ENGLISH

Directions (1-5) : In the following questions, some of the sentences have errors and some have none. Find out which part of a sentence has an error and select answer (1), (2) or (3). If there is no error, your answer is (4).

1. A milk (1)/ can provide protein (2)/ for nutritionally balanced diet. (3)/ No error (4).

2. When the football team walked onto the field (1)/ the crowd burst into applause, (2)/ but some cheers were heard too. (3)/ No error (4).

3. A lot of form-filling is just red tape, (1)/ and sometimes the forms are so complicated (2)/ that people can’t make head or tail from them. (3)/ No error (4).

4. You are required to explain (1)/ your conduct within two days (2)/ after the receipt of this letter, (3)/ No error (4).

5. I now (1)/ am knowing (2)/ all the facts about him. (3)/ No error (4).

Directions (6-10) : In the following questions, sentences are given with blanks to be filled in with appropriate and suitable words. Four alternatives are suggested for each question. Choose the correct alternative out of the four.

6. I am satisfied__________his innocence.
   (1) at (2) with (3) for (4) of

7. People like to work for organisation that takes interest in their personnel and ________growth.
   (1) social (2) physical (3) financial (4) professional

8. Ram, along with the members of the family and that of his friend, _______the movie.
   (1) was watching (2) were watching (3) have been watching (4) watch

9. The manager wanted to meet you _______the theft in the office.

10. I absolutely refuse to put _______with that sort of conduct.
    (1) up (2) on (3) off (4) out

Directions (11-15) : Out of the four alternatives, choose the one which expresses the right meaning of the given word.

11. SOMBRE
    (1) gloomy (2) quiet (3) serious (4) sleepy

12. REGRESSION
    (1) deteriorate (2) degenerate (3) backslide (4) lapse

13. TOXIC
    (1) bitter (2) foul-smelling (3) medicinal (4) poisonous

14. YARDSTICK
    (1) summation (2) size (3) statistics (4) standard

15. LITTLE
    (1) trivial (2) petty (3) sample (4) simple

Directions (16-20) : Choose the word opposite in meaning to the given word.

16. CUMBERSOME
    (1) heavy (2) convenient (3) confident (4) automatic

17. LOGUOUS
    (1) talkative (2) confident (3) diffident (4) bashful

18. INTELLIGIBLE
    (1) dull (2) incomprehensible (3) garbled (4) confused

19. PHILANTHROPIST
    (1) philanthropist (2) moralist (3) spendthrift (4) miser

20. ANXIOUS
    (1) fearful (2) worried (3) calm (4) concerned

Directions (21-25) : In the following questions, you have a brief passage with five questions. Read the passage carefully and choose the best answer to each question out of the four alternatives.

All of us have enormous capabilities. In many of us however, our achievements fail to correlate with our potential, because of lack of self-discipline-the effort needed to channel our energy for productive uses. To maximise your effectiveness you must learn to put your nose to the grindstone, work against boredom and learn to take the long, hard way in life rather than the short, easy way.

Here are a few suggestions that focus on “How to do what you want to do.” Take risks. It is important to realise that nothing in life is achieved unless you risk something. That’s how self-confidence develops. Every chance you take offers you valuable spinoffs in terms of learning. Earn a reward. Sometime back I had to face the rather unenviable task of preparing for two examinations simultaneously. I had to be ruthless in driving myself from one goal to another hard nosed attitude saw me sail through the courses. I rewarded myself at the end of it indulging in my favourite pastime and taking a short holiday.

21. Why do our achievements fail to correlate with our potential?
    (1) Because of lack of intelligence
    (2) Because of lack of discipline
    (3) Because of lack of external help
    (4) Because of lack of self-discipline

22. How does one’s self-confidence develop?
    (1) By taking risks
    (2) By always meeting with success
    (3) By being cautious
    (4) By being garrulous

23. What does every chance in our life teach us?
    (1) It helps us to become philosophical
    (2) It helps us to become idealistic
24. How does the author reward him after his success?
   (1) By taking a short holiday
   (2) By doing more work
   (3) By visiting friends
   (4) By thanking God

25. What does the author try to convey?
   (1) One has to be complacent with his present self.
   (2) One has to work hard and at least learn from failures.
   (3) Only inborn genius succeed in life.
   (4) One has to believe in luck.

