47.

Complete the sequence with the missing number.

382 198 106 60 .....

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NUMERICAL REASONING - ANSWERS AND EXPLANATIONS

Question 1.

The rabbit challenged the turtle to a 1000 metre race. He knew that the turtle could only run at a speed of 400 metres per hour while he could run at twice that speed. He was so confident of beating the turtle that he gave it a 1 1/2 – hour lead. Who won the race?

Given: Speed of the turtle = 400 metres per hour
Speed of the rabbit = 2 x speed of the turtle = 800 metres per hour
Distance to be covered = 1000 metres
Lead time given to the turtle = 1 1/2 hours

Solution: The best approach in solving this type of problem is to compare how long it took each animal to cover the given distance. We should also recognise that this is a rate problem and we have the following relationships:

(1) Speed = distance/time
(2) Distance = speed x time
(3) Time = distance/speed

Without considering the lead time, let us start with the turtle's time to cover the 1000 metre distance. We have the turtle's speed at 400 metres an hour, the race distance of 1000 metres, and using these in (3) above, we get:

Time (Turtle) = 1000 metres /(400 metres/hour)

Perform the division and we have:

Time (Turtle) = 10/4 hours or 2 1/2 hours

It will take the turtle **2 1/2 hours** to cover the distance of 1000 metres.

We now compute the rabbit's time to run the same distance of 1000 metres. We substitute this distance and his speed of 800 metres per hour in (3) above and we have:

Time (Rabbit) = 1000 metres/(800metres/hour)

Again we perform division and get:

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Time (Rabbit) = 10/8 hours or 1 1/4 hours

So, the rabbit took only **1 1/4 hours** to run the same distance of 1000 metres.

At first glance, the rabbit took less time to cover the 1000 metre distance and might have won the race. But we must remember that the turtle started the race earlier than the rabbit. We now take into consideration the lead time of 1 1/2 hours he gave the turtle and subtract it from the total time the turtle ran the whole race and we get:

Total Time (Turtle)	=	2 1/2 hours
Less: Lead time given by the rabbit	=	1 1/2 hours
Time it took the turtle to complete the race	=	1 hour

Note that the turtle had been running for 1 1/2 hours and had covered a certain distance from the starting point before the rabbit took off. The turtle needed only **1 hour** to finish the rest of the 1000 metre distance. We compare this to the rabbit's time of **1 1/4 hours** to complete the race and we know that **the turtle won the race**!

Alternatively, we can add the time the rabbit needed to cover the 1000 metre distance and the lead time he gave the turtle because he started running only after the turtle had been running for 1 1/2 hours.

Time (Rabbit) to complete the distance	=	1 1/4 hours
Add: Lead time he gave the turtle	=	1 1/2 hours
Actual time that elapsed when the rabbit crossed the finish line	=	2 3/4 hours

The turtle has completed the 1000 metre distance in 2 1/2 hours while the rabbit finished the race in 2 3/4 hours. Therefore, **the turtle won the race**!

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Question 2.

What comes next? 2, 7, 12, 17, 22, 27, ?

In a series of numbers where one number is missing, we must find the pattern that will work for that series.

Given: The number series 2, 7, 12, 17, 22, 27

Solution:

There are two ways we can solve this.

The first is recognising that if we add 5 to the number from the left of the series, we get the next number. Let us show that this is true for the given series starting with 2:

2 + 5 = 7
7 + 5 = 12
12 + 5 = 17
17 + 5 = 22
22 + 5 = 27

Now that we have the pattern, we can now add 5 to 27 and get 32. **32** is the next number in the given series.

The other solution is based on the observation that every 2nd number increases by 10. Let us illustrate this again starting from 2. :

2,_____, 12 (2+10),_____, 22 (12+10), _____, ?

This is also true with the numbers we left blank in the series. If we start with 7, then the next number is 17, the next is 27 and so on.

Now we have established another pattern, an increase by 10 from the previous number two places to the left of the number series. We can now find the next number in the series from the last number 22 by adding 10 to it. Note that we get the same answer **(32).**

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Question 3.

In the figures presented below, which number will replace the question mark?

a) 5

b) 3

c) 8

d) 9

The correct answer is d) 9. The sum of the numbers at the lower vertex is equal to the sum of numbers at the center and upper vertex. To find this answer you must first see the pattern in the first two pictures:

$$7 + 9 = 16 \text{ and } 12 + 4 = 16$$

$$1 + 4 = 5 \text{ and } 4 + 1 = 5$$

Once you see this you can make the following calculations:

$$6 + 5 = 11$$

Therefore:

$$2 + ? = 11$$

Then move the 2 to the other side of the equation:

$$? = 11 - 2$$

$$? = 9$$

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Question 4.

There are three children in the Carpenter family. The eldest Dan is two years older than his brother Ed and Ed is two years older than their sister Faye. The sum of their ages is 21. How old is Ed?

Given: Age difference between siblings.
Sum of their ages = 21

Find: The age of Ed

Solution:

This type of problem requires that we represent our unknown quantity by a variable, let us say x. In using this variable x, we should evaluate the conditions given and make the least of these conditions our baseline. We now proceed as follows:

Let x	=	age of Faye
x+2	=	age of Ed
(x +2)+2	=	age of Dan

(Note that we have represented their ages in terms of the youngest since the problem has stated the ages of her elder siblings based on her own).

Having represented the conditions as arithmetic expressions, we now apply the other condition that the sum of their ages equals 21. This is accomplished as follows

$$x + (x+2)+(x+2+2) = 21$$

Then we combine similar terms and continue solving for x. Start by adding up the total number of 'x's and the total number of '2's.

$$(x+x+x) + (2+2+2) = 21$$

The (x+x+x) can be represented as 3x and the (2+2+2) equals 6.

$$3x + 6 = 21$$

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Next, move the 6 to the other side of the equation by subtracting 6 from each side. This looks like this:

$$3x = 21 - 6$$

$$3x = 15$$

To determine x from this, simply divide both sides of the equation by 3.

$$x = 5$$

We now have Faye's age as 5. The problem asks for Ed's age and we know that he is 2 years older than Faye. Therefore, Ed is now **7** (5+2=7).

We can check by adding their ages which should equal 21 as given in the problem:

Faye's age	=	5
Ed's age	=	7
Dan's age	=	9
Total	=	**21**

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Question 5.

0.35 x 0.20 =

a) 7.35
b) 0.70
c) 72.0
d) 0.07

The correct answer is d) 0.07. If you do not have the mathematics skill to quickly solve this problem, you can at least narrow your options to b) and d) by recognising that 2 x 35 = 70. This quickly eliminates options a) and c). This will boost your odds of guessing the right answer to 50%!

The mathematics, however, is not difficult to learn and you can do so in the bonus mathematics chapter further on in the book.

Question 6.

Mary needed different coloured balloons for decoration. She had $1.25 and spent it all on a number of white, red, and blue balloons. A white balloon costs $.10, a red one $.15 and a blue one $.05. She bought one white balloon less than the red and the total number of white and red balloons equals the number of blue ones. How many of each colour did Mary buy?

Given: Total money she spent = $ 1.25

Price of balloons per piece:
White = $.10
Red = $.15
Blue = $.05

Find: The number of balloons for each colour Mary bought.

Solution:
Let x = number of red balloons
x-1 = number of white balloons
x + (x-1) = 2x -1 = number of blue balloons

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For purposes of this problem, let us drop the currency sign ($), since everything is expressed in dollar values.

Then,

.15x = total cost of red balloons
.10 (x -1) = total cost of red balloons
.05 (2 x-1) = total cost of blue balloons

When we sum up the above expressions, we get

.15 x + .10 (x-1) + .05 (2 x-1) = 1.25

We distribute the coefficients and we have

.15 x + .10 x - .10 + .10 x - .05 = 1.25

Combining similar terms, we arrive at

.35 x - .15 = 1.25

Isolating the term with the variable x,

.35 x = 1.25 + .15 = 1.40

Dividing both sides .35

x = 1.40/.35 = 4

We have solved the number of red balloons as **4**. We now use the relations we have stated above and we have **3** white balloons (one less than the red ones) and **7** blue balloons (the total number of red and white balloons).

We could check by applying these numbers in computing the dollar values of the balloons bought:

Red: 4 x $ .15 = $ .60
White: 3 x $ .10 = $ .30
Blue: 7 x $ .05 = $ .35
Total = $1.25

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Question 7.

