GATEway to General Aptitude

K   Te
4
Ta
4 knew all three

h
a   a

Researchers
Professors
Scientists

$8 | 1634$
$8 | 204 - 2$
$8 | 25 - 4$
$3 - 1$

N

M

4 km

W ← → E

O 1 km

2 km   N   SE

P

S

Q
P 6 | 1
R 5 | 2 U
4 | 3 S
T

$\exp(x)$

$2 - 0.5x^2$

0

× had wanted
× should have practised

Past   Future
Present

T V X Z +2 +2 +2
+4
L N P +2 +2
+4
B F H +2
+4

m subbu

s siddarth   ▲   r pavan

GATEway to General Aptitude

(Useful for GATE and other Aptitude Tests)

m subbu

s siddarth ▲ r pavan

GATE$\overrightarrow{\text{way}}$ to General Aptitude

m subbu
s siddarth
r pavan

2017

Typeset in LATEX

Total number of pages: 349

Price: Rs. 450/-

FOREWORD

Competitive examinations are becoming prevalent nowadays for any placement or higher study opportunities to test the sharpness and employability of candidates. GATE is one of the best competitive examinations of international standards. Many good opportunities for graduating engineers could be accomplished by taking up this examination. Choosing this *GATE's way* is a **GATEway** for any graduating engineer.

I got delighted upon going through the contents of this book titled "GATEway to General Aptitude". Entire sets of GATE 2010–2017 examinations' general aptitude questions are solved and presented with suitable illustrations and supporting notes. The authors of this book are a right combination, comprising of competent faculty—my colleague Dr. M. Subramanian and aspiring graduate students Mr. S. Siddarth & Mr. R. Pavan Kumar, from Chemical Engineering Department of our College. This combination resulted in providing impeccable solutions with good readability.

I am confident that this book will help, not only the aspirants of GATE, but also every candidate seeking the best placement opportunity. By going through the contents of this book, the reader will gain confidence in facing the screening tests of any sort.

Dr. S. Salivahanan
Principal
SSN College of Engineering
OMR, Chennai - 603 110

23rd September, 2017

PREFACE

Competitive examinations have become inevitable nowadays for admission to higher studies and placement in industries. For such examinations, apart from a sound knowledge in their respective core discipline, students need to have a good sense of verbal and numerical abilities with adequate practice.

This book targets mainly the prefinal and final year engineering students who are gearing up to appear in the competitive exams like GATE (Graduate Aptitude Test in Engineering, organized by IITs/IISc of India), CAT, Bank exams, Institute placement process, etc. Since, all these processes involve analytical skills as well, one has to spend time to master it.

This book gives complete solutions to general aptitude (GA) questions of GATE 2010–2017 exams, and typical questions from other exams. Additionally it has instant notes for a variety of topics which will be very useful to the reader for refreshing their basics. This book will be very helpful to students by giving them a good idea about the type of questions that are being asked in GA tests.

Acknowledgments by Dr. M. Subramanian:

Many thanks are due to the GATE authorities for their sincere work in preparing wonderful questions, which forms the heart of this book. I sincerely thank my students Mr. S. Siddarth and Mr. R. Pavan Kumar, who became the co-authors, for their continuous meticulous inputs in the form of typed and handwritten solutions, notes and new questions.

I extend my gratitude to my teachers, mentors, and philosophers Dr. N. Subramanian, and Dr. K. Krishnaiah, Former Professors of Chemical Engineering in IITM, and, Dr. A. Kannan, Professor & Head of Chemical Engineering, IITM, for their guidance and wishes throughout my academic career. I am grateful to Dr. D. Krishna Sandilya, Assistant Professor, IIT (ISM) Dhanbad for his continuous motivating ideas about teaching/learning processes.

I sincerely thank the Principal Dr. S. Salivahanan, management, faculty, and students of SSN College of Engineering, Chennai for their support. I thank the Chemical Engineering community all over the World for their encouragement through my website *www.msubbu.in*.

I thank Mr. T. Bhalaji for proof reading the drafts of the book. Many thanks are due to my wife Mrs. S. Panchi for her suggestions during various stages of this book project and providing administrative assistance. I thank my kids Rishal & Rithish, parents, in-laws, well-wishers and the Almighty for their support during these years.

Acknowledgments by Mr. S. Siddarth & Mr. R. Pavan Kumar:

We thank our parents and the Almighty for their support during the process of executing this project. We thank all the teaching and non-teaching staff of SSN-Chemical Engineering Department for providing us a platform to demonstrate our abilities. Finally, we thank our beloved teacher Dr. M. Subramanian for giving us this wonderful opportunity.

Awaiting for your valuable responses to be posted at: www.msubbu.in

m subbu   s siddarth   r pavan
(M. Subramanian)   **(S. Siddarth)**   **(R. Pavan Kumar)**

Chennai   September 30, 2017

Contents

Chapter 1

Instant Notes

1 Verbal Ability

1.1 Parts of Speech

Parts of speech is a category to which a word is assigned in accordance with its syntactic functions. It can be typically classified into 8 types:

1. Noun, 2. Pronoun, 3. Verb, 4. Adjective, 5. Adverb, 6. Conjunction, 7. Preposition, and, 8. Interjection.

1. Noun: Any naming word.

- Proper noun: used to indicate a particular place/person. It starts with capital letters.
  e.g.: Ram, Chennai, etc.
  NOTE: Proper nouns are always singular.
  e.g.: India <u>is</u> a diverse nation.
- Common noun: indicates common things.
  e.g.: chair, table, etc.
- Abstract noun: indicates intangible qualities. They are always singular.
  e.g.: unity, hunger, poverty, etc.
- Collective noun: indicates a group of person or things taken together but referred to as a single entity.
  e.g.: crowd, team, army, etc.
- Countable nouns: Nouns which can be counted.
  e.g.: pen, book, Rupees, Dollars.
- Uncountable nouns: Nouns which cannot be counted.
  e.g.: Money, traffic, space.
  Uncountable nouns are always singular.

- **Use of 'the'**:

  1. To represent a whole category.

     e.g.: <u>The</u> cow is a domestic animal.

  2. When the object is referred for second time.

     e.g.: I went to a shop. <u>The</u> shop was open.

  3. While referring to a particular place.

     e.g.: Shall we go to <u>the</u> market?

  4. Before superlative degree of adjectives.

     e.g.: the best.

  5. Before the names of rivers, oceans, places, oceans, etc.

     e.g.: The Ganges, The Himalayas, The Indian, etc.

  6. Before the names of holy books.

     e.g.: The Ramayana.

  7. Before universal objects.

     e.g.: the sun, the stars, the moon, etc.

  8. Before the names of countries which have several states or colonies under control.

     e.g.: The USA, The UK, etc.

  9. Before a proper noun when it is qualified by an adjective or defining an adjective clause.

     e.g.: The Great Alexander, The wonderful achiever, etc.