GENERAL KNOWLEDGE

26. The term rishka which meant an ornament in the Vedic period was used in later times to denote a/an:
   (1) coin
   (2) weapon
   (3) script
   (4) agricultural implement

27. Lord Buddha was born in
   (1) Lumbini
   (2) Vaishali
   (3) Both Gaya
   (4) Pavaipuri

28. The Puranas are _____ in number.
   (1) 25
   (2) 18
   (3) 52
   (4) 108

29. Bimbisara was the ruler of
   (1) Avadh
   (2) Kanyak
   (3) Magadh
   (4) Gandhara

30. In 1498 Vasco da Gama landed at:
   (1) Bombay
   (2) Cochin
   (3) Calicut
   (4) Goa

31. The term 'Macedonia's Madman' referred to:
   (1) Philip 11
   (2) Xerxes
   (3) Darius
   (4) Alexander

32. Solar system was discovered by:
   (1) Kepler
   (2) Galileo
   (3) Copernicus
   (4) Eratosthenes

33. The temperature of the Sun's outer surface is:
   (1) 600000°C
   (2) 6000°C
   (3) 60°C
   (4) 0°C

34. The word used to describe the shape of earth is:
   (1) Flat
   (2) Circle
   (3) Sphere
   (4) Oblate spheroid

35. What is the longitude of a town if its local time is 6 p.m. when Greenwich mean time is 4 p.m.?
   (1) 20°E
   (2) 30°E
   (3) 20°W
   (4) 30°W

36. Myopia is a defect of:
   (1) Eye
   (2) Ear
   (3) Teeth
   (4) Mouth

37. Which gas is filled in balloons?
   (1) Oxygen
   (2) Argon
   (3) Nitrogen
   (4) Hydrogen

38. The term 'checkmate' is associated with:
   (1) Golf
   (2) Badminton
   (3) Tennis
   (4) Chess

39. Thomas cup is associated with:
   (1) Badminton
   (2) Golf
   (3) Lawn tennis
   (4) Basket ball

40. The national emblem of France is:
   (1) Eagle
   (2) Lily
   (3) Lion
   (4) Rose

41. The currency Thailand is:
   (1) Waht
   (2) Dinar
   (3) Dirham
   (4) Dong

42. Who was the first man to reach North pole?
   (1) Robert Peary
   (2) Amundsen
   (3) Yuri Gagarin
   (4) None of these

43. The book 'Raghuvamsa' was written by:
   (1) Tulsidas
   (2) Valmiki
   (3) Kalidas
   (4) Minoo Masani

44. The height of Mt. Everest is:
   (1) 8880 m
   (2) 886 m
   (3) 8511 m
   (4) 8484 m

45. In northern hemisphere, the longest day falls on:
   (1) June 25
   (2) June 21
   (3) December 21
   (4) June 7

46. Marble is a _____ rock.
   (1) Igneous
   (2) Sedimentary
   (3) Metamorphic
   (4) None of these

47. The Headquarters of Universal Postal Union is:
   (1) Berne
   (2) Rome
   (3) Geneva
   (4) New York

48. First world war ended in:
   (1) 1914
   (2) 1916
   (3) 1918
   (4) 1920

49. India signed an agreement for 57 hawk AJT aircraft in July 2010 with

50. Who invented aeroplane?
   (1) W. Roentgen
   (2) Wright brothers
   (3) Z. Jansen
   (4) Pitman

GENERAL SCIENCE

51. The heaviest among the inner planets is the
   (1) Earth
   (2) Mars
   (3) Mercury
   (4) Venus

52. Which comet was seen in 1910 and again in 1986?
   (1) Kohoutek Comet
   (2) Halley's Comet
   (3) Great Comet
   (4) Holmes' Comet