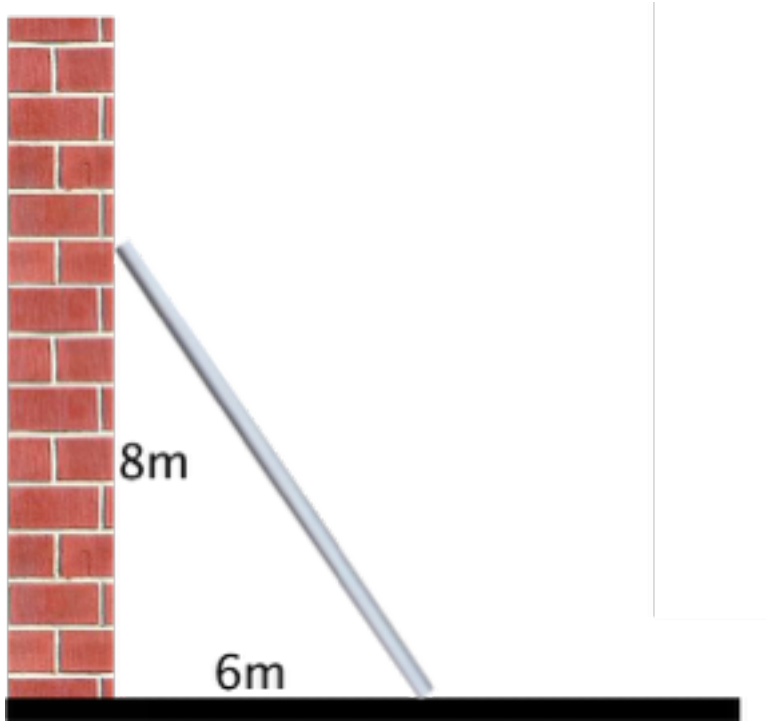
32 x 45 =

a) 1450
b) 1440
c) 1460
d) 1420

The correct answer is b) 1440. There are few people who could calculate in their head accurately enough to discern which exact answer is correct. In this case, it is useful to know how to work out the sum on scrap paper. You will find a detailed explanation of this solution and other similar problems in the bonus mathematics chapter.

Question 8.

An inclined pole rests against a wall. The pole rests 6 metres from the base of the wall and 8 metres up the wall. How long is the pole?



This solution employs the Pythagorean Theorem. You may see a question just like this in your aptitude exams.

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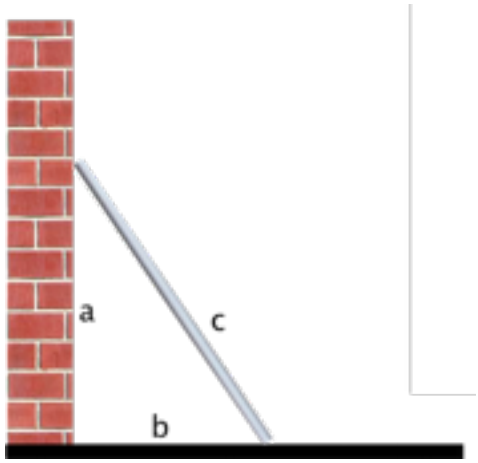
Recall the formula for a right triangle: $c^2 = a^2 + b^2$ (Pythagorean Theorem) where c = length of the hypotenuse (the longest side of the triangle) and a and b = length of the perpendicular sides (the shorter sides of the triangle).



Let c = length of the pole
a = height of the pole on the wall
b = distance of the pole from the wall

We have been given that a = 8 and b = 6.

Using these in our Pythagorean relation, we get

$c^2 = a^2 + b^2$

We input our data:

$c^2 = 8^2 + 6^2$

This becomes:

$c^2 = 64 + 36$

Therefore $c^2 = 100$, which means $c = \sqrt{100}$
(the square root of 100) which we know is 10.

Therefore c = 10

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Question 9.

963 x 9 =

a) 8007
b) 7667
c) 8667
d) 9007

The correct answer is c) 8667. There is a bonus mathematics chapter now included further in the book to help you solve these types of problems.

However, if you are presented options, like this example, you can easily simplify problems like this by identifying an easier estimate.

In this case, we know that 9 x 9 equals 81, so it follows that 963 x 9 is greater than 8100 which narrows the answer down to option c) or d). We also know that 1000 x 9 is 9000. This is still less than 9007, which therefore eliminates option d)

Question 10.

2/3 x 6/8 =

a) 0.5
b) 3/8
c) 1/3
d) 0.6

The correct answer is a) 0.5. There are detailed lessons in the bonus mathematics chapter on how to solve these problems. Yet again though, we can solve this rapidly with very basic maths skills to isolate the options presented.

If you have decimal answers that can be converted to fractions similar to the problem described, that is always a good start. In this case, a) 0.5, easily converts to 4/8. If you recognise this then it quickly becomes apparent that if you multiply 2/3 by 6/8 you are left with 4/8 which converts back to 0.5.

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Again, the ability to understand multiplication of fractions is detailed in the bonus chapter MATHEMATICS WITHOUT A CALCULATOR.

Question 11.

Follow the number pattern to find the numbers that should be in the empty squares:

5	4	
12		10
19		17

On the rows, the numbers decrease by 1, from left to right. On the columns, they increase by 7, from top to bottom. So the missing numbers are 3 (1st row), 11 (2nd row) and 18 (3rd row).

Question 12.

Daniel has bought a box of ice cream for $10. How many 75-cent ice cream cones could he have got for the same amount of money?

Solution: He could have bought 13 ice cream cones.

When calculating, it is important to use the same unit in a mathematical operation. In this case, we have dollars and cents, so we must converts dollars (the larger unit) to cents (the smaller unit). Each dollar has 100 cents, so 10 dollars * 100 cents = 1000 cents.

Now we divide the total sum, 1000 cents, to the price of an ice cream cone, which is 75 cents. 1000 ÷ 75 = 13,(3), or 13 (remainder 25). In other words, Daniel could have bought 13 ice cream cones, and he would have been left with 25 cents.

Question 13.

Find the missing number in the following sequence:

2 4 16 65536

Solution: The missing number is 256.

Each number in the sequence is the square of the previous number (except for two, which is not a perfect square.) So, 2*2=4, 4*4=16, 16*16=**256**, 256*256=65536. In conclusion, the missing number is 256.

You don't need to know the square of 256 to answer this! The sheer size of the final number just confirms the pattern from the first three numbers.

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Question 14.

Find the missing number in the following sequence:

102 210 328 544

Solution: The missing number is 436.

Each number has three figures. The first two figures add 1 each, while the third figure subtracts 2. For example, the first number is 102. By applying the rule, we obtain: 1+1=**2**, 0+1=**1**, 2-2=**0,** so the second number is 210. Likewise, if the third number is 328 and 3+1=**4**, 2+1=**3**, 8-2=**6,** then the missing number is 436.

Question 15.

Using number patterns, find the number in the square labeled with an X.

1	8	5
--	10	7
0	X	4

Solution: 7

In order to find this answer, we first need to look at how each column and row changes and find patterns. From the first to second row (rows are horizontal), we see an increase of 2, as both 10-8=2 and 7-5=2. Next, we also notice a pattern in the columns. From the second to third column (columns are vertical), we see a decrease of 3, as both 8-5=3 and 10-7=3.

We can then assume that all numbers in the grid follow a similar pattern and increase or decrease accordingly with the columns and rows. Now we can start solving for the missing number.

In the third column, we see that the second and third values have a difference of 3, as 7-4=3. We can assume this also applies to the second column with the missing value, and 10-X=3. We can now find X, which is 7.

To double check our work, we can use this same method but with the rows. In the first row, the first and second value have a difference of 8-1=7. We then know that in the third column, 0 and X have a difference of 7, and X-7=0. Once again, X=7. Now we can be sure that the missing number is 7.

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Question 16.

Jill would like to adopt a puppy, but the adoption costs $192. If Jill's parents agree to cover half the cost and Jill earns $12 per week, how many days will it take for Jill to get her puppy?

The answer is: 56 days.

We know that Jill's parents will pay for half of the cost, so that means Jill will pay for the other half. We can calculate the cost with ½*$192=$96, and now we know that Jill will have to pay $96. To find the number of weeks it'll take for Jill to earn this $96, we can divide the total cost by the amount she earns per week. This results in $96/($12/week)=8 weeks. Now we know it will take Jill 8 weeks, but the question asks for the answer in days. Knowing there are 7 days in a week, we can find the total number of days: (8 weeks)*(7 days/week)=56 days. It will take Jill 56 days to get her puppy.

Question 17.

Find the missing number in the sequence.

11 10 8 5 ___

The answer is: 1

First we can try to identify a pattern by looking at the difference in the numbers. The difference between the first and second terms is 11-10=1. The difference between the second and third terms is 10-8=2. The difference between the third and four term is 8-5=3. Each number is decreasing, and difference is greater by 1 each time. Knowing this pattern, we can reason that the difference between the fourth and fifth term is 4. As 5-4=1, we can determine that the missing number in the sequence is 1.