  10. With ordinals.

      e.g.: She was <u>the</u> first woman to arrive.

  11. Before musical instruments.

      e.g.: He can play <u>the</u> violin.

- **Omission of Articles**:

  1. Before names of substances and abstract nouns (i.e. uncountable nouns) used in general sense.

     e.g.: Honesty is the best policy.

  2. Before plural countable nouns used in general sense.

     e.g.: Children like cookies.

  3. Before languages.

     e.g.: We are studying Hindi.

- ambi - both

    e.g.: ambiguous - open to more than one interpretation; having a double meaning.
    ambidextrous - able to use the right and left hands equally well.

- multi - many

    e.g.: multimedia - using more than one medium of expression or communication.
    multiple - having or involving several parts, elements, or members.

- rupt - to break

    e.g.: rupture - break or burst suddenly.
    disruption - disturbance or problems that interrupt an event, activity, or process.
    bankrupt - declared in law unable to pay outstanding debts.

1.8   Confusable Words

Words that sounds alike.

- Illicit - negative word, something morally bad, illegal.

    Ellicit - Teacher did not want to give information, rather the teacher ellicited (to get from them) answer from specific students. It is a neutral or positive word.

- Complement - to add, to combine, complete

    Compliment - praise

- Apprise - inform someone about something

    Appraise - assess the value or quality of

- Principal (n) - the most important or senior person in an organization or group; a sum of money lent or invested, on which interest is paid.

    Principle - fundamental belief, moral code

- Emigrant - person from my country goes to other country

    e - exit, move out

    Immigrant - person from other country comes to my country.

    i - inside, move in

- Illusion - make it seem true, bad quality

    Allusion - allude to something. Referring to something without naming it. Comparison with something.

- Cache - safe place to keep things.

    Cash

- Affect (v)

    Effect (n)

- Mixed fraction: Fractions consisting of whole numbers and fractions are mixed fractions.
  e.g.: $\dfrac{14}{3} = 4\dfrac{2}{3}$; $\dfrac{5}{9} = 1\dfrac{5}{9}$

- Decimal fractions: A set of digits after a decimal is called decimal fraction. A fraction not expressed as p/q but as $a.b$ is called decimal fraction.

  e.g.: $0.33, 4.54$, etc.

Radicals

If n is a positive integer that is greater than 1 and a is a real number then,

$$\sqrt[n]{a} = a^{1/n}$$

where n is called the index, a is called the radicand, and the symbol $\sqrt{}$ is called the radical. The left side of this equation is often called the radical form and the right side is often called the exponent form.

For square roots, we simply write as

$$\sqrt[2]{a} = \sqrt{a}$$

In other words, for square roots we typically drop the index.

Divisibility Criteria

Following are certain tips to check divisibility of numbers.

- **Divisibility by 2** — A number is divisible by 2 if its unit digit is 0,2,4,6 or 8.

- **Divisibility by 3** — A number is divisible by 3 if sum of its digits is completely divisible by 3.

  To find: 758 is divisible by 3 or not?

Step 1: Sum of its digits is $7 + 5 + 8 = 20$ which is not divisible by 3.

Result: 758 is not divisible by 3.

- **Divisibility by 4** — A number is divisible by 4 if number formed using its last two digits is completely divisible by 4.

  To find: 30298 is divisible by 4 or not?

Step 1 Number formed using its last two digits is 98 which is not divisible by 4.

Result 30298 is not divisible by 4.

- **Divisibility by 5** — A number is divisible by 5 if its unit digit is 0 or 5.

- **Divisibility by 6** — A number is divisible by 6 if the number is divisible by both 2 and 3.

2.2   Series and Progressions

- Every progression is a sequence of numbers.

    1. Arithmetic Progression (A.P)
    2. Geometric Progression (G.P)
    3. Arithmetico Geometric Progression (A.G.P)
    4. Harmonic Progression (H.P)

- **Arithmetic Progression (A.P)**

    General A.P :
    $$a, a + d, a + 2d, a + 3d, \cdots$$

    a-first term; d-common difference.

    Examples:
    $$1, 2, 3, 4, \ldots \qquad 1, 3, 5, 7, 9, \ldots$$

    n^{th} term (t_n):
    $$t_n = a + (n-1)d$$

    Sum of n terms (S_n):
    $$S_n = \frac{n}{2}\big(2a + (n-1)d\big) = \frac{n}{2}(a + l)$$

    l-last term.

    If a, b and c are in A.P, then $b - a = c - b$, and b is called the arithmetic mean of a and c. $b = \dfrac{a+c}{2}$

- **Geometric Progression (G.P)**

    General G.P:
    $$a, ar, ar^2, \cdots$$

    a-first term; r-common ratio.

    Examples:
    $$2, 6, 18, 54, \ldots = 2, 2 \times 3, 2 \times 3^2, 2 \times 3^3, \ldots$$

    n^{th} term (t_n):
    $$t_n = ar^{n-1}$$

    Sum of n terms (S_n):
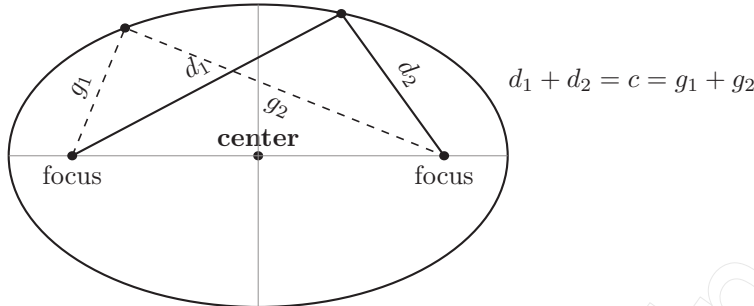 $$S_n = a\left(\frac{r^n - 1}{r - 1}\right)$$

    Sum of an infinite G.P:
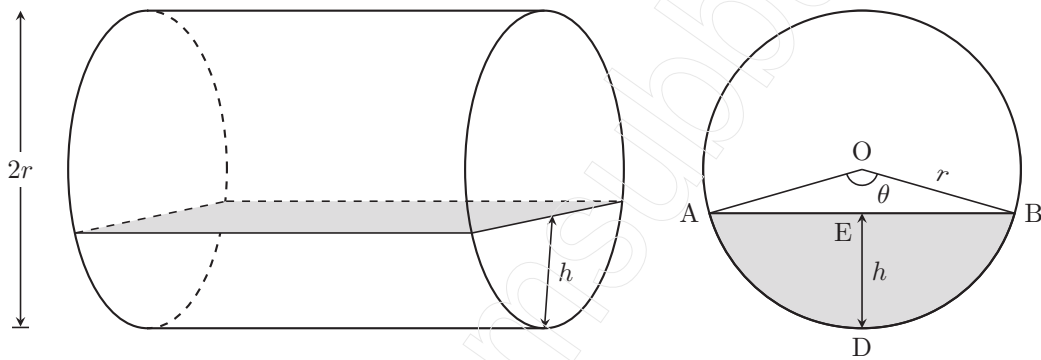 $$S_\infty = \frac{a}{1 - r}$$

    If a, b and c are in G.P, then $b/a = c/b$, and b is called the geometric mean of a and c. $b^2 = ac$.

The sum of the distances to any point on the ellipse (x, y) from the two foci $(c, 0)$ and $(-c, 0)$ is a constant. That constant will be $2a$.

If we let d_1 and d_2 be the distances from the foci to the point, then $d_1 + d_2 = 2a$.

$$d_1 + d_2 = c = g_1 + g_2$$

Volume of Horizontal Partly-filled Cylinder

To find the volume of a partly-filled horizontal cylinder, the following steps have to be used:

1. Calculate the entire area of one cylinder "end".

2. Calculate the segment area (the filled area, enclosed by ADB) by: subtracting triangle Area AOB from the sector area OADB.

3. Divide the segment area by area of the cylinder end.

4. Multiply this by the entire volume of the cylinder.

Example Problem: A horizontal cylinder has a length of 300 cm and a diameter of 100 cm. It is partially filled to a depth of 20 cm. What is the volume when filled to this depth?

   Solution:

Total Cylinder Volume $= \pi r^2 H = \pi \times 50^2 \times 300 = 2,356,195$ cm^3.

   Area of cylinder "end" = area of circle $= \pi r^2 = \pi \times 50^2 = 7,854$ cm^2.
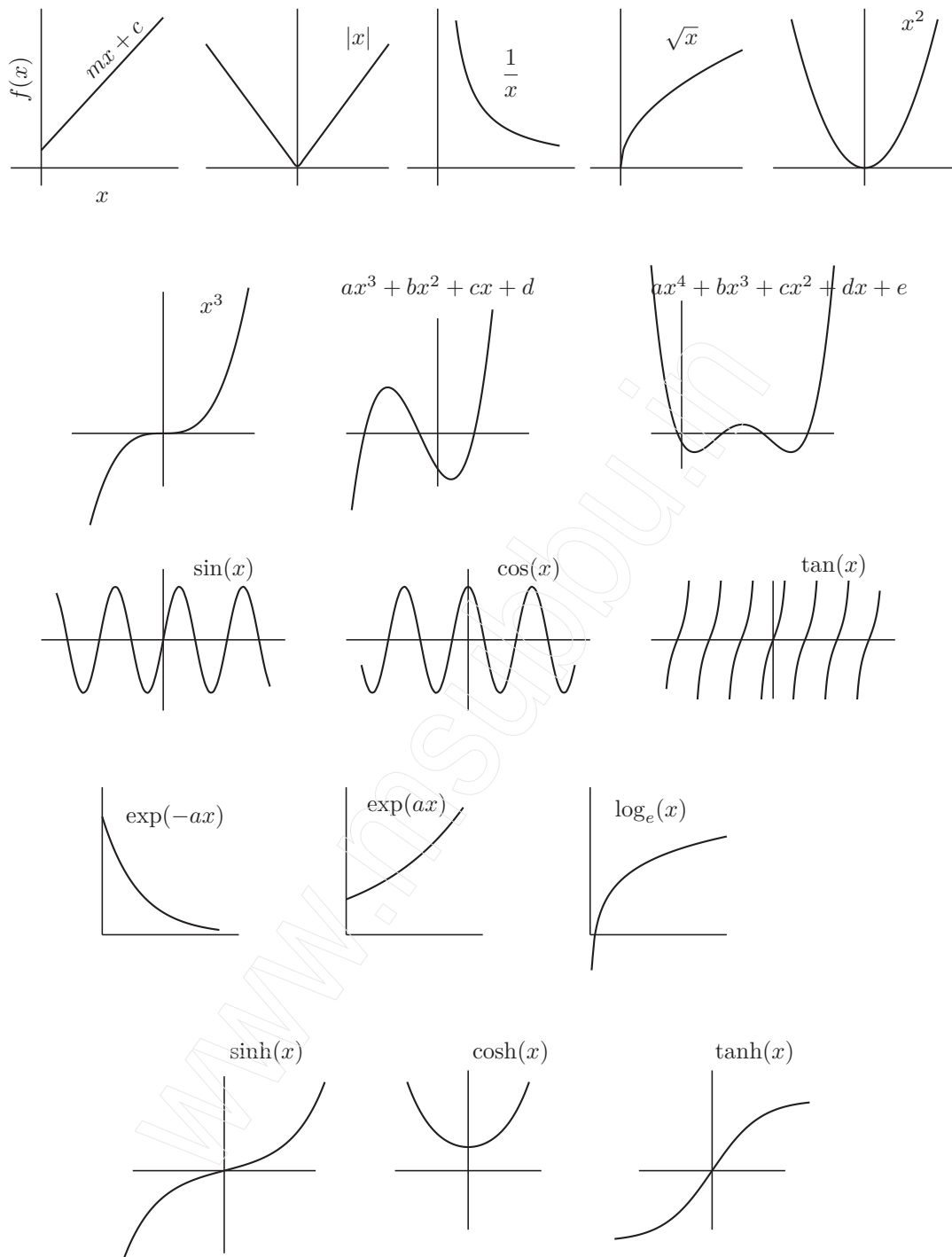
Figure 1.2: Graph of Some Important Functions: $f(x)$ vs. x

21. She will feel much better if she _____. (G-2014-S4-2)

    (a) will get some rest   (b) gets some rest
    (c) will be getting some rest   (d) is getting some rest

    (b) ✓ *Explanation:*

To feel better in future, she has to get rest now (present tense).

Tenses of answer options:

(a) future—wrong.

(b) simple present—correct.

(c) future—wrong.

(d) present continuous. Getting rest cannot be a continuous process. If she is getting rest continuously, she will be getting rest even after or even during feeling better, which is wrong.

Also, 'she will feel much better' is simple future, hence simple present form of the verb must be used. ☐

22. 'Advice' is _____. (G-2014-S5-3)

    (a) a verb   (b) a noun
    (c) an adjective   (d) both a verb and a noun

    (b) ✓ *Explanation:* 'Advice' is an abstract noun and 'advise' is a verb.

NOTE: In British English, the noun form often ends in '...ice' and the verb in '...ise'. ☐

23. The Headmaster _____ to speak to you. (G-2013-S2-2)

Which of the following options is incorrect to complete the above sentence?

    (a) is wanting   (b) wants   (c) want   (d) was wanting

    (c) ✓ *Explanation:* 'The headmaster' is the subject and it is singular. Hence, the verb must also be singular. 'wants' is the correct option to fill the blank. Also, options (a) and (d) are right; they are in different tenses but are in agreement to the subject.

Clearly, 'want' is wrong. Hence, option (c) is the correct answer. ☐

24. Were you a bird, you _____ in the sky. (G-2013-S3-1)

    (a) would fly   (b) shall fly   (c) should fly   (d) shall have flown

29. Many ancient cultures attributed disease to supernatural causes. However, modern science has largely helped _____ such notions. (G-2014-S3-3)

    (a) impel   (b) dispel   (c) propel   (d) repel

    (b) ✓ *Explanation:*

    impel(v)—drive, force, or urge (someone) to do something.
    dispel(v)—make (a doubt, feeling, or belief) disappear.
    propel(v)—drive, push, or cause to move in a particular direction, typically forward.
    repel(v)—drive or force (an attack or attacker) back or away.

    Here, the use of word 'however' indicates the former statement contradicts the latter. Hence, options (a) and (c) are wrong.

    The use of dispel in this sentence is more apt than using repel. Hence, option (b) is the correct answer. □

30. She could not _____ the thought of _____ the election to her bitter rival. (G-2014-S4-3)

    (a) bear, loosing   (b) bare, loosing
    (c) bear, losing   (d) bare, losing

    (c) ✓ *Explanation:*

    bear(v)—carry, support
    bare(adj)—naked; basic and simple
    bare(v)—undress
    losing(v)—be deprived of or cease to have or retain (something), become unable to find (something or someone)
    loosing(v)—set free, release

    Clearly, 'bare' and 'loosing' are wrong. Hence, options (a), (b) and (d) are wrong. □

31. The value of one U.S. dollar is 65 Indian Rupees today, compared to 60 last year. The Indian Rupee has _____. (G-2014-S5-2)

    (a) depressed   (b) depreciated   (c) appreciated   (d) stabilized

    (b) ✓ *Explanation:*

    depressed(adj)—(of a person) in a state of unhappiness or despondency.
    depreciated(v)—diminish in value over a period of time.
    appreciated(v)—recognize the full worth of.
    stabilized(v)—make or become unlikely to give way or overturn.

(c) ✓ *Explanation:* Options (a) and (b) are wrong.

Option (d) is wrong because different women of different countries may have different legal rights.

Option (c) is right. It is a metaphorical statement.   □

5. "India is a country of rich heritage and cultural diversity."   (G-2014-S5-1)

Which one of the following facts best supports the claim made in the above sentence?

(a) India is a union of 28 states and 7 union territories.

(b) India has a population of over 1.1 billion.

(c) India is home to 22 official languages and thousands of dialects.

(d) The Indian cricket team draws players from over ten states.

    (c) ✓ *Explanation:* Analyzing the options,

(a) It doesn't talk about the rich heritage. The number of states could probably refer to the cultural diversity. Hence, wrong.

(b) It doesn't talk about either the heritage or the diversity. Hence, wrong.

(c) The official languages and their dialects indicate the cultural diversity and the rich heritage. Hence, correct.

(d) Cricket team players cannot represent the heritage or diversity. Hence, wrong.   □

6. After the discussion, Tom said to me, 'Please revert!'. He expects me to ___. (G-2014-S6-2)

(a) retract   (b) get back to him
(c) move in reverse   (d) retreat

    (b) ✓ *Explanation:* 'get back to someone' is a phrasal verb. It generally means to give a reply later, because you are for some reason unable to give an immediate reply.   □

7. Archimedes said, "Give me a lever long enough and a fulcrum on which to place it, and I will move the world."

The sentence above is an example of a _____ statement.   (G-2016-S5-3)

(a) figurative   (b) collateral   (c) literal   (d) figurine

    (a) ✓ *Explanation:* Here, we are talking about figure of speech. So, figurative is figure of speech.   □

8. He <u>turned a deaf ear to</u> my request.
What does the underlined phrasal verb mean?   (G-2016-S7-2)

(a) ignored   (b) appreciated   (c) twisted   (d) returned

    (a) ✓ *Explanation:* It means 'refuse to listen or ignored'.   □

(b) Anshul is elder to Abhishek

(c) Abhishek and Anshul are of the same age

(d) No conclusion follows

(d) ✓ *Explanation:* Let $X > Y$ represent X is elder to Y.
Let Ab, S and An be Abhishek, Savar and Anshul respectively.
Given:

$$Ab > S \qquad An > S \qquad \Longrightarrow \qquad \text{S is the youngest among the three}$$

Analyzing the inferences,
Both Ab and An are elder to S but no data available to compare Ab and An. Hence,
options (a), (b) and (c) are wrong, and no conclusion follows. ☐

21. All professors are researchers.
Some scientists are professors.

Which of the given conclusions is logically valid and is inferred from the above arguments? (G-2013-S2-10)

(a) All scientists are researchers

(b) All professors are scientists

(c) Some researchers are scientists

(d) No conclusion follows

(c) ✓ *Explanation:*
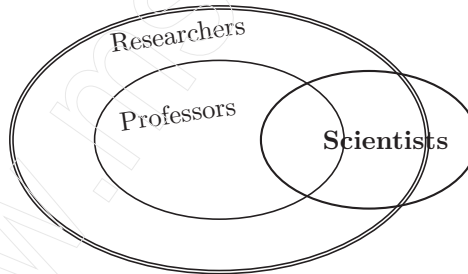
Analyzing the conclusions,

(a) Some scientist are not researchers; hence, option (a) is false.

(b) Some professors are not scientists; hence, option (b) is false.

(c) Some researchers are scientists; hence, option (c) is correct. ☐

22. Some tables are shelves. Some shelves are chairs. All chairs are benches. Which of the following conclusions can be deduced from the preceding sentences? (G-2017-S3-5)

i. At least one bench is a table

(c) To check for the possibility of 'P is a son of X and Y':

P can be son or daughter. No specific information is given. Hence this statement is not necessarily false.

(d) To check for the possibility of 'Q cannot be married to R':

$$Z \longrightarrow W \qquad X \longrightarrow Y$$
$$\searrow \qquad \swarrow \quad \searrow$$
$$R \longrightarrow Q \qquad P$$
$$\downarrow$$
$$S$$
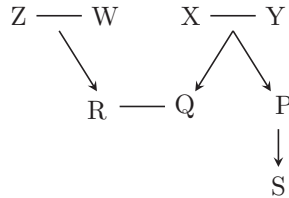
Because there is no information about gender, Q can be married to R. Hence the statement 'Q cannot be married to R' is false.

Hence option (d) is the correct answer. □

7. Rahul, Murali, Srinivas and Arul are seated around a square table. Rahul is sitting to the left of Murali. Srinivas is sitting to the right of Arul. Which of the following pairs seated opposite each other? (G-2017-S5-3)

    (a) Rahul and Murali   (b) Srinivas and Arul
    (c) Srinivas and Murali   (d) Srinivas and Rahul

(c) ✓ *Explanation:*
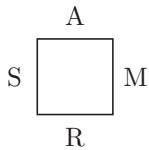
       A
     ┌───┐
  S │   │ M   (i) Fix M
     └───┘   (ii) Fix R with respect to M
       R   (iii) Fix A in such a way that S is to the right of A

The pairs sitting opposite to each other are: (1) Srinivas and Murali, (2) Arul and Rahul. □

8. Six people are seated around a circular table. There are at least two men and two women. There are at least three right-handed persons. Every woman has a left-handed person to her immediate right. None of the women are right-handed. The number of women at the table is (G-2017-S5-7)

    (a) 2   (b) 3   (c) 4   (d) Cannot be determined

(a) ✓ *Explanation:* Given informations: (Let M = man; W = woman, R = right-handed; L = left-handed). Total 6 persons.

    (i) $M \geq 2$ and $W \geq 2$

15. Which number does not belong in the series below?   (G-2014-S9-4)

$$2, 5, 10, 17, 26, 37, 50, 64$$

(a) 17   (b) 37   (c) 64   (d) 26

(c) ✓ *Explanation:* If $a_1, a_2, a_3, \ldots, a_n$ is the series and $i = 1, \ldots, n$, then the given series is fitting with: $a_i = i^2 + 1$. i.e., the ith term is 1 plus the square of i.

Series will be as follows:

$$1^2 + 1, \ 2^2 + 1, \ 3^2 + 1, \ 4^2 + 1, \ \ldots, \ n^2 + 1 = 2, 5, 10, 17, 26, 37, 50, 65$$

Hence 64 does not belong to the series.   □

16. Given the sequence of terms, AD CG FK JP, the next term is   (G-2012-S3-9)

(a) OV   (b) OW   (c) PV   (d) PW

(a) ✓ *Explanation:*
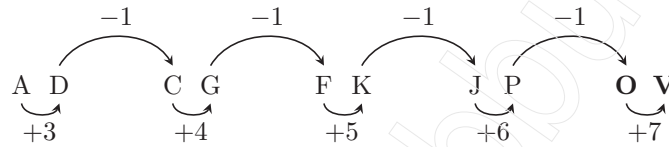
2.2 Numbers

1. The number of 3-digit numbers such that the digit 1 is never to the immediate right of 2 is   (G-2017-S4-9)

(a) 781   (b) 791   (c) 881   (d) 891

(c) ✓ *Explanation:* The three digit numbers are: $100, 101, 102, \ldots, 998, 999$.

Total number of 3 digit numbers $= 1000 - 1 - 99 = 900$.

From the above, we need to subtract the number of numbers matching the following pattern:

$$\underline{2}\,\underline{1}\,x \qquad \text{and} \qquad \underline{z}\,\underline{2}\,\underline{1}$$

We know that x could be $\{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\} = 10$ numbers. Hence, the number of numbers of the pattern $\underline{2}\,\underline{1}\,\underline{x} = 10$. i.e.,

$$210, 211, 212, 213, 214, 214, 216, 217, 218, 219$$

And, z could be $\{1, 2, 3, 4, 5, 6, 7, 8, 9\} = 9$ numbers. Hence, the number of numbers of the pattern $\underline{z}\,\underline{2}\,\underline{1} = 9$. i.e.,

$$021, 121, 221, 321, 421, 521, 621, 721, 821, 921$$

Hence, numbers with 1 to the immediate right of $2 = 10 + 9 = 19$.
And, answer $= 900 - 19 = 881$.   □

This is wrong, as there is no addition logic here.   □

21. A positive integer m in base 10 when represented in base 2 has the representation p and in base 3 has the representation q. We get $p - q = 990$ where the subtraction is done in base 10. Which of the following is necessarily true: (G-2010-S2-9)

   (a) $m \geq 14$ (b) $9 \leq m \leq 13$ (c) $6 \leq m \leq 8$ (d) $m < 6$

   (b) ✓ *Explanation:* Given: for a positive integer m,

$$(m)_{10} = (p)_2 = (q)_3$$

From the given answer choices, the possible values of m are as below:

Option:	(d)	(c)	(b)	(a)
Values of m:	$1, 2, 3, 4, 5$	$6, 7, 8$	$9, 10, 11, 12, 13$	$14, 15, 16, \ldots$

Let $m = 8$. For this,

$$
\begin{array}{r|l}
2 & 8 \\
2 & 4 \ \text{- 0} \uparrow \\
2 & 2 \ \text{- 0} \\
 & 1 \ \text{- 0}
\end{array}
= 1000 \quad \Longrightarrow \quad (8)_{10} = (1000)_2
$$

and

$$
\begin{array}{r|l}
3 & 8 \\
 & 2 \ \text{- 2} \uparrow
\end{array}
= 22 \quad \Longrightarrow \quad (8)_{10} = (22)_3
$$

By simply considering $(p)_2 - (q)_3 = p - q$, we get for $(8)_{10}$

$$p - q = 1000 - 22 = 978$$

By similar calculations, we get the following table of values:

m	7	8	9	10	11	12	13	14	15	16
p	111	1000	1001	1010	1011	1100	1101	1110	1111	10000
q	21	22	100	101	102	110	111	112	120	121
$p-q$	90	978	901	909	909	**990**	**990**	998	991	9879

From the table, it can be seen that for values of $m = 12$ and 13, we get the difference $p - q$ as 990. This corresponds to option (b). Hence, (b) is correct answer.   □

22. If a prime number on division by 4 gives a remainder of 1, then that number can be expressed as   (G-2012-S2-8)
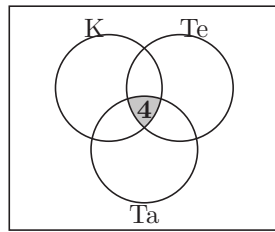
(i) 4 knew all three
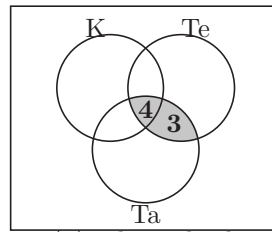
(ii) 7 knew both
Telugu and Tamil
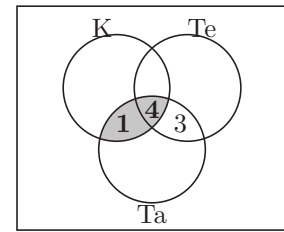
(iii) 5 knew both
Kannada and Tamil
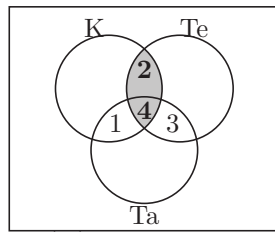
(iv) 6 knew both
Telugu and Kannda
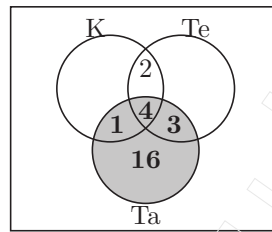
(v) 24 knew Tamil
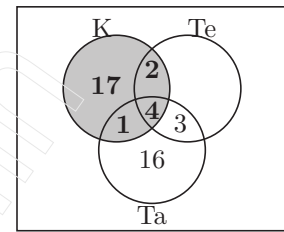
(vi) 24 knew Kannada
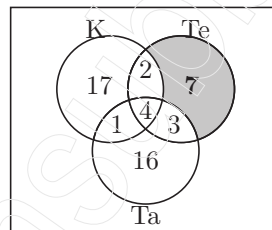
(vii) Linguists who know only Telugu

Number of linguists who know only Telugu $= 50 - (17 + 2 + 4 + 1 + 16 + 3) = 7$ □

2.4   Percentage Calculations

1. In the summer, water consumption is known to decrease overall by 25%. A Water Board official states that in the summer household consumption decreases by 20% while other consumption increases by 70%.