53. Treads on the shoe soles are made to increase
   (1) strength
   (2) durability
   (3) friction
   (4) elasticity

54. An apparatus used for locating submerged objects is known as
   (1) radar
   (2) sonar
   (3) quasar
   (4) pulsar

55. A GM Counter is used for detecting
   (1) underground oil
   (2) coal
   (3) underground water
   (4) radioactivity

56. The number of stars in the universe is believed to be
   (1) 10^10
   (2) 10^11
   (3) 10^15
   (4) 10^21

57. Rocks of which planet are likely to float on water?
   (1) Mars
   (2) Venus
   (3) Saturn
   (4) Jupiter

58. The device used for converting a.c. into d.c. is called
   (1) transformer
   (2) rectifier
   (3) induction coil
   (4) dynamo

59. The number of chromosomes in a normal human body cell is
   (1) 43
   (2) 44
   (3) 45
   (4) 46

60. The deficiency of vitamin A causes
   (1) hair to fall
   (2) dysentery
   (3) night blindness
   (4) weakness
61. Jaundice results from the malfunctioning of the
   (1) kidney (2) liver
   (3) lungs (4) stomach

62. The medicine for typhoid is
   (1) chloroquin (2) vitamin A
   (3) chloromycetin (4) sulphadruge

63. Trypanosomes are transmitted from animal to animal or man by the
   (1) sand fly (2) tsetse fly
   (3) bacilli (4) spirochaetes

64. Excessive consumption of alcoholic drinks causes damage to the
   (1) liver (2) kidney
   (3) heart (4) lungs

65. Palaeontology is the study of
   (1) birds (2) bones
   (3) fossils (4) primate

66. Turpentine is obtained from
   (1) crude petroleum (2) deodor
   (3) pine (4) oak

67. Which country is called the sugar bowl of the world?
   (1) Cuba (2) India
   (3) Argentina (4) USA

68. Size of nanoparticles is in the range of
   (1) 10⁻⁹ m (2) 10⁻⁶ cm
   (3) 10⁻¹⁹ cm (4) 10⁻¹⁰ cm

69. An example of a lyophilic colloid is
   (1) milk (2) gum
   (3) fog (4) blood

70. Example of a lewis acid is
   (1) NaOH (2) AlCl₃
   (3) K₂CO₃ (4) KOH

71. Morphine is
   (1) a terpene (2) a flaronoid
   (3) an alkaloid (4) a tannin

72. An example of an alkaloid is
   (1) isomagnolol (2) psoralen
   (3) magnolol (4) paperene

73. Cocaine is isolated from
   (1) opium (2) cocoa
   (3) rauwafia (4) piper

74. The compound that is not a natural product is
   (1) α pinene (2) citral
   (3) camphor (4) diethyl phthalate

75. Fat-soluble pigments are
   (1) tannins (2) lignins
   (3) alkaloids (4) flavonoids

76. If α, α₁, α₂, α₃, …, αₙ, b are in AP and α, g₁, g₂, g₃, …, g₂ₙ b
   are in GP and h is the HM of α and b then
   \[ \frac{\alpha_1 + \alpha_2}{g_1} + \frac{\alpha_2 + \alpha_3}{g_2} + \frac{\alpha_3 + \alpha_4}{g_3} + \ldots + \frac{\alpha_n + \alpha_{n+1}}{g_n} \]
   is equal to \( \frac{2n}{h} \)

77. If cosθ, sinθ, tanθ are in GP then roots of \( x^2 + 2 \cot \theta \cdot x + 1 = 0 \) are
   (1) equal (2) real
   (3) imaginary (4) greater than 1

78. Non-real Complex number \( z \) satisfying the equation
   \( z^3 + 2z^2 + 3z + 2 = 0 \)
   \[ \frac{1}{2} \left( -1 + \sqrt{-7} \right) \]
   \[ \frac{1}{2} \left( 1 + \sqrt{7}i \right) \]
   \[ \frac{1}{2} \left( -1 - \sqrt{7}i \right) \]
   \[ \frac{1}{2} \left( 1 - \sqrt{7}i \right) \]
   None of these

79. If \( \Delta (x) = \frac{1}{\sin x} - \frac{\cos x}{\sin x} \)
   then, \( \int_0^\pi \Delta (x) \, dx \) is equal to
   (1) \( \frac{1}{4} \) (2) \( \frac{1}{2} \)
   (3) 0 (4) \( -\frac{1}{2} \)