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Question 18.

Joe took 12 minutes to drive 9 km. At this speed, how many km could he drive in 3 hours?

Answer: 135 km

To start, we can convert Joe's speed into km per hour. There are 60 minutes in an hour, so (9 km/12min) * (60min/hr) = 45km/hr.

Or another way to think of this is 60 minutes / 12 minutes = 5 sets of 12 fit into 60.

Therefore we can say 5 sets of 9 = 45km in one hour.

Now we can find how far he drove by multiplying Joe's speed by the time, getting 45km/hr*3hrs = 135 km. Joe can drive 135 km in 3 hours.

Question 19.

Fill in the missing number in the sequence.

7 14 28 ___ 112

Answer: 56

First, we look for a pattern. Looking just at the first three terms, we see immediately that they're all multiples of 7. Next, we notice that each term is twice as much as the previous term, as in 7*2=14 and 14*2=28. Now that we've figured out the pattern, we can solve for the missing term. As 28 is the term before the missing one, we can find the missing term with 28*2=56. The missing number is 56. To check our work, we can also apply the pattern we found and see if it coordinates with the next term. We see that 56*2=112, which is indeed the last term. Now we're sure the missing number is 56.

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Question 20.

Adam and Ben are cycling on the same trail. Adam can cycle at a speed of 3 km per hour and Ben can cycle at a speed of 4 km per hour. Adam begins cycling 1 hour before Ben begins. How many km will they each have cycled when Ben catches up to Adam?

Answer: 12 km

There are two ways to do this. Let's start with the easier way, which just involves tracking each person's movement after an hour. After the first hour, Ben has cycled 3 km and Adam has cycled 0. After the second hour, Ben has cycled 6 km and Adam has cycled 4 km. After the third hour, Ben has cycled 9 km and Adam has cycled 8 km. After the fourth hour, Ben has cycled 12 km and Adam has cycled 12 km. They have now met and have each cycled 12 km.

However, we can also solve this equation using variables. Suppose we set time in hours to t, as we don't know how long they cycled before they met. As we know, speed*time=distance, and Ben's and Adam's distances traveled should be the same when they meet. Ben's travel distance is 3t, as his speed is 3 and time is t. Adam's travel distance is 4(t-1), as Adam's speed is 4 and he started 1 hour after Ben, or t-1. Because their travel distances are the same, we can set these equations equal to each other and solve for t.

$3t = 4 (t-1)$
$3t = 4t-4$
$t = 4$

Now that we know t = 4, we can plug it in to find how far they each traveled. 3t=3(4)=12km and 4(t-1)=4(4-1)=4(3)=12km. We've checked our work with both boys and now know that they had each travelled 12 km when they met.

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Question 21.

Jenny wants to buy a new shirt that normally costs $20 but is on sale for 14% off. However, she also has to pay 10% tax after applying the discount. How much total will Jenny be paying?

Answer: $18.92

First, we can find out how much the shirt is after the discount. Knowing the shirt is 14% off, the discount can be found with $20 * 0.14 = $2.80 and we can find Jenny's shirt cost as 20 - $2.80 =$17.20. Jenny's shirt with the discount is $17.20.

Now we have to apply the 10% tax which is equal to $17.20 * 0.10 = $1.72. We can add this to the cost of the discounted shirt for a total of $17.20+$1.72= $18.92. Jenny will be paying a total of $18.92.

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Question 22.

Using number patterns, find the number in the square labeled with an X.

4	6	12
1	3	X
--	5	11

Answer: 9

In order to find this answer, we first need to look at how each column and row changes and find patterns.

From the first to second row (rows are horizontal), we see a decrease of 3, as 4 - 1 = 3 and 6 - 3 = 3.

Next, we also notice a pattern in the columns. From the first to second column (columns are vertical), we see an increase of 2, as 6 - 4 = 2 and 3 - 1 = 2.

We can then assume that all numbers in the grid follow a similar pattern and increase or decrease accordingly with the columns and rows.

Now we can start solving for the missing number. In the second column, we see that the second and third values have a difference of 2, as 5 - 3 = 2. We can assume this also applies to the second column with the missing value, and 11 - X = 2. We can now find X, which is 9. To double check our work, we can use this same method but with the rows. In the first row, the second and third values have a difference of 6, as 12 - 6 = 6. We then know that in the third column, 3 and X have a difference of 6, and X - 3 = 6. Once again, X=9. Now we can be sure that the missing number is 9.

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Question 23.

Lisa has a bag of coloured candies. She knows that ¼ of the candies are blue, 10 of the candies are green, and 1/8 of the candies are red. How many candies are there total?

Answer: 16 candies in total.

Knowing that 1/4 of the candies are blue and 1/8 of them are red, we can find the fraction that corresponds to the number of green candies. See below.

1/4 + 1/8 = 2/8 + 1/8 = 3/8.

If 3/8 of the candies are blue and red combined, the remaining candies must be green. See below.

8/8 - 3/8 = 5/8

Suppose we create a variable c for the total amount of candies. Using the fraction of the green candies, we can solve for c using the following:

5/8c = 10
5c = 80
c = 16

Now we know that there are 16 candies total (4 blue, 2 red and 10 green).

Question 24.

Helen wants to make a quilt. Her quilt will be 2 m by 3 m, and is made up of a number of patches. Each patch will be ½ m by ½ m. How many patches will be on her quilt?

Answer: 24 patches

To start, we can find the total area of the quilt, which is 2m * 3m = 6 m^2. Then we can find the area of each patch, which is ½m * ½m = ¼ m^2. To find the total number of patches on Helen's quilt, we can divide the total area by the area of each patch, and we get (6m^2) / (¼ m^2 per patch) = 24 patches. There will be 24 patches on Helen's quilt. Remember dividing by ¼ is the same as multiplying by 4!

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Question 25.

Barbara needs new pencils for the next school term. She knows she uses up two per week, but she also loses one every day of the week (including weekends). How many pencils should she buy for her eight weeks of school term?

Answer: 72 pencils

Knowing that she uses up 2 per week and loses 1 every day of week, we can find how many she needs for each week.

In one week, Barbara needs 2 + (1*7) = 9 pencils/week. So that allows for 2 used plus one lost every day (1 x 7).

Now we can find how many pencils she'll need for her 8 weeks of school with (9pencils/week) * (8weeks) = 72 pencils. Barbara should buy 72 pencils.

Question 26.

Fill in the missing number in the sequence.

2 5 7 12 19 __

Answer: 31

As with number sequences, we must first identify the pattern. The difference between the first and second terms is 5 - 2 = 3.

The difference between the second and third terms is 7 - 5 = 2.

The difference between the third and fourth terms is 12-7=5.

The difference between the fourth and fifth terms is 19-12=7.

Though you may not notice it at first, the difference between the terms is equal to the preceding term. In other words, each term starting with the third is the sum of the previous two terms, as 2 + 5 = 7 and 5 + 7 = 12 and 12 + 7 = 19.

To find the missing term, we must find the sum of its previous two terms, which make the last term 12 + 19 = 31. The missing number is 31!

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Question 27.

Jerry, Jason, and James are brothers. Jerry is 10 years older than Jason, and Jason is twice as old as James. Their ages add up to 55. How old is James?

Answer: 9 years old

To start, we can assign the variable J to Jason's age. As Jerry is 10 years older than Jason, Jerry's age is J+10. Jason's age is J. Jason is twice as old as James, so James' age is ½ x J. As we know their ages add up to 55, we can find the sum of their ages and solve for J:

(J + 10) + (J) + (½ J) = 55
J + 10 + J + ½ J = 55
2½ J + 10 = 55
2½ J = 45
J = 18

Knowing Jason's age and that Jason is twice as old as James, we find that James is ½ J = ½ (18) = 9. James is 9 years old.

Question 28.

Amy wants to make a fruit smoothie, and she always adds ½ cup of blueberries for every 2 cups of juice. If Amy has 5 cups of juice, how many cups of blueberries will she need?

Answer: 1.25 or 5/4 or 1¼ cups

We know Amy likes her ratio of ½ cup of blueberries for every 2 cups of juice, and can multiply this ratio by her 5 cups of juice to find how many blueberries she will need.

(5 cups juice)*(½ cup blueberries)/(2 cups juice) = 1.25 cups of blueberries.

Now we know Amy needs 1.25 cups of blueberries, which can also be written as 5/4 or 1¼ cups.

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Question 29: Using number patterns, find the number in the square labeled with an X.

--	2	3
5	0	X
9	4	5

Answer: 1

In order to find this answer, we first need to look at how each column and row changes and find patterns. From the second to third row (rows are horizontal), we see an increase of 4, as 9-5=4 and 4-0=4.

Next, we also notice a pattern in the columns. From the first to second column (columns are vertical), we see a decrease of 5, as 5-0=5 and 9-4=5. We can then assume that all numbers in the grid follow a similar pattern and increase or decrease accordingly with the columns and rows. Now we can start solving for the missing number.

As we noticed earlier, moving from the second to third row causes an increase of 4, or 5-X=4. Solving for that, we find that X=1. Now we know the missing number is 1. We can also check our work using the pattern with columns. As we noticed earlier, moving from the second to third column causes an increase of 1, so X-1=0. Again we find that X=1. The missing number is 1.

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Question 30.

Maggie needs to write her research paper, and it has to be 1000 words long. She knows that when she's working hard, she can write 25 words per minute. However, when she's not trying, she can only write 10 words per minute. If Maggie has already been not trying for 20 minutes, and she decides that she will work hard until she finishes the paper. How many minutes total did it take for Maggie to finish writing the paper?

Answer: 52 minutes

After 20 min of not trying, Maggie has written a total of (20 min)*(10 words/min)=200 words. This means she has 1000 – 200 words = 800 words left to write. In this time, she will be working hard, so it will take her (800 words) / (25 words/min) = 32 minutes to finish the paper.

For the total minutes it took Maggie, we can add together her times of not trying and working hard to get 20min + 32min = 52min. It took 52 minutes total for Maggie to finish writing the paper.

Question 31.

In order to make it to her karate competition, Annie has to drive 20 km to the train station and then ride the train for 60 km. Annie drives an average of 50 km per hour, and train travels at 80 km per hour. Assuming no changeover time, how many minutes will it take for Annie to get to her competition?

Answer: 69 minutes

We can calculate the drive and the train ride separately and then add them together to find the total minutes Annie took.

For the drive, Annie drives 20 km at 50 km per hour, meaning it will take her (20km) / (50km/hr) = 2/5 hr. We can convert this time to minutes, getting (2/5hr)*(60min/hr) = 24min. Annie will drive for 24 minutes.

Now we can find the length of her train ride. The train travels 60 km at 80 km per hour, meaning the ride will take (60km)/(80km/hr) = 3/4hr. We can convert this time to minutes, getting (3/4hr)*(60min/hr) = 45min. The train ride will take 45 minutes. Adding the two times together, we get 24min + 45min = 69min. It will take Annie 69 minutes to get to her competition.

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Question 32.

Using number patterns, find the number in the square labeled with an X.

--	5	2
8	7	4
9	X	5

Answer : 8

In order to find this answer, we first need to look at how each column and row changes and find patterns. From the second to third row (rows are horizontal), we see an increase of 1, as 9-8=1 and 5-4=1.

Next, we also notice a pattern in the columns. From the second to third column (columns are vertical), we see a decrease of 3, as 5-2=3 and 7-4=3. We can then assume that all numbers in the grid follow a similar pattern and increase or decrease accordingly with the columns and rows. Now we can start solving for the missing number.

As we noticed earlier, moving from the second to third row causes an increase of 1, so X-7=1. Solving for that, we find that X=8. Now we know the missing number is 8. We can also check our work using the pattern with columns. As we noticed earlier, moving from the second to third column causes a decrease of 3, so X-5=3. Again we find that X=8. The missing number is 8.

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Question 33.

If a tomato weighs 115 grams and a plum weighs 69 grams, how many plums do you need to balance 30 tomatoes, considering all the plums, respectively all the tomatoes have the same weight?

Answer: 50 plums.

This question can be solved through a simple equation: 30 * 115 = x * 69, where x is the number of plums we need.

30 (tomatoes) * 115 (grams each) = 3450 (grams)

Thus, 30 tomatoes weigh 3450 grams.

x (plums) * 69 (grams each) = 3450, because the x number of plums must also weigh 3450 grams, in order to balance the 30 tomatoes.

x = 3450 ÷ 69

x = 50

In conclusion, 50 plums will weigh as much as 30 tomatoes.

Question 34.

Yesterday, Bob, Sam and Hank started reading the same book. If Bob reads 8 pages a day, Sam reads 18 pages every three days and Hank reads 49 pages a week, which of the boys will finish the book first?

Answer: Bob will finish first.

It is essential to work with a single measuring unit for the reading speed of the three boys. That is, we must know how many pages each one of them reads a day. If Sam reads 18 pages every three days, then 18 ÷ 3 = 6, so he reads 6 pages a day. Hank reads 49 pages a week, so 49 ÷ 7 (days in a week) = 7; thus, Hank reads 7 pages a day.

Since 8 > 7 > 6, it results that Bob (8 pages a day) will finish the book first, then Hank (7 pages a day) and, finally, Sam (6 pages a day).

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Question 35.

I want to cover my 3.8-meter-long and 3.5-meter-wide kitchen with 20 cm by 15 cm floor tiles. Given that a box of tiles contains 20 pieces, I can only buy full boxes and I don't want to use any leftovers, how many boxes do I need to buy in order to tile my kitchen floor?

Answer: 23 boxes

Let's convert the meters into centimeters, so that we can work with a single unit of measurement.

3.8 m = 380 cm and 3.5 m = 350 cm

If we lay the tile to parallel the length of the floor, then we will need:

380 (cm) ÷ 20 (cm) = 19 tiles to cover one length of the floor.

350 (cm) ÷ 15 (cm) = 23.3 (tiles). Considering we must not use any leftovers, we will round 23.3 to 24. Consequently, we need 24 tiles to cover one width of the room.

19 * 24 = 456 tiles needed for tiling the whole floor.

456 (tiles) ÷ 20 (pieces in a box) = 22.8 boxes. Since we can only buy full boxes, we must round 22.8 to 23. So we will need 23 boxes of tiles for covering the kitchen floor.

Question 36.

Julie ran 9 kilometers in 27 minutes. Supposing her speed was constant, how fast did she run in km/h?

Answer: Julie ran at 20 km/h.

Knowing that an hour has 60 minutes, we can solve this problem quickly by using the rule of three.

9 kilometers ..... 27 minutes

X kilometers ..... 60 minutes

9 / x = 27 / 60 => x = 9 * 60 ÷ 27

x = 540 ÷ 27

x = 20

So 9 kilometers in 27 minutes means that, at the same speed, Julie would have run 20 kilometers in an hour. In conclusion, Julie's speed was 20km/h.

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Question 37.

Jackie's cake recipe serves six people. The recipe includes 10 eggs, 150 grams of sugar and 450 grams of flour. If she plans to invite 20 friends to her birthday party, what ingredients would she need for a cake big enough for everyone, including herself?

Answer: Jackie will need 35 eggs, 525 grams of sugar and 1575 grams of flour.

This question requires the use of the rule of three, or cross-multiplication, three times. We know what quantities are enough for 6 persons, so we must calculate the necessary for 21.

6 (persons) ..... 10 (eggs) ..... 150 (g sugar) ..... 450 (g flour)

21 (persons) ..... x (eggs) ..... y (g sugar) ..... z (g flour)

Eggs:

6 / 21 = 10 / x

x = 21 * 10 ÷ 6

x = 210 ÷ 6

x = 35 (eggs)

Sugar:

6 / 21 = 150 / y

y = 21 * 150 ÷ 6

y = 3150 ÷ 6

y = 525 (g sugar)

Flour:

6 / 21 = 450 / z

z = 21 * 450 ÷ 6

z = 9450 ÷ 6

z = 1575 (g flour)

In conclusion, a cake that would cater for 21 persons needs to contain 35 eggs, 525 g of sugar and 1575 g of flour.

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Question 38.

Notice the number patterns in the grid and write the missing numbers in the squares marked with '?'.

38	26	14
19	?	7
57	39	?

Solution: The missing numbers are 13 (2nd column) and 21 (third column).

The pattern goes vertically, from top to bottom. On the second row, there are the halves of the numbers on the first row, while on the third one we have got the sum of the numbers on the first two rows.

Column 1: On the first row we have number 38.

38 ÷ 2 = 19 (second row), and

38 + 19 = 57 (third row).

Using the same method, we discover the missing numbers.

Column 2: On the first row we have number 26.

26 ÷ 2 = **13** (second row), and

26 + 13 = 39 (third row)

Column 3: On the first row we have number 14.

14 ÷ 2 = 7 (second row), and

14 + 7 = **21** (third row)

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Question 39.

Notice the number patterns in the grid and write the missing number in the squares marked with '?'.

3	4	5
-	1	?
9	8	-

Solution: The missing number is 6.

The grid above contains numbers 1 to 9 in ascending order, starting from the central square, going left then up and continuing in a helicoidal shape until it reaches 9 in the bottom left corner.

Question 40.

Notice the number patterns in the grid and write the missing number in the squares marked with '?'.

8	32	56
16	?	64
24	48	72

Solution: The missing number is 40.

The grid consists of nine multiples of 8, from 8 to 72, listed in order on each column, from top to bottom. The only multiple missing from the list is **40**, situated between 32 and 48, in the middle square of the grid.

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Question 41.

Notice the number patterns in the grid and write the missing number in the squares marked with '?'.

24	48	8
192	24	?
N/A	144	N/A

Solution: The missing number is 96.

The pattern is ruled by number 24 in the center of the grid. This number divides and multiplies in turn by 1, 2, 3 and so on, in clockwise sequence, starting from the top left corner.

Consequently, 24 ÷ 1 = 24

24 * 2 = 48

24 ÷ 3 = 8

24 * 4 = **96**

24 ÷ 5 = N/A (because the result is not a natural number)

24 * 6 = 144

24 ÷ 7 = N/A

24 * 8 = 192

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Question 42.

Notice the number patterns in the grid and write the missing numbers in the squares marked with '?'.

3	?	7
9	25	49
27	125	?

Solution: The missing numbers are 5 and 343.

The grid has prime numbers on the first row, their squares on the second row and their cubes on the third row.

The pattern is: $3^2 = 9$, $3^3 = 27$, so the first column will consist of numbers 3, 9 and 27.

We know that 25 and 125 are the square, respectively the cube of 5, because $5^2 = 25$ and $5^3 = 125$. Thus, the second column will consist of numbers **5**, 25 and 125.

Similarly, $7^2 = 49$ and $7^3 = 343$, so the third column will be 7, 49 and **343.**

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Question 43.

Complete the sequence with the missing number.

4 103 15 92 81

Solution: 26

There are two ways we could analyse this number sequence.

Firstly, we can notice that there are two mingled patterns concerning every second number. From 4 to 15 there is an increase by 9. From 103 to 92 to 81 there is a repeated decrease, also by 9. Our missing number is situated in the ascendant sequence, so 15+9 = **26**. In conclusion, the missing number is 26.

Secondly, we can observe a mathematical pattern for all numbers in the sequence. 4 is 99 less than 103; 103 is 88 greater than 15; 15 is 77 less than 92 and so on. Each number at a time adds, respectively subtracts 99, 88, 77 etc. Following this pattern, we can easily discover the missing number:

4 + 99 = 103

103 – 88 = 15

15 + 77 = 92

92 – 66 = **26**

26 + 55 = 81

Question 44.

Complete the sequence with the missing number.

0 3 8 ..... 24 35 48

Solution: 15

Each number in the sequence adds an odd number, in ascending order, starting from 3.

0 + 3 = 3

3 + 5 = 8

8 + 7 = **15**

15 + 9 = 24 and so on.

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Question 45.

Complete the sequence with the missing number.

416 208 104 52 13

Solution: 26

Each number in the sequence is half of the previous number.

416 ÷ 2 = 208

208 ÷ 2 = 104

104 ÷ 2 = 52

52 ÷ 2 = **26**

26 ÷ 2 = 13

In conclusion, the missing number is 26.

Question 46.

Complete the sequence with the missing number.

8253 2537 5371 3714 ..... 1426 4260

Solution: 7142

We have got a sequence of numbers, four figures each. We notice that each new number is obtained by using the last three figures from the previous number, in order, then annexing the first figure of which we have subtracted 1.

Example: how do we obtain 2537 from 8253?

We take the last three figures of 8235, which are 253. Then, we take the first figure of the number, which is 8, and subtract 1: 8 – 1 = 7. Consequently, the last figure of the new number will be 7, so the number obtained is 2537.

We apply the same method to 3741. We take figures from the second one onwards and we have **741**. Then we subtract 1 from the first figure: 3 – 1 = **2**, and we juxtapose the figures to obtain **7412**, which is the missing number.

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Question 47.

Complete the sequence with the missing number.

382 198 106 60 .....

Solution: 37

This time, each number is half the previous one, *plus 7*.

382 ÷ 2 + 7 = 198

198 ÷ 2 + 7 = 106

106 ÷ 2 + 7 = 60

60 ÷ 2 + 7 = **37**

So 37 is the missing number.

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BONUS CHAPTER

MATHEMATICS WITHOUT A CALCULATOR

Welcome to this new chapter of Master the Victoria Police Exams. In the following pages we will cover the basics of multiplication and division often used in aptitude exams. Knowing how to complete these equations without a calculator will put you ahead of many other applicants who will only be able to guess at the answers.

If you struggle to follow the explanations, try writing them down and following each step as you write each part.

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Make sure you know your basic times tables from 1 through 12 before going any further into this mathematics lesson!

X	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144

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MULTIPLYING WHOLE NUMBERS

We are all familiar with the multiplication table which allows us to give the products of whole numbers from *0* to *12*. If you're not familiar with this, you may want to become so.

If you are familiar with those times tables, what happens when we are given a problem with digits greater than *12*?

Let's take a look at the following sample problem to see how it goes:

Find the product of *13 and 2.*

What an easy question! We have learned that multiplication is simply repeated addition and that:

13 x 2 = 2+2+2+2+2+2+2+2+2+2+2+2+2 = 26

So we got *26* as the product of *13* and *2* by adding *2* to itself *13* times.

What if we are asked to multiply *53* by *2*? Just imagine adding *2* to itself *53* times to get that product. We might lose count along the way and get the wrong answer. But we do not have to worry; there is still an easier way.

We now recall that changing the order of the numbers we are multiplying will not affect the product (This is the ***commutative property of multiplication***). Using this rule, we have:

53 x 2 = 2 x 53 and,

2 x 53 = 53 + 53 = 106

Therefore,

53 x 2 = 2 x 53 = 106.

That is right! We only added *53* two times to get *106* which is a lot easier than adding *2* to itself *53* times to also get *106*.

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But we have another method of solving this problem. We will transform the horizontal multiplication equation into a vertical one. The horizontal form *53 x 2 = (product)* can be rewritten as:

$$\begin{array}{r} 53 \\ \underline{\times\ \ 2} \end{array}$$

We now have the vertical form of the same problem. Before we continue solving, there are some very important things we should remember in doing this transformation:

1. We know that the commutative property of multiplication allows us to multiply numbers in any order. In using the vertical form, however, it is best to put the larger number on top and the lower number on the bottom. The horizontal line drawn under this lower number represents the equal (=) sign in the horizontal form.

2. We should be careful that all numbers are properly aligned in their corresponding place values. In the example above, the numbers *2* and *3* are aligned in the *one's* place column.

3. For each digit in the lower number multiplied by each digit in the upper number:

    a. If the product is greater than ***9***, the *ten's* value of this product is raised above the upper number with the next place value (We will see this in the next examples).

    b. If it is not greater than ***9***, then we will just bring it down below the horizontal line at the corresponding place value.

We can now perform the multiplication. We start with the *one's* place and multiply *2* and *3*. We have the result as *6 (2 x 3 = 6).* Note that this product is not greater than ***9*** so we put it below the line under the *one's* place column. Our solution will now look like this:

$$\begin{array}{r} 53 \\ \underline{\times\ \ 2} \\ 6 \end{array}$$

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Then we proceed by multiplying *2* by *5* to get *10 (2 x 5 = 10).* This is greater than ***9*** but since *5* is also the last number that we performed the multiplication on, we only have to bring down the *10*. Note that the *0* in *10* is aligned with the *5* on the *ten's* place value column.

53
x 2
106

This time, we got the answer by performing the multiplication process instead of adding repeatedly.

Multiplication of a three-digit number by a one-digit number

So far repeated addition easily worked because we have multiplied a low one-digit number by a two-digit one. Let us now multiply a three-digit number by the largest one-digit number, say *963* by *9*. Again, using the *commutative property of multiplication,* we have:

963 x 9 = 9 x 963

Now, we really have to work hard if we apply repeated addition to this multiplication problem. Try adding *9* to itself *963* times or adding *963* to itself *9* times. That's a lot of work!

We will now go to an easier solution:

First we transform the horizontal form of the multiplication equation into a vertical one. The horizontal form *9 x 963 = (product)* can be transformed into the vertical form below:

963
x 9

The next step is to multiply the *one's* digits, *9* and *3* to get *27 (9 x 3=27)*. We align the *7* in the *one's* place column below the line. Since this product is greater than ***9***, we put the *2* on top of the *ten's* place column. This is how it will appear:

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2
963
x 9
7

We then go to the *ten's* place column and multiply *9* by *6*. This will give us *54 (9 x 6 = 54).* What do we do with the number *2* we placed on top of the *ten's* place column? We add this *2* to *54* to get *56.* After adding, we place the *6* at the *ten's* place column below the line and put the *5* in the *hundred's* place column to get:

52
963
x 9
67

The last step is to multiply *9* by *9* to get *81*. As we did in the *ten's* place column, we also add the *5* in the *hundred's* place column to *81* to get *86*. Since the *hundred's* place column is the last place value where we need to perform multiplication, we bring the total amount of *86* down below the line.

52
963
x 9
8667

Then we have the product of *963* and *9* which is *8,667*.

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Multiplication of a two-digit number by another two-digit number

Now that we have done multiplying a one-digit number and a three-digit number, let us try a more challenging question: What is the product of *45* and *32*?

To answer this question, we write the required multiplication in vertical form as follows:

$$\begin{array}{r} 45 \\ \underline{\times\ 32} \end{array}$$

We proceed with the multiplication process by starting with *2*, the *one's* digit of the bottom number, and multiply it with *5* to get *10 (2 x 5= 10)*. As in our previous example, this product is more than ***9*** so we put *0* below the line and raise *1* to the *ten's* place column to get:

$$\begin{array}{r} 1 \\ 45 \\ \underline{\times\ 32} \\ 0 \end{array}$$

The next step is to multiply *2* by *4* to get *8 (2 x 4 = 8)*. Add the number *1* we placed above the *4* and we have *9*. We bring this down on the *ten's* place column below the line and it will look like this:

$$\begin{array}{r} 1 \\ 45 \\ \underline{\times\ 32} \\ 90 \end{array}$$

The number *90* is not our final product! We still have to deal with the *3* in the *ten's* place column. This simply means that we also have to multiply *45* by *3* and here's how we do it.

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Just as we did with the number *2*, we will first multiply *3* by *5* to get *15. (3 x 5 = 15)*. Since this value is again greater than ***9***, we place the *5* below the line and raise the *1* above the number *4*. We should note that since we are multiplying from the *ten's* place, the number *5* should be placed under the *ten's* place column as shown below:

1
45
x 32
90
5

Then we proceed and multiply *3* by *4* to get *12 (3 x 4 = 12)*. We add the *1* we have raised above the *4* to this product and get *13*. Since the *ten's* place value is the last place value that we need to perform multiplication, we bring down the total amount of *13* as follows:

1
45
x 32
90
135

The last step is to add the two products (*90* and *135*) that we have, taking extra care of the place value of all numbers:

1
45
x 32
90
135
1440

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The final answer is *1,440*! As an added bonus, you can reverse order of multiplying the numbers *45* and *32* to get the same product. See if you can solve the equation to get the same answer as below.

$$\begin{array}{r} 32 \\ \times\ 45 \\ \hline 160 \\ 128 \\ \hline \mathbf{1440} \end{array}$$

Remember that in any whole number multiplication problem; the trick is to know the place value of the number you are multiplying with to place its product in the proper place value column.

MULTIPLYING FRACTIONS

Before we go into the process of multiplying fractions, let us review some important concepts about them:

- Fractions usually represent a part or parts of a whole; for example:

$$\frac{1}{2}, \quad \frac{2}{3}, \quad \frac{3}{5}$$

- These fractions may also be shown as *1/2, 2/3* and *3/5*

- There are two important numerical components of a fraction:

  Numerator – the number on top of the horizontal line

  Denominator – the number below the horizontal line

- The horizontal line (or the right slanted line) represents the symbol for division (÷)

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Now the rule for multiplying fractions is very simple – multiply the numerator of one fraction by the numerator of the other fraction; do the same for the denominators. The product should be another fraction.

Let us take two fractions from our example to multiply; say *1/2* and *3/5*

1/2 x 3/5 = (1x3)/(2x5) = ***3/10***

That was easy! The most common problem we will encounter in multiplying fractions is to simplify the product. This simply means that we express our answer in the lowest possible terms.

Let us see what will happen if we are asked to find the product of *2/3* and *6/8*

2/3 x 6/8 = (2x6)/(3x8) = 12/24

Note that in order to express a fraction in its lowest term, we have to find the greatest common factor (GCF) between the numerator and the denominator. After eliminating this GCF by division, the fraction is then simplified.

We continue with our example and note that the GCF = *12*

Therefore 12/24 is the same as:

(12x1) / (12x2)

Now we pair the numerators and the denominators (as previously explained) which gives us:

(12/12) x (1/2)

This equals:

1 x (1/2) = 1/2.

We now have the required answer which is ***1/2****.*

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Multiplying a fraction and a whole number

We often encounter the phrase *"a fraction of –"* something or some number. This simply means multiplying that fraction and that number. Take for example this question – what is *3/4* of *20*?

3/4 of *20* = *3/4 x 20*

We note that here we are multiplying a fraction *(3/4)* and a whole number *(20)*. Can we apply the rule in multiplying fractions here? The answer is YES! The whole number can be rewritten as a fraction with denominator equal to *1*. Using this:

3/4 x *20* = *3/4 x 20/1 = (3x20)/(4x1) =60/4*

We find the GCF = *4* and

60/4 = (4x15)/(4x1) = (4/4)x(15/1) = 15/1 =15

Therefore, *3/4* of *20* is ***15.***

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Multiplying a fraction and a mixed number

What is a mixed number? A mixed number is whole number combined with a fraction; for example: one and a half *(1 1/2)* or three and two-thirds *(3 2/3).*

Let us see how we can solve this: Find *1/4* of *8 2/3* and simplify.

We already know that:

1/4 of *8 2/3 = 1/4 x 8 2/3*

The first step in our solution is to convert the mixed number into a single fraction with a denominator equal to the denominator in the fractional component of the mixed number. In this case, we want to have an equivalent fraction with a denominator equal to *3.* Multiply the whole number *8* by *3* to get *24 (8x3=24).* Add this product to the numerator of our given fraction which will result to *26 (24 + 2 =26).* Divide this sum by *3* and we have the equivalent fraction *26/3.* Then after substituting this in our problem we can now perform the multiplication process –

1/4 x 8 2/3 = 1/4 x 26/3 =(1x26)/(4x3) = 26/12

We found the GCF = *2* and using this:

26/12 = (2x13)/(2x6) = (2/2)x(13/6) = 26/12 =2 2/12 = 2 1/6

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MULTIPLICATION OF DECIMALS

Everything we learned in multiplying whole numbers and fractions will apply to decimals. The reason is that decimals can be expressed as fractions. Let us see some examples:

(1) *.2 = 2/10*

(2) *.35 = 35/(10x10) = 35/100*

(3) *.106 = 106/(10x10x10) = 106/1000*

(4) *.0456 = 456/(10x10x10x10) = 456/10000*

Notice that we moved the decimal point to the right to get the whole number and divided by *10* each time we moved the decimal point. We have seen that it is easy to convert a decimal into a fraction. Let us try this problem: Find the product of *.2* and *.35.* Simplify your answer.

Using all that we have learned, here is our solution:

Method I : *Converting the decimals to fractions*

1. Convert the decimals to fractions:

   .2 x .35 = 2/10 x 35/100

2. Apply the rule in multiplying fractions:

   2/10 x 35/100 = (2x35)/(10x100)

3. Apply lessons in multiplying whole numbers:

   (2x35)/(10x100) = 70/1000

4. Find the GCF to get the lowest term:

   70/1000 = (10x7) / (10x100) = 7/100

   or simply cross off a zero from each side:

   70/1000 = 7~~0~~/100~~0~~ = 7/100

5. Convert the fraction into its decimal form. We now move the decimal point to the left according to the number of zeroes in the denominator. In this case, we have two zeroes and we have to move the decimal point two places from the right of the whole number to two places to its

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left. To do this, we add a zero to the left of *7* and move the decimal point two places to the left to get ***.07***

This looks like this:

7/100: There are two zeros in the denominator. Therefore move two decimal places left on the '7'.

0007.00 becomes 00.0700

This can also be written as

7 becomes .07

6. Then we have the product of *.2* and *.35* which is ***.07***

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METHOD II : *Treating decimals as whole numbers*

We will explore another method of multiplying decimals. Using the same decimals *.2* and *.35, we* will show that multiplying decimals like whole numbers will also give us a solution. In multiplying whole numbers, it is easier to present the problem in vertical form. We will do the same for decimals and our equation will appear as follows:

.35
x.2

Notice that what we did not align the decimals according to place values. This is so because we will treat these decimals as whole numbers. This means moving the decimal point to the right until we get the whole number. For the decimal *.2*, we move the decimal point *1* place to the right to get *2*; for the decimal *.35* we need to move *2* decimal places to the right to get *35*. Remember that we moved a total of *3* decimal places to get the whole numbers. Applying our knowledge of multiplying whole numbers we get:

35
x 2
70

After getting the whole number product, we now move the decimal point *3* places to the left (the same number of decimal places we moved to the right before we multiplied the decimals). Because our product is a two-digit number and we have to move *3* places to its left, we need to place a *0* before *70.* Our product will now appear as:

35
x 2
070

We go back to our problem with the decimal points in their original decimal positions and move the decimal point 3 places to the left of our product. Then we have:

.35
x. 2
.070

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The only question remaining is that the answers in METHOD I *(.07)* and METHOD II *(.070)* do not match. But they are equal! To prove this we will use conversion of decimals to fractions. Using our previous lesson:

METHOD I:

.07 = 7/(10x10) = 7/100

METHOD II:

.070 = 70/(10x10x10) = (10 x7)/(10x100) =(10/10)x(7/100) =7/100

Therefore, .07 is the same as .070!

Remember that removing or adding zeroes to the right of the last whole number in any decimal does not change the value of that decimal.

If you're not confident with the above explanation, make some examples of your own and practice finding the product of decimals using any of the two methods. Use a calculator to check your work.

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DIVISION OF NUMBERS

Let's look at the process of division. Suppose we have 8 books that we need to read in 4 days. How many equal numbers of books each day do we have to read? If you think about it, we have to read 2 books each day for 4 days to finish reading all 8 books. We express this problem as:

$$4\overline{)8}\,2$$

Where ***8*** is called the ***dividend, 4*** is called the ***divisor*** and the result ***2*** is called the ***quotient.*** We can also express division in the form **8÷4 =2** or **8/4 = 2.**

Did you notice that **2 x 4 = 8?** That's because ***division*** is simply the reverse of ***multiplication*****!**

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Before we go on, there are certain rules that we need to remember:

1. Certain properties of multiplication do not apply to division.

    - Division IS NOT commutative. We cannot reverse the order of the dividend and the divisor. Let us show this by using our previous example

        $8 \div 4 = 2$
        $4 \div 8 = 4/8 = 1/2$

    - Division IS NOT associative. If we recall, the associative property of multiplication allows us to change the grouping of a set of 3 or more numbers to get the same answer. For example,

        $8 \times (4 \times 2) = 8 \times 8 = 64$
        $(8 \times 4) \times 2 = 32 \times 2 = 64.$

        Note that we always do the mathematical operation inside the brackets first. Now let us use the same sequence for division of the same numbers.

        $8 \div (4 \div 2) = 8 \div 2 = 4$
        $(8 \div 4) \div 2 = 2 \div 2 = 1$

        We see that we cannot change the grouping of the numbers being divided.

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- Division IS NOT distributive. Let us first illustrate the distributive property of multiplication. Consider the following:

  $$8 \times (4 + 2) = 8 \times 6 = 48$$

  Following the rule on performing operations inside the parenthesis first, we got the product equal to **48.** The distributive property of multiplication allows us to "distribute" 8 inside the brackets to get:

  $$8 \times (4 + 2) = (8x4) + (8x2) = 32 + 16 = 48$$

  As you can see, we got the same product equal to **48.** In other words, we can separately apply the multiplying factor to each number.

  Now using the same numbers as our example for division, we have

  $$8 \div (4 + 2) = 8 \div 6 = 8/6 = 4/3$$

  Note that this **4/3** is the correct answer.

  If we distribute the 8, we get the result as 6:

  $$8 \div (4 + 2) = (8 \div 4) + (8 \div 2) = 2 + 4 = 6.$$

We have different quotients and therefore shown that the distributive property of multiplication does not apply to division.

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The remaining rules are:

2. Division by the number 0 is not allowed. The quotient is undefined!

   eg. The equation 15 / 0 cannot exist.

3. A number (including 0) divided by 1 will result in that same number.

   eg. 15 / 1 = 15 and 0 / 1 = 0

4. A number (except 0) divided by itself equals 1.

   eg. 15 / 15 = 1 and 1 / 1 = 1

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Division of whole numbers

Exact Division

Let's consider the first example again:

$$4\overline{)8}\,\,2$$

This may be restated as how many 4's will fit into 8? And of course, the answer is 2. This a good example of dividing numbers without a ***remainder.*** We will discuss what a remainder is and how it is treated in problems involving division in our later illustrations.

Example 1. Find the quotient of 126 ÷ 9.

We will try solving this problem using the process called ***long division***. We make use of the following division form:

$$9\overline{)126}$$

The first step is to test how many 9's will fit into 1. The answer is none. If the first digit of the dividend is smaller than the divisor, then we go to the next digit. Again, if we ask the question how many 9's will fit into 12, the answer is 1 and place it on top of the 2 we "borrowed" from the dividend since we have included this in our initial division. We now have:

$$9\overline{)126}\,\,1$$

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Then we multiply 1 x 9 to get 9 and place this below the 12. The next step is to subtract this 9 from 12 to get 3. Our solution will look like this:

$$\begin{array}{r} 1 \\ 9\overline{)126} \\ \underline{9} \\ 3 \end{array}$$

We bring down the next (and final) digit 6 to the row where we had a 3. We will now have a 36 for this step and our solution will appear as:

$$\begin{array}{r} 1 \\ 9\overline{)126} \\ \underline{9} \\ 36 \end{array}$$

We again divide this 36 by 9 to get 4 which we place on top of the 6 in the division symbol:

$$\begin{array}{r} 14 \\ 9\overline{)126} \\ \underline{9} \\ 36 \end{array}$$

The next step is to multiply 4 and 9 to get 36. We place this product below the other 36 we have shown above. The last step is to subtract these two numbers and we obtain 0.

$$\begin{array}{r} 14 \\ 9\overline{)126} \\ \underline{9} \\ 36 \\ \underline{36} \\ 0 \end{array}$$

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Note that ***long division*** is a continuous process of (1) dividing, (2) multiplying and (3) subtracting. We repeat these operations in the same sequence until we have used up all the digits in our dividend. In our given problem, the result of the last subtraction step is 0. In other words, we have no remainder and our final answer is **14.** This is an example of an exact division problem.

Note: *If we check by multiplication, we get 9 x 14 = 126.*

Example 2. Divide 2208 by 12.

Let's get right into it and find how many 12's fit into 22. The answer is 1 and we place it over the second 2. Note that we have taken the first two digits of the dividend as our starting point because our divisor is a two-digit number:

$$12\overline{)2208}\quad 1$$

The next step is to multiply 1 x 12 = 12 and subtract this from 22:

This is how we calculate the 'remainder' figure for the next stage of long division. In other words, this is the number left that didn't fit into the first division. So 22 - 12 = 10. This '10' goes underneath:

$$\begin{array}{r} 1 \\ 12\overline{)2208} \\ \underline{12} \\ 10 \end{array}$$

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We bring down the next digit which is 0 to get 100. How many 12's fit into 100? The answer is 8 and place it above the 0 next to the 1:

$$\begin{array}{r} 18 \\ 12\overline{)2208} \\ \underline{12} \\ 100 \end{array}$$

Multiply 8 x 12 and we have 96. Subtract this from 100 and we get 4. We bring down the last digit 8 to show 48:

$$\begin{array}{r} 18 \\ 12\overline{)2208} \\ \underline{12} \\ 100 \\ \underline{96} \\ 48 \end{array}$$

We now divide 48 by 12 and get 4. Put this on top of the 8 in the dividend. Multiply 4 x 12 to get 48 and write it below the other 48. Subtract these two and we have a difference of 0.

$$\begin{array}{r} 184 \\ 12\overline{)2208} \\ \underline{12} \\ 100 \\ \underline{96} \\ 48 \\ \underline{48} \\ 0 \end{array}$$

So if we divide 2208 by 12, the quotient is **184.** You can always check this by multiplication. This is also a good way to revise the multiplication lesson.

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INEXACT DIVISION

As previously mentioned, there are problems in division of whole numbers where there is a ***remainder.*** This is what inexact division implies. The dividend is not an exact multiple of the divisor.

Example 3. To illustrate this, let's try a simple question: How many groups of 2 can we make from 7? If we think carefully, we can show that we can make only 3 of these groups of 2 and have 1 left. This 1 is called the remainder. In equation form

$$\begin{array}{r} 3 \text{ r } 1 \\ 2\overline{)7} \\ \underline{6} \\ 1 \end{array}$$

To check our answer to this type of problem in division, we multiply the quotient and the divisor and add the remainder to their product. Checking our sample problem, we have (3x2) + 1 = 6 + 1 = 7.

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Example 4. Divide 1007 by 3.

Let's go straight to the solution. Notice that the first digit in our dividend is less than the divisor so we start dividing using the first two digits. We now divide 10 by 3 to get 3.

$$\begin{array}{r} 3 \\ 3\overline{)1007} \end{array}$$

After dividing, we multiply 3 and 3 to get 9. We subtract this from 10 and we have a difference of 1. Thus we have worked out the 'remainder' for this first part of the equation. We then bring down the next 0. Our solution will now look like this:

$$\begin{array}{r} 33 \\ 3\overline{)1007} \\ \underline{9} \\ 10 \end{array}$$

We continue this process until we get to the final digit in the dividend. By this time, our solution will appear as:

$$\begin{array}{r} 335\text{ r }2 \\ 3\overline{)1007} \\ \underline{9} \\ 10 \\ \underline{9} \\ 17 \\ \underline{15} \\ 2 \end{array}$$

The equation **1007 ÷ 3 = 335 R 2** can also be expressed as **1007 ÷ 3 = 335 2/3.** We divided the remainder by the divisor to form the fractional part of the answer.

In other words, after the final division (17 / 3) there is still a 'remainder' of 2.

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DIVISION OF FRACTIONS

We need to remember the rules on division that we set at the beginning of this lesson. A fraction is also an expression of dividing numbers, for example: 1/2 = 1 ÷ 2; 3/4 = 3 ÷ 4. We approach dividing fractions in a different way.

Example 6. What is 1/2 ÷ 3/4 equal to?

The process of dividing a fraction by another fraction involves two steps. The first step is to get the ***reciprocal*** of the divisor and this is done by inverting its numerator and the denominator. Our divisor for the given question is 3/4, and by inverting its numerator and denominator we have 4/3. The next step is to multiply the dividend (1/2) by the reciprocal (4/3) and we have:

$$1/2 \div 3/4 = 1/2 \times 4/3 = (1x4)/(2x3) = 4/6$$

We found the GCF = 2, then 4/6 = (2 x 2)/(2x3) = (2/2) x (2/3) = 2/3.

Notice that we simplified our answer to get **2/3.** This is the usually done in problems involving fractions.

Example 7. Now lets reverse it and solve 3/4 ÷ 1/2.

Following the steps in Example 6, we get the reciprocal of 1/2 = 2/1. Then our equation becomes:

$$3/4 \div 1/2 = 3/4 \times 2/1$$

Next we multiply each numerator (3 x 2) and each denominator (4 x 1) to get:

$$6/4$$

This can then be divided by the GCF (Greatest Common Factor). In this case the largest number that fits into both 6 and 4 is 2. Therefore we arrive at:

$$3/2$$

Note that we have a different answer when we reversed the order of the division equation given in example 6.

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Example 8. What if we are to divide a whole number by a fraction? Let us try 48 ÷ 1/2.

Recall that a whole number can be expressed as a fraction with denominator = 1. Therefore,

$$48 \div 1/2 = 48/1 \times 2/1 = (48 \times 2)/(1 \times 1) = 96/1 = 96.$$

Example 9. We now try the reverse, dividing a fraction by a whole number. What is 3/4 ÷ 5?

$$3/4 \div 5 = 3/4 \div 5/1 = 3/4 \times 1/5 = (3 \times 1)/(4 \times 5) = 3/20$$

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DIVISION OF DECIMALS

In multiplication of decimals, we learned the process of moving the decimal point to get the equivalent whole number. We also learned how to manipulate the decimal place to solve equations with decimals. These lessons also apply in the division of decimals but with a slight difference. We will illustrate these with some examples using long division.

Example 10. Divide 0.25 by 0.05. This can be shown as

$$.05\overline{).25}$$

The first thing to do in solving this kind of division problem is to convert the divisor into a whole number. We have already learned that this will help make it easier for us to perform the operation. In our given problem, we have to move the decimal point two places to the right to get the whole number 5. At the same time, the decimal point in the dividend should move the same places to the right. Doing this we have 25 inside the symbol of division or the division box and we have:

$$\begin{array}{r} 5 \\ 5\overline{)25} \end{array}$$

This is an example where we moved the decimal point of both the divisor and the dividend equally and got a whole number **5** for an answer. Note there is no requirement here to re-state the decimal point. There would be other combinations of decimals but the important thing to keep in mind is that we have to transform the divisor to a whole number to make our division easier.

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Example 11. Lets see another combination. Try dividing 0.105 by 0.03. This can be written as follows:

$$.03\overline{).105}$$

We have to convert the divisor to a whole number and move the decimal point two places to the right and get 3. We also have to move the decimal point inside the division box two decimal places to the right. Doing this we got 10.5 and our expression becomes:

$$3\overline{)10.5}$$

Now we introduce another concept. Once the divisor is already converted and we have moved the decimal point of the dividend to the corresponding number of decimal places the decimal point of the divisor had been moved, then we proceed as if we are dividing whole numbers. We should take extra care that the quotient has a decimal point at the same place as the dividend's present position after conversion. We now proceed with our long division as follows:

$$\begin{array}{r} 3.5 \\ 3\overline{)10.5} \\ \underline{9} \\ 15 \\ \underline{15} \\ 0 \end{array}$$

The answer to our problem, divide .105 by .03 is **3.5.**

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Example 12. So far our problems had dividends greater than their divisors. Let's see how it will work for the reverse roles. Divide 0.00105 by 0.003. This can be expressed as:

$$.003\overline{).00105}$$

To follow our rule on the conversion of the divisor, we have to move the decimal point three places to the right and get 3. The corresponding conversion of the dividend gives us 1.05 and our expression is now:

$$3\overline{)1.05}$$

As we have shown, we divide these numbers as if they were whole numbers. We need only to consider the placement of the decimal point of the quotient. In this case, the answer looks like this:

$$\begin{array}{r} .35 \\ 3\overline{)1.05} \\ \underline{9} \\ 15 \\ \underline{15} \\ 0 \end{array}$$

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Example 13. Divide 1 by 3 and *express your answer in three decimal places.*

We easily recognise that the numbers given are already whole numbers. We will now introduce the concept of an “implied” decimal point to the right of the whole number. This simply means that 1 and 1.0 or 3 and 3.0 are expressions of the same numbers. Although the 0 is added to the right of the decimal point, it does not add any value to the whole number. We must also remember that any zero to the right of the whole number in any decimal does not add value to the decimal.

We now express our problem as follows:

$$3\overline{)1.0}$$

As we want the divisor to be a whole number, we retain the expression of the number 3 without the decimal point. We can now proceed with division as we have done in our previous examples:

$$\begin{array}{r} .3 \\ 3\overline{)1.0} \\ \underline{9} \\ 1 \end{array}$$

We now have a one-decimal place answer but the question asked us to give a three-decimal place answer. As we can see in the above equation, there is only one zero to the right of the decimal point. Adding 2 more zeroes will not affect the value of that decimal. In fact, we can add any number of zeroes to the right of that decimal point and the value of the whole number 3 will not be affected. We now add two more zeroes to our equation above and we have

$$\begin{array}{r} .3 \\ 3\overline{)1.000} \\ \underline{9} \\ 1 \end{array}$$

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We continue the process of long division as follows:

$$
\begin{array}{r}
.333 \\
3\overline{)1.000} \\
\underline{9} \\
10 \\
\underline{9} \\
10 \\
\underline{9} \\
1
\end{array}
$$

The requirement of the problem is a three-decimal place answer and we have **0.333** as the result of our long division.

If we multiply .333 by 3, we will have a product equal to .999 which is the approximate value of the dividend 1. There is a .001 difference between our dividend and our product because of the remainder in the last digits that we subtracted. Although our remainder is a whole number, we should remember that we got it from the thousandths decimal place of the dividend. We have to adjust the value of the remainder accordingly. If we were required to give the exact answer, it will be .333 R .001.

This final equation is likely far beyond the requirements of your aptitude exams, but if you can grasp this concept, the earlier problems of division will be surprisingly simple to you.

Final Comments

Congratulations! You've completed the basics of multiplication and division without use of a calculator. This is an important skill in boosting your exam scores. If you practice these basic processes you will significantly improve your speed and accuracy in basic calculations during the aptitude exams. Remember that some aptitude tests are long enough that many applicants will not complete all questions. Developing your speed will put you ahead of others in the selection pool. You will answer more questions and get more of them correct!

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