   Which of the following statements is correct?   (G-2017-S3-3)

   (a) The ratio of household to other consumption is 8/17

   (b) The ratio of household to other consumption is 1/17

   (c) The ratio of household to other consumption is 17/8

   (d) There are errors in the official's statement.

She is at 8 km away from P; and has to go towards East, to reach P.

Note: $(3, 4, 5)$ and $(6, 8, 10)$ are examples for Pythagorean triples. □

13. Four branches of a company are located at M, N, O, and P. M is north of N at a distance of 4 km; P is south of O at a distance of 2 km; N is southeast of O by 1 km. What is the distance between M and P in km? (G-2015-S6-10)

    (a) 5.34   (b) 6.74   (c) 28.5   (d) 45.49

    (a) ✓ *Explanation:*
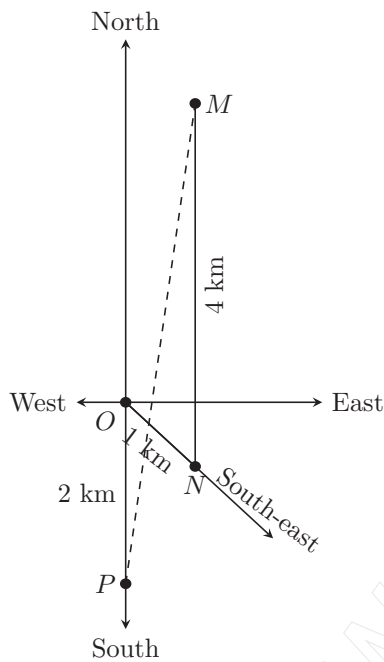
Coordinates of $O = (0, 0)$

Coordinates of $P = (0, -2)$

Coordinates of $N = (1 \cos 45°, -1 \sin 45°)$
$$= (0.707, -0.707)$$

Coordinates of $M = (0.707, 4 - 0.707)$
$$= (0.707, 3.293)$$

Distance between M and P:
$$\overline{MP} = \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2}$$
$$= \sqrt{\left(3.293 - (-2)\right)^2 + (0.707 - 0)^2}$$
$$= 5.34$$

□

14. Mr. Vivek walks 6 meters North-east, then turns and walks 6 meters South-east, both at 60 degrees to east. He further moves 2 meters South and 4 meters West. What is the straight distance in meters between the point he started from and the point he finally reached? (G-2015-S8-4)

    (a) $2\sqrt{2}$ (b) 2   (c) $\sqrt{2}$ (d) $1/\sqrt{2}$

    (a) ✓ *Explanation:*

Hence, 'Executive' contributes the greatest fraction to the revenue of the company in that year. □

10. The multi-level hierarchical pie chart shows the population of animals in a reserve forest. The correct conclusions from this information are: (G-2014-S5-7)
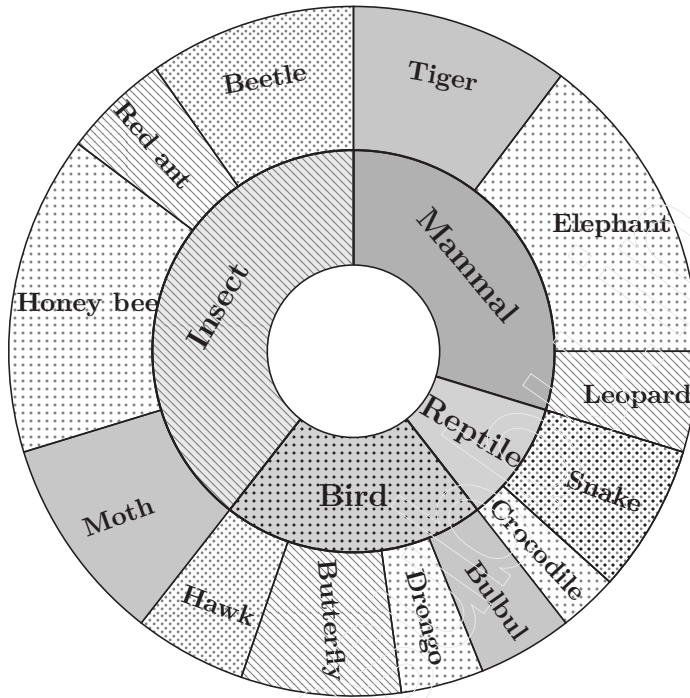
 (i) Butterflies are birds

 (ii) There are more tigers in this forest than red ants

(iii) All reptiles in this forest are either snakes or crocodiles

(iv) Elephants are the largest mammals in this forest

(a) (i) and (ii) only   (b) (i), (ii), (iii) and (iv)
(c) (i), (iii) and (iv) only   (d) (i), (ii) and (iii) only

(d) ✓ *Explanation:* Analyzing the options,

 (i) True. Even hawk, drongo and bulbul are birds.

 (ii) True. The width of 'tiger' is significantly more than that of 'red-ant'.

(iii) True. There is no other animal given in the reptile zone of the figure.

(iv) False. This chart signifies population of the animals. No information about size is given in the figure.

(a) Wrong, not applicable for case P (take $a = 3, b = 5$)

(b) Wrong, not applicable for case Q (take $a = 2, b = 4$)

(c) Wrong, not applicable for case Q (take $a = 2, b = 4$)

(d) True, applicable for both cases $ab - b = b(a - 1)$. If a is odd, then b is also odd, so $(a - 1)$ is even. Product of b and $(a - 1)$ is always even. It is also applicable if a is even. $\qquad\square$

5. The number of roots of $e^x + 0.5x^2 - 2 = 0$ in the range $[-5, 5]$ is $\qquad$ (G-2017-S6-9)

   (a) 0 $\qquad\qquad$ (b) 1 $\qquad\qquad$ (c) 2 $\qquad\qquad$ (d) 3

   (c) ✓ *Explanation:*
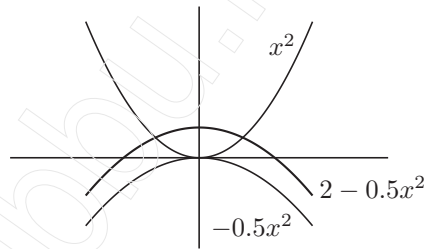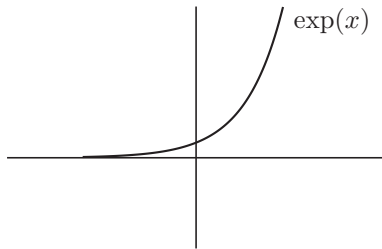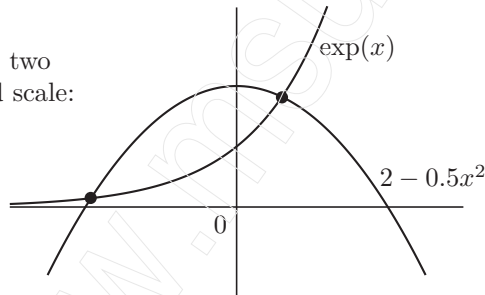
   The points (two numbers) marked as ● are the roots of $e^x = 2 - 0.5x^2$.

   For the function $y = 2 - 0.5x^2$, at $y = 0$, we get $x = \pm 2$. Hence, the two roots as shown in the figure are definitely in the range $[-5, 5]$. $\qquad\square$

6. In a process, the number of cycles to failure decreases exponentially with an increase in load. At a load of 80 units, it takes 100 cycles for failure. When the load is halved, it takes 10000 cycles for failure. The load for which the failure will happen in 5000 cycles is $\qquad$ (G-2016-S5-10)

   (a) 40.00 $\qquad\qquad$ (b) 46.02 $\qquad\qquad$ (c) 60.01 $\qquad\qquad$ (d) 92.02

By Bayes' theorem,

$$P(X|A) = \frac{P(X) \times P(A|X)}{P(X) \times P(A|X) + P(Y) \times P(A|Y)} = \frac{0.1 \times 0.95}{0.1 \times 0.95 + 0.9 \times 0.11} = 0.49 \qquad \square$$

17. In a factory, two machines M_1 and M_2 manufacture 60% and 40% of the auto-components respectively. Out of the total production, 2% of M_1 and 3% of M_2 are found to be defective. If a randomly drawn auto-component from the combined lot is found defective, what is the probability that it was manufactured by M_2? (G-2013-S2-7)

    (a) 0.35   (b) 0.45   (c) 0.5   (d) 0.4

    (c) ✓ *Explanation:* Let E_1 and E_2 be the events of drawing a component manufactured by machines M_1 and M_2.

    Let X be the event of picking a defective from the lot.

    Given:

$$P(E_1) = 0.6 \qquad \text{and} \qquad P(E_2) = 0.4$$
$$P(X|E_1) = 0.02 \qquad\qquad P(X|E_2) = 0.03$$

    From Bayes' theorem,

$$P(E_2|X) = \frac{P(E_2) \times P(X|E_2)}{P(E_1) \times P(X|E_1) + P(E_2) \times P(X|E_2)}$$
$$= \frac{0.4 \times 0.03}{0.6 \times 0.02 + 0.4 \times 0.03} = 0.50 \qquad \square$$

18. An automobile plant contracted to buy shock absorbers from two suppliers X and Y. X supplies 60% and Y supplies 40% of the shock absorbers. All shock absorbers are subjected to a quality test. The ones that pass the quality test are considered reliable. Of X's shock absorbers, 96% are reliable. Of Y's shock absorbers, 72% are reliable. The probability that a randomly chosen shock absorber, which is found to be reliable, is made by Y is (G-2012-S3-6)

    (a) 0.288   (b) 0.334   (c) 0.667   (d) 0.720

    (b) ✓ *Explanation:* Let E_1 and E_2 be the events of buying shock absorbers from suppliers X and Y. Let A be the event of selecting the supplies that are considered reliable.

    Given:

$$P(E_1) = 0.6 \qquad P(E_2) = 0.4$$
$$P(A|E_1) = 0.96 \qquad P(A|E_2) = 0.72$$

Hence, option (c) is the correct answer.   □

17. L, M and N are waiting in a queue meant for children to enter the zoo. There are 5 children between L and M, and 8 children between M and N. If there are 3 children ahead of N and 21 children behind L, then what is the minimum number of children in the queue?   (G-2011-S2-8)

    (a) 28   (b) 27   (c) 41   (d) 40

   (a) ✓ *Explanation:* Let us assume L, M, and N are also children.

   The statement '3 children ahead of N' indicates, N has to be near the start.

   The statement '21 children behind L' indicates, L has to be also near the start so as to get minimum count of children.

   To have minimum number of children, L has to be placed between M and N, because number of children between M & N are more than L & M.
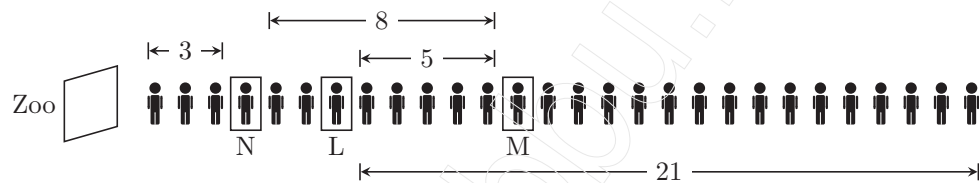
   Total number of children, so as to meet all the required conditions is 28.   □

18. Four archers P, Q, R and S try to hit a bull's eye during a tournament consisting of seven rounds. As illustrated in the figure below, a player receives 10 points for hitting the bull's eye, 5 points for hitting within the inner circle and 1 point for hitting within the outer circle.
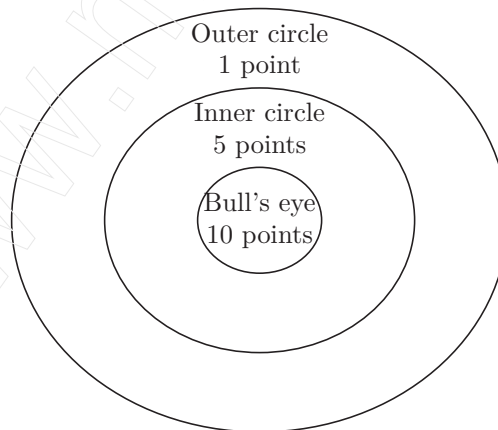
   The final scores received by the players during the tournament are listed in the table below.

3. The area between the parabola $x^2 = 8y$ and the straight line $y = 8$ is ____ (G-CE-2016-29)
   (85.34) ✓ *Explanation:*
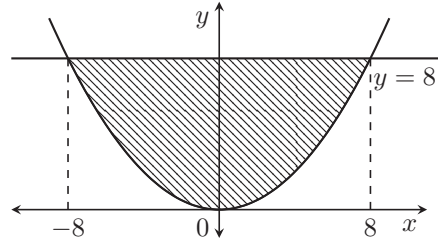
The parabola $y = x^2/8$ and the straight-line $y = 8$ intersects at $(-8, 8)$ and $(8, 8)$. The area enclosed by these two functions are represented as ▨. The area of this portion can be evaluated as below:

As the above area is symmetric with respect to x, we can evaluate the area of half of the region and multiply it by 2 to get the total area.

Area of half of the region in positive x axis (I) = {Area of rectangle enclosed by $x = 0, 8$ and $y = 8$ (II)} minus {Area below the parabola in x-axis (III)}.
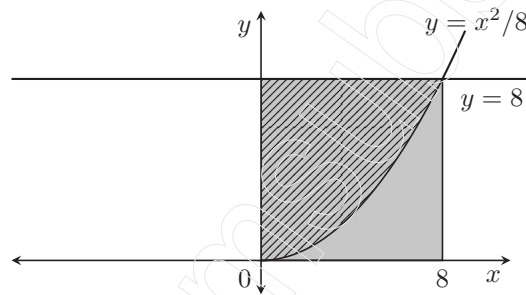
i.e.,

$$\text{I} = \text{II} - \text{III} = 8 \times 8 - \int_0^8 y\,dx$$

$$\int_0^8 y\,dx = \int_0^8 \frac{x^2}{8}\,dx = \left[\frac{x^3}{24}\right]_0^8 = \frac{8^3}{24} = 21.33$$

Hence,

$$\text{I} = 64 - 21.33 = 42.67$$

Total enclosed area $= 2 \times 42.67 = 85.34$. ☐

4. Consider an ant crawling along the curve $(x - 2)^2 + y^2 = 4$, where x and y are in meters. The ant starts at the point $(4, 0)$ and moves counter-clockwise with a speed of 1.57 meters per second. The time taken by the ant to reach the point $(2, 2)$ is (in seconds) ____
   (ME-2015-S1-27)

GATE GA Questions — Year-Session-Stream

Year	Session	AE	AG	AR	BT	CE	CH	CS	CY	EC	EE	EY	GG	IN	MA	ME	MN	MT	PE	PH	PI	TF	XE	XL
2017	1			•												•						•		
	2		•										•			•								
	3				•				•	•		•									•			
	4	•								•					•			•	•	•				
	5						•				•													
	6						•				•													
	7					•	•										•							
	8					•								•									•	•
2016	1									•						•								
	2			•		•							•			•	•			•				
	3									•						•								
	4			•					•	•				•	•				•					
	5					•		•																
	6							•			•													
	7		•			•						•						•			•			
	8	•									•											•	•	•
2015	1		•	•	•		•		•	•		•											•	•
	2									•						•								
	3									•						•								
	4	•											•	•	•	•	•	•		•	•	•		
	5							•		•														
	6							•		•														
	7					•		•																
	8					•																		
2014	1	•		•		•	•	•				•			•			•		•		•		
	2		•		•	•							•	•			•			•	•			•
	3									•						•								
	4									•						•								
	5									•						•								
	6									•						•								
	7							•			•													
	8							•			•													
	9							•			•													
2013	1			•		•							•		•			•		•	•			
	2	•	•		•		•		•								•						•	•
	3							•									•				•			
	4									•	•			•										
2012	1			•								•										•		
	2	•	•														•							
	3			•	•	•	•										•			•	•			
	4							•	•	•					•	•		•					•	•
2011	1											•										•		
	2	•															•							
	3			•	•	•	•	•										•		•	•			
	4		•						•	•	•				•	•		•					•	•
2010	1																					•		
	2																•							
	3	•	•	•	•	•	•	•	•	•	•		•	•	•	•		•		•	•		•	•

GA questions which are common for the streams in a particular session could be read horizontally.

GATE Index

343

5, 197
6, 161
7, 140
8, 218
9, 208
10, 287
S3
1, 82
2, 126
3, 93
4, 291
5, 167
6, 167
7, 302
8, 202
9, 217
10, 284
S4
1, 86
2, 83
3, 93
4, 281
5, 167
6, 167
7, 159
8, 171
9, 218
10, 203
S5
1, 121
2, 93
3, 83
4, 168
5, 303
6, 168
7, 225
8, 204
9, 221
10, 292
S6
1, 108
2, 121
3, 109
4, 260
5, 172
6, 168
7, 159
8, 197
9, 221

10, 238
S7
1, 122
2, 94
3, 122
4, 254
5, 278
6, 127
7, 160
8, 191
9, 223
10, 233
S8
1, 94
2, 87
3, 109
4, 173
5, 255
6, 141
7, 118
8, 278
9, 219
10, 210
S9
1, 114
2, 86
3, 109
4, 169
5, 220
6, 119
7, 141
8, 191
9, 219
10, 179
2015
S1
1, 90
2, 90
3, 106
4, 253
5, 274
6, 113
7, 117
8, 297
9, 244
10, 137
S2
1, 81
2, 106

3, 107
4, 227
5, 281
6, 113
7, 125
8, 203
9, 254
10, 138
S3
1, 81
2, 107
3, 90
4, 166
5, 275
6, 81
7, 118
8, 244
9, 266
10, 161
S4
1, 101
2, 101
3, 91
4, 158
5, 236
6, 113
7, 126
8, 245
9, 237
10, 298
S5
1, 91
2, 120
3, 107
4, 298
5, 282
6, 122
7, 116
8, 190
9, 282
10, 220
S6
1, 86
2, 115
3, 107
4, 299
5, 275
6, 81
7, 249

8, 299
9, 173
10, 207
S7
1, 91
2, 102
3, 86
4, 166
5, 257
6, 139
7, 139
8, 217
9, 277
10, 158
S8
1, 91
2, 115
3, 108
4, 207
5, 284
6, 108
7, 300
8, 231
10, 185
2016
S1
1, 79
2, 89
3, 90
4, 189
5, 300
6, 224
7, 132
8, 133
9, 252
10, 215
S2
1, 85
2, 79
3, 115
4, 160
5, 241
6, 290
7, 133
8, 165
9, 253
10, 266
S3
1, 79

Note: Questions numbered 1–5 carry one marks each; and 6–10 carry two marks each. 'S' refer to session; e.g.: S1 refer to session 1.

Subject Index

347

BEST WISHES !

GATEway to General Aptitude

m subbu   s siddarth   r pavan

About the Book

- Solutions to 500+ general aptitude (verbal ability & numerical ability) questions of **GATE** and other exams.

- Comprises quick reference notes on **ALL** the major topics of general aptitude.

- Solutions to all the general aptitude questions of **GATE** in the years 2010–2017.

- Contains detailed solutions with suitable illustrations.

- Useful for any general aptitude test, and in particular for **GATE**.

About the Authors

M. Subramanian is a doctorate from IIT Madras. He is working at SSN College of Engineering, Chennai. He has authored a book titled "An Insight into Chemical Engineering" which is one of the most preferred books for preparing to GATE.

S. Siddarth & R. Pavan Kumar are chemical engineering graduates of SSN. They are top scorers in GATE-2017, placed in PSUs of India.

Price: Rs. 450