80. If \( x \) denotes the fractional part of \( x \), then \( \left\lfloor \frac{3n}{8} \right\rfloor \) n ∈ N, is
   (1) \( \frac{3}{8} \) (2) \( \frac{7}{8} \)
   (3) \( \frac{1}{8} \) (4) None of these

81. If \( |x| < \frac{1}{2} \), the coefficient of \( x^{1/2} \) in the expansion of \( \frac{1}{(1 + 2x)(1 - x^2)} \) is
   (1) 1 (2) 22
   (3) 21 (4) None of these

82. The set of all possible values of \( \alpha \) in \([\pi, \pi]\) such that \( \sqrt{1 - \sin \alpha} \)
   is equal to \( \sec \alpha + \tan \alpha \) is
   (1) \[ \left[ 0, \frac{\pi}{2} \right] \]
   (2) \[ \left( \frac{\pi}{2}, \pi \right) \]
   (3) \[ \left( -\pi, 0 \right) \]
   (4) \[ \left( -\frac{\pi}{2}, 0 \right) \]

83. The number of solutions of the equation \( x^3 + x^2 + 4x + 2 \sin x = 0 \) in \( 0 \leq x \leq 2\pi \) is
   (1) Zero (2) One
   (3) Two (4) Four

84. \( \tan \left( \frac{\pi}{4} + \frac{1}{2} \cos^{-1} x \right) \)
   \( + \tan \left( \frac{\pi}{4} - \frac{1}{2} \cos^{-1} x \right) \)
   is equal to
   (1) \( x \) (2) \( 2x \)
   (3) \( \frac{2}{x} \) (4) None of these

85. The number of real values of the parameter \( k \) for which \( \log_{10} x^2 \cdot \log_{10} x^2 + \log_{10} x + \log_{10} k = 0 \) with real coefficients will have exactly one solution is
   (1) 2 (2) 1
   (3) 4 (4) None of these

86. In \( \triangle ABC \), \( \angle A = \frac{2\pi}{3} \), \( b - c = 3\sqrt{3} \) cm and ar \( \triangle ABC \) = \( \frac{a\sqrt{3}}{2} \) cm². Then side \( a \) is
   (1) 6\sqrt{3} cm (2) 9 cm
   (3) 18 cm (4) None of these

87. The diagonals of a parallelogram PQR are along the lines \( x + 3y = 4 \) and \( 6x - 2y = 7 \). Then PQR must be a
   (1) rectangle (2) square
   (3) cyclic quadrilateral (4) rhombus
88. The area of the triangle formed by two rays whose combined equation is \( y = |x| \) and the line \( x + 2y = 2 \), is

\[
\begin{align*}
8 & \text{ sq. unit} & 4 & \text{ sq. unit} \\
\frac{3}{4} & \text{ sq. unit} & \frac{16}{3} & \text{ sq. unit}
\end{align*}
\]

89. If the line \( y - 1 = m(x - 1) \) cuts the circle \( x^2 + y^2 = 4 \) at two real points then the number of possible values of \( m \) is:

(1) 1 & (2) 2 & (3) infinite & (4) None of these

90. The ends of a line segment are \( P(1, 3) \) and \( Q(1, 1) \). \( R \) is a point on the line segment \( PQ \) such that \( PR : QR = 1 : 2 \). If \( R \) is an interior point of the parabola \( y^2 = 4x \) then

(1) \( \lambda \in (0, 1) \) & (2) \( \lambda \in \left( \frac{3}{5}, 1 \right) \) & (3) \( \lambda \in \left( \frac{1}{3}, \frac{3}{2} \right) \) & (4) None of these

91. The hyperbola \( \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1 \) passes through the point \( (2, 3) \) and has the eccentricity 2. Then the transverse axis of the hyperbola has the length

(1) 1 & (2) 3 & (3) 2 & (4) 4

92. The domain of the real-valued function \( f(x) = \log_e |\log_e e^x| \) is

(1) \( (1, +\infty) \) & (2) \( (0, +\infty) \) & (3) \( (e, +\infty) \) & (4) None of these

93. If \( f(x) = \sqrt{2x^2 - 1} \) and \( y = f(x^2) \), then \( \frac{dy}{dx} \) at \( x = 1 \) is

(1) 2 & (2) 1 & (3) \(-2\) & (4) None of these

94. Let \( f(x) \) be a twice-differentiable function and \( f''(0) = 2 \). Then \( \lim_{x \to 0} \frac{2f(x) - 3f(2x) + f(4x)}{x^2} \), is

(1) 6 & (2) 3 & (3) 12 & (4) None of these

95. Let \( f(x) = \lambda + \mu |x| + \nu |x|^2 \), where \( \lambda, \mu, \nu \) are real constants. Then \( f'(0) \) exists if

(1) \( \mu = 0 \) & (2) \( \nu = 0 \) & (3) \( \lambda = 0 \) & (4) \( \mu = \nu \)

96. If \( y = \int_0^x \frac{t^2}{\sqrt{t^2 + 1}} \, dt \) then the rate of change of \( y \) with respect to \( x \) when \( x = 1 \) is

(1) \( \sqrt{2} \) & (2) \( \frac{1}{2} \) & (3) \( \frac{1}{2} \) & (4) None of these

97. Let \( f(x) = 1 + 2ax + 2a^2x^2 + \ldots + 2a^{19}x^{20} \). Then \( f(x) \) has

(1) more than one minimum & (2) exactly one minimum & (3) at least one maximum & (4) None of these

98. The curve given by \( e^y = e^{2x} \) has a tangent parallel to the \( y \)-axis at the point

(1) \( (0, 1) \) & (2) \( (1, 0) \) & (3) \( (1, 1) \) & (4) None of these

99. If \( f(x) = a \log_e |x| + bx^2 + x \) has extremums at \( x = 1 \) and \( x = 3 \), then

(1) \( a = -\frac{3}{4}, b = -\frac{1}{8} \) & (2) \( a = \frac{3}{4}, b = -\frac{1}{8} \) & (3) \( a = -\frac{3}{4}, b = \frac{1}{8} \) & (4) None of these

100. Let \( f(x) = 2 \sin^2 x - 3 \sin^2 x + 12 \), then \( f(x) \) is

(1) decreasing in \( [0, \frac{\pi}{2}] \) & (2) increasing in \( [0, \frac{\pi}{2}] \) & (3) increasing in \( [0, \frac{\pi}{4}] \) and decreasing in \( [\frac{\pi}{4}, \frac{\pi}{2}] \) & (4) None of these

**EXPLANATIONS**

1. (1) Article 'A' should be replaced.
2. (2) 'Cheers' should be replaced with 'abuses'.
3. (3) 'From' should be replaced with 'of'.
4. (4) No error
5. (2) 'Am knowing' should be replaced with 'know'.
6. (2) with
7. (4) professional
8. (1) was watching
9. (4) in connection with
10. (1) up
11. (3) Sombre (Adjective) means: very sad or serious; dull.
12. (3) Regress (Verb) means: return to an earlier or less advanced state.
13. (4) Toxic (Adjective) means: poisonous or relating to or caused by poison.
15. (1) Little means: small in size, amount or degree.
16. (2) Cumbersome (Adjective) means: difficult to carry or use through size or weight. Its opposite is convenient.
17. (4) Loquacious (Adjective) means: talkative. Its opposite is bashful.
18. (2) Intelligible (Adjective) means: that can be understood. Its opposite is incomprehensible.
19. (4) Philanthropist (Noun) is a person who donates money to good causes or otherwise helps others. Its opposite is miser.
20. (3) Anxious (Adjective) means: eager or apprehensive. Its opposite is calm.
21. (4) Because of lack of self-discipline 22. (1) By taking risks 23. (3) It helps us to learn 24. (1) By taking a short holiday 25. (2) One has to work hard at least from failures.
72. (4) papaverine 73. (2) cocoa 74. (4) diethyl phthalate 75. (2) lignins 76. (1) