

Institute of Actuaries of India
ACET January 2018
Mathematics

1. If n is a positive integer, then $n(n + 1)(2n + 1)$
- A. is a perfect square
 - B. is an odd number
 - C. is an integral multiple of 6
 - D. does not necessarily have any of the above properties.
- 1 mark

2. If $\log_k x \times \log_5 k = 3$, then the value of x is:
- A. 125
 - B. 25
 - C. 243
 - D. 15.
- 1 mark

3. The value of x and the cumulative distribution function $F(x)$ for a random variable X is given below.

x	$F(x)$
2.5	0.3554
3.5	0.5221

The approximate value of $F(x)$ for $x = 3.0$, using linear interpolation is:

- A. 0.4387
 - B. 0.3667
 - C. 0.4065
 - D. 0.5000.
- 1 mark
4. The set of values x satisfying the inequality $\frac{x-2}{3x+1} > \frac{x-3}{3x-2}$ is:

- A. $(-\infty, \frac{1}{3}) \cup (-\frac{2}{3}, \infty)$
- B. $(-\infty, 2) \cup (3, \infty)$
- C. $(-\infty, -2) \cup (-3, \infty)$
- D. $(-\infty, -\frac{1}{3}) \cup (\frac{2}{3}, \infty)$.

2 marks

5. If α and β are the roots of the quadratic equation $x^2 + x + 1 = 0$, then the equation whose roots are $\frac{1}{\alpha}, \frac{1}{\beta}$ is :
- A. $x^2 + x + 1 = 0$
B. $x^2 - x + 1 = 0$
C. $x^2 + x - 1 = 0$
D. $x^2 - x - 1 = 0$

2 marks

6. The coefficient of x^5 in the expansion of $\left(x + \frac{1}{x^3}\right)^{17}$ is:

- A. 2380
B. 680
C. 136
D. 51.

2 marks

7. The value of $\lim_{x \rightarrow a} \frac{x \sin a - a \sin x}{x - a}$:

- A. does not exist
B. is equal to $\sin a + a \cos a$
C. is equal to $a \sin a - \cos a$
D. is equal to $\sin a - a \cos a$.

1 mark

8. The slope of the curve $y = x^3 - 3x + 1$; $-\infty < x < \infty$ is minimum at:

- A. $x = -1$
B. $x = 1$
C. $x = 0$
D. $x = \pm 1$

1 mark

9. The minimum value of the function

$$f(x) = \frac{(1+x)^{0.3}}{1+x^{0.3}} \text{ in the interval } 0 \leq x \leq 1$$

is attained at x equal to:

- A. 1
B. $2^{0.7}$
C. $2^{-0.7}$
D. 0.

3 marks

10. If $u = \sqrt{x^2 + y^2}$, then $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$ is:

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

1 mark

11. If $y = x^3 + \tan x$, then $\frac{d^2y}{dx^2}$ is:

- A. $6x + 2 \sec x \tan x$
- B. $6x + \sec^2 x \tan x$
- C. $6x + 2 \sec^2 x \tan x$
- D. $6x + 2 \sec^2 x$

1 mark

12. The value of the integral $\int_{-4}^4 |x - 3| dx$ is :

- A. 25
- B. 0
- C. 5
- D. 125.

2 marks

13. The value of the integral $\int \frac{x+1}{(x+2)(x+3)} dx$ is:

- A. $-\log(x + 2) + \log(x + 3) + c$
- B. $-\log(x + 2) + 2 \log(x + 3) + c$
- C. $\log(x + 2) + \log(x + 3) + c$
- D. $\log(x + 2) + 2 \log(x + 3) + c.$

2 marks

14. The value of the integral $\int_0^{\infty} x^4 e^{-2x^5} dx$ is:

- A. $\frac{1}{5}$
- B. $\frac{1}{10}$
- C. 1
- D. ∞

1mark

15. If $|\vec{a}| = 2$, $|\vec{b}| = 7$ and $|\vec{a} + \vec{b}| = 7$, then the angle between \vec{a} and \vec{b} is:

- A. $\sin^{-1} \frac{2}{7}$
- B. $\cos^{-1} \frac{2}{7}$
- C. $\sin^{-1} \frac{1}{7}$
- D. $\cos^{-1} \frac{1}{7}$.

2 marks

16. The inverse of the matrix $\begin{bmatrix} 2 & 5 \\ 1 & 6 \end{bmatrix}$ is:

- A. $\frac{1}{17} \begin{bmatrix} 6 & -5 \\ -1 & 2 \end{bmatrix}$
- B. $\frac{1}{17} \begin{bmatrix} 6 & -5 \\ -1 & 2 \end{bmatrix}$
- C. $\frac{1}{7} \begin{bmatrix} 6 & -5 \\ -1 & 2 \end{bmatrix}$
- D. $\frac{1}{7} \begin{bmatrix} -6 & 5 \\ 1 & -2 \end{bmatrix}$.

1 mark

17. A and B are matrices such that $AB = A$ and $BA = B$, then B^3 must be:

- A. B
- B. A
- C. 0
- D. I .

1 mark

18. The rank of the matrix $P = \begin{bmatrix} m & m & m \\ m & m & m \\ m & m & m \end{bmatrix}$; $m \neq 0$ is :

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

1 mark

Statistics

19. Four boys and 3 girls are to sit in a row. The probability that all the boys sit together and so do all the girls is
- A. $144/5040$
 - B. $288/5040$
 - C. $24/5040$
 - D. 1
- 1 mark
20. Let A and B be two events with $P(A) = 1/4$ and $P(A \cup B) = 1/3$. If A is a subset of B then the value of $P(B)$ is
- A. $1/3$
 - B. $1/12$
 - C. $1/9$
 - D. None of the above
- 1 mark
21. In a population, where 49% of the population is male and 51% is female, about 10% of men and 1% of women are colorblind. Suppose a person is colorblind, then the probability he is a male is approximately
- A. 0.85
 - B. 0.77
 - C. 0.91
 - D. 0.95
- 2 marks
22. The numbers 15, 12, 8, x , $x - 2$, -4 , where x is unknown, are arranged in descending order. Suppose the median of the numbers is 5. The arithmetic mean of the numbers is
- A. 5
 - B. 5.5
 - C. 6.5
 - D. 7
- 2 marks

23. The standard deviation of 10 observations is 1.5. Suppose each observation is first multiplied by -4 and then added to 3. The standard deviation of the new observations is

- A. 9
- B. 1.5
- C. 4.5
- D. 6

1 mark

24. The number of accidents per month at a busy intersection follows Poisson distribution with average $\theta = 6.5$. Suppose each accident costs local government Rs. 20,000.00 for clean-up. On average, the accidents costs to the local government over a year time is

- A. Rs. 1,30,000.00
- B. Rs. 2,40,000.00
- C. Rs. 15,60,000.00
- D. None of the above

1 mark

25. Suppose X is uniformly distributed on $\{-3, -2, -2, 0, 1, 2, 3\}$. Then $P(X^2 = 9)$ is

- A. $1/7$
- B. $2/7$
- C. $3/7$
- D. $2/5$

1 mark

26. Let X be a random variable with the probability density function $f(x) = 2e^{-2x}$, $x > 0$. The median of $Y = 2X$ is

- A. $\ln 2$
- B. $-2 \ln 0.5$
- C. $-4 \ln 0.5$
- D. $0.5 \ln 2$

3 marks

27. Suppose Z has standard normal distribution. Then $E(Z^{17})$ is

- A. -1
- B. 1
- C. 0
- D. None of the above

1 mark

28. Suppose X and Y are independent random variables with $\text{Var}(X) = V_1$ and $\text{Var}(Y) = V_2$. Let $Z = pX + (1 - p)Y$, for $0 < p < 1$. The value of p that minimizes $\text{Var}(Z)$ is

- A. $\frac{V_2}{V_1 + V_2}$
- B. $\frac{V_1}{V_1 + V_2}$
- C. $\frac{V_1^2}{V_1^2 + V_2^2}$
- D. $\frac{V_2^2}{V_1^2 + V_2^2}$

2 marks

29. The random variables X and Y have joint distribution

$$P(X = i, Y = j) = c(i + j), \text{ for } i = 0, 1; j = 1, 2, 3.$$

The value of c is

- A. $1/6$
- B. $1/9$
- C. $1/12$
- D. $1/15$

2 marks

30. Suppose $X \sim \text{Binomial}(n, p)$. Then $\text{Cov}(X, n - X)$ is

- A. $np(1 - p)$
- B. $-np(1 - p)$
- C. $np(1 - p)^2$
- D. $-np(1 - p)^2$

1 mark

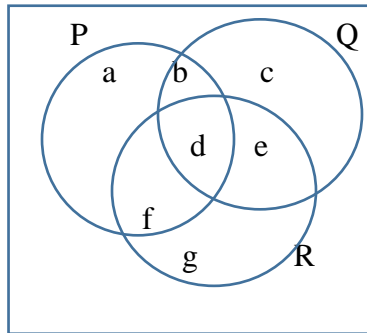
31. Consider the paired observations on (x, y) : $(0, 0)$, $(1, 2)$, $(2, 3)$, $(3, 5)$ and $(5, 7)$. A regression line of the form $y = ax$ is to be fitted based on the observations by the least square method. The least square estimate of a is

- A. 1.5
- B. $39/58$
- C. $58/39$
- D. Cannot be obtained

3 marks

Data Interpretation

32. The elements of the sets P, Q and R are given in the Venn-diagram.



Then the set $P \cup (Q \cap R)$ is given by

- A. $\{a, b, d, e, f\}$
- B. $\{b, d, f, g\}$
- C. $\{a, d, c, e, f\}$
- D. $\{a, b, d, f\}$

2 marks

33. Consider the frequency distribution given in the following table.

Class Interval	Frequency
356.5 – 365.5	4
365.5 – 374.5	15
374.5 – 383.5	30
383.5 – 392.5	16
392.5 – 401.5	11
401.5 – 410.5	7
410.5 – 419.5	5
419.5 – 428.5	2

The distribution is

- A. U-shaped
- B. Negatively skewed
- C. Symmetric
- D. Positively skewed

1 mark

Answer Questions 34-36 based on the data given in the table below.

Table: The age distribution of people in a country

Age	Percent of population
[0, 5)	7
[5, 15)	14
[15, 20)	7
[20, 25)	7
[25, 30)	7
[30, 35)	7
[35, 45)	15
[45, 55)	14
[55, 65)	10
[65, 75)	6
75 and over	6

34. The percentage of people below 30 years age is

- A. 42
- B. 49
- C. 41
- D. 35

1 mark

35. The percentage of people with age above 55 years is

- A. 12
- B. 36
- C. between 12 and 22
- D. 25

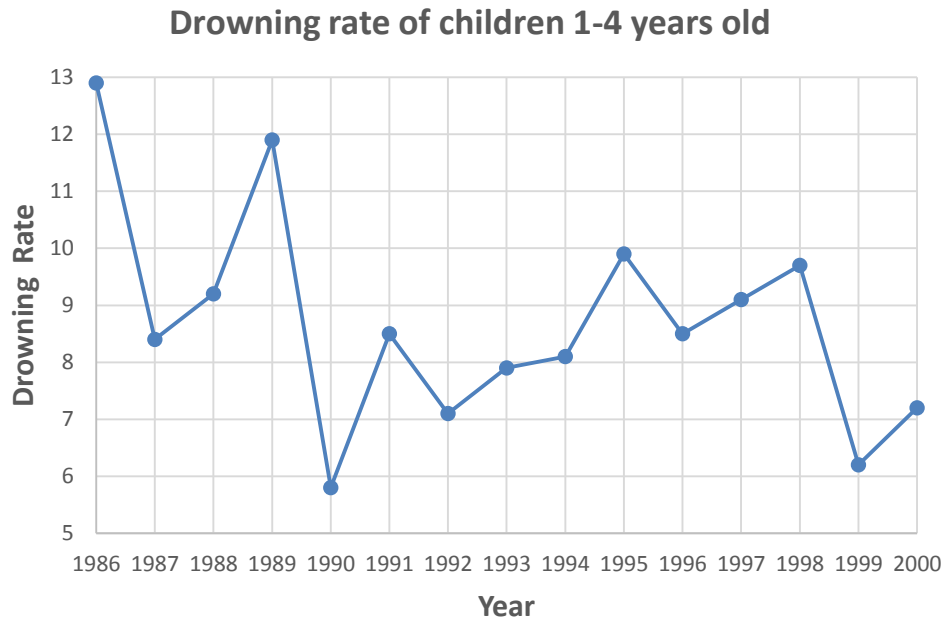
2 marks

36. The ratio of people with age 65 and above to people in the age group [45, 65) is

- A. 1:2
- B. 2:1
- C. 11:12
- D. 1:3

1 mark

Answer Questions 37 and 38 based on the graph of the number of 1-4 years old children (per 100,000) who had drowned in a calendar year, referred to here as the 'drowning rate'



37. In how many years was the drowning rate less than 8.0

- A. 4
- B. 6
- C. 7
- D. 5

1 mark

38. The maximum drop in the annual drowning rate occurred in the year

- A. 1987
- B. 1990
- C. 1996
- D. 1999

1 mark

English

39. The synonym of the word 'Acknowledge' is:
A. Recognize
B. Memorandum
C. Advisory
D. Response 1 mark
40. The synonym of the word 'Variety' is:
A. Heterogeneity
B. Homogeneity
C. Difference
D. Quality 1 mark
41. The antonym of the word 'Common' is:
A. Routine
B. Extraordinary
C. Ideal
D. Typical 1 mark
42. The antonym of the word 'Apart' is:
A. Obscure
B. Aside
C. Cornered
D. Together 1 mark
43. One word for "combination whose value exceeds the total value of the parts" is:
A. Harmony
B. Synergy
C. Metamorphosis
D. Synchrony 1 mark
44. One word for "a depository containing historical records and documents" is
A. Archives
B. Safeguard
C. Locker
D. Warehouse 1 mark

45. The meaning of 'Polygamy' is:
A. the practice of having more than one spouse at a time
B. the practice of marrying one's cousin
C. the practice of marrying a person of different religion
D. the practice of marrying a person of the same gender 1 mark
46. The alternative which replaces '?' in "Rumour : Squash :: Fire: ?" is:
A. Illuminate
B. Light
C. Arson
D. Extinguish 1 mark
47. The alternative which replaces '?' in "Rajya Sabha : Vice President :: Lok Sabha : ?" is:
A. President
B. Prime Minister
C. Speaker
D. Governor 1 mark
48. Meaning of the phrase "to go Dutch" is:
A. to go to the Netherlands
B. to behave like a Dutch
C. to share the expenses
D. to invest in stocks 1 mark
49. Meaning of the phrase "to get foot in the door" is:
A. to complete the first step in a process
B. to create disturbance in a process
C. to oppose somebody
D. to make use of the opportunity 1 mark
50. Meaning of the phrase "last straw" is:
A. the final problem in a series of problems
B. the final savings
C. the final clean-up after an event
D. the ultimate savior 1 mark

51. Rearrange the following parts (1, 2, 3 and 4) in proper sequence to obtain a correct sentence:

- I. the boss wanted to tell me
- II. not to take work to home
- III. not be listening to him
- IV. but I would

- A. I, II, III, IV
- B. I, II, IV, III
- C. I, III, IV, II
- D. I, III, II, IV

1 mark

52. Rearrange the following parts (1, 2, 3 and 4) in proper sequence to obtain a correct sentence:

- I. he would ever
- II. I wondered if
- III. work hard for a living
- IV. because he was so rich

- A. I, II, III, IV
- B. I, II, IV, III
- C. II, I, III, IV
- D. II, III, I, IV

1 mark

53. Rearrange the given parts (1, 2, 3 and 4) in proper sequence to obtain the correct part of the sentence "Children who show":

- I. their age often turn
- II. out to be average
- III. in adult life
- IV. intelligence far beyond

- A. II, III, IV, I
- B. II, I, III, IV
- C. IV, II, I, III
- D. IV, I, II, III

1 mark

54. Select the most logical order of sentences from among the given choices to construct a coherent paragraph:

P: Payment for imports and exports is made through a system called foreign exchange.

Q: The value of the money of one country in relation to the money of other countries is agreed upon at a given time.

R: These rates of exchange vary from time to time.

S: For instance, an American dollar or a British pound sterling is worth certain amounts in Indian rupees at a given time.

A. PQSR

B. PQRS

C. QPRS

D. RPQS

2 marks

55. Select the most logical order of sentences from among the given choices to construct a coherent paragraph:

P: The oceans are very deep.

Q: For example, the Indian ocean has a range that goes to Antarctica.

R: Much of it is fairly flat.

S: However, there are great mountain ranges as well.

A. PRQS

B. PRSQ

C. PQRS

D. PSRQ

2 marks

56. Fill the blanks in the sentence "One should not time on such issues.":

A. waste, trivial

B. spend, significant

C. kill, important

D. utilize, useful

2 marks

57. Fill the blanks in the sentence "An ounce of is worth a pound of" :

- A. iron, gold
- B. prevention, cure
- C. harm, anger
- D. care, accident

2 marks

58. Fill the blanks in both sentences by a single word:

The fleeting of snowfall have increased the fears of steep rise in Apple prices.

Many Chinese people have difficulty in learning how to a word in English.

- A. Order
- B. Spell
- C. Form
- D. Change

2 marks

59. Choose the correct sentence:

- A. The secretary will inform the boss this.
- B. The secretary will inform this the boss.
- C. The secretary will inform the boss of this.
- D. The boss will be informed this by the secretary.

2 marks

60. Choose the correct sentence:

- A. There are more ways of killing a cat than choking it with cream.
- B. The cat can be killed by more ways instead choking it with cream.
- C. There are more ways of killing a cat instead of choking it with cream.
- D. There are more ways of killing a cat to choking it with cream.

2 marks

Read the passage below and answer Question No. 61:

Today, it seems almost everyone owns a smartphone. It was not long ago that the technology was first introduced to the general public. Because of their user friendly features, smartphones have quickly become popular. Before the invention of smartphones, there were several devices that were used including regular mobile phones and personal digital assistant (PDA) devices. Eventually the technologies were combined and the concept of the smartphone was born. The initial concepts that later led to the invention of the smartphone came in 1970s. However, IBM came up with a prototype mobile phone that incorporated PDA features in 1992 and demonstrated the device at a computer industry trade show called COMDEX. In 1994, BellSouth came up with a more refined version of the phone and called it the Simon Personal Communicator. This is the first device that could really be referred to as a smartphone. The Simon Personal Communicator was able to make and receive calls, send faxes and emails, and more. In 1990s, many mobile phone users began carrying PDAs. Early PDAs ran on various systems such as Blackberry OS, and Palm OS. Nokia released a phone combined with a PDA in 1996. The device was called the Nokia 9000. In 1999, a smartphone was released by Qualcomm. It was called pdQ smartphone and featured a Palm PDA with internet connectivity capabilities. Smartphone technology continued to advance throughout the early 2000s. These advances in technology brought about the introduction of the iPhone, the Android operating system and more.

I. The first smartphone was developed by:

- i. IBM
- ii. Qualcomm
- iii. BellSouth

II. The first smartphone was developed in:

- i. 1970s
- ii. 1992
- iii. 1994

III. Meaning of PDA is:

- i. professional data analyser
- ii. personal digital assistant
- iii. personal digital analyser

61. The correct answers to I, II and III are:

- A. iii, iii, ii, respectively
- B. i, ii, iii, respectively
- C. ii, i, iii, respectively
- D. ii, i, i, respectively

3 marks

Read the passage below and answer Question No. 62:

India is known as a country of cultural and traditional festivals. It has many cultures and religions. In India, there are several festival celebrations every month. As it is a secular country full of diversity in the religions, languages, cultures and castes, it is always crowded with the people involved in the fairs and festivals celebration. People from each religion have their own cultural and traditional festivals. Some of the festivals are celebrated by the people of all religions in the entire nation. Each and every festival is celebrated uniquely in different ways according to the rituals, beliefs and its significant history. Each festival has its own history, legend and significance of celebration. People of Indian origin living abroad also celebrate their cultural festivals with immense passion. India is a country of unity in diversity as it contains people of various religions like Hindu, Muslim, Sikh, Jain, Christian and etc.

- I. Which community celebrates most of the festivals in India?
- i. Hindus
 - ii. Muslims
 - iii. Don't know
- II. India is known as a country of:
- i. cultures
 - ii. religions
 - iii. festivals
- III. All the festivals are celebrated:
- i. by the whole nation
 - ii. uniquely
 - iii. similarly

62. The correct answers to I, II and III are:

- A. iii, iii, i, respectively
- B. i, ii, iii, respectively
- C. ii, i, iii, respectively
- D. iii, iii, ii, respectively

3 marks

Logical Reasoning

63. Rattan has a brother, Noel. Rattan is the son of Cyrus. Mukesh is Cyrus's father. In terms of relationship, what is Noel of Mukesh?
- A. Son
 - B. Grandson
 - C. Brother
 - D. Grandfather
- 1 mark
64. The six faces of a cube are coloured black, brown, green, red, white and blue.
- (i) Red is opposite to black
 - (ii) Green is between red and black
 - (iii) Blue is adjacent to white
 - (iv) Brown is adjacent to blue
 - (v) Red is at the bottom
- Which of the following can be deduced from (i) and (v) ?
- A. Black is on the top
 - B. Blue is on the top
 - C. Brown is on the top
 - D. Brown is opposite to black
- 1 mark
65. What was the day of the week on 17th June, 2006?
- A. Thursday
 - B. Friday
 - C. Saturday
 - D. Sunday
- 1 mark
66. If in a certain code language, 'MIRACLE' is coded as 'NKUEHRL', then how is 'RECLAIM' coded in that same code language?
- A. ULHRENK
 - B. UHLREKN
 - C. ULHREKN
 - D. LUHREKN
- 1 mark
67. Arrange the words given below in a meaningful sequence.
1. Yarn 2. Plant 3. Saree 4. Cotton 5. Cloth
- A. 2, 4, 5, 1, 3
 - B. 2, 4, 3, 5, 1
 - C. 2, 4, 1, 5, 3
 - D. 2, 4, 5, 3, 1
- 1 mark

68. Which of the following words is an odd one?

- A. inch
- B. ounce
- C. centimeter
- D. yard

1 mark

69. There are 60 sportspersons playing football, cricket and basketball. Thirty three of them play football, twenty five cricket and twenty six basketball. Ten players play football and cricket, nine play basketball and cricket, while eight play both football and basketball.

How many play only one of the three games?

- A. 21
- B. 30
- C. 39
- D. 42

2 marks

70. In the following question, two statements are given followed by four conclusions numbered I, II, III and IV. You have to take the given statements to be true even if they seem to be at variance from the commonly known facts and then decide which of the given conclusions logically follows from the given statements disregarding commonly known facts.

Statements:

- All terrorists are guilty.
- All terrorists are criminals.

Conclusions:

- I. Either all criminals are guilty or all guilty are criminals.
- II. Some guilty persons are criminals.
- III. Generally criminals are guilty.
- IV. Crime and guilt go together.

- A. Only I follows
- B. Only I and III follow
- C. Only II follows
- D. Only II and IV follow

2 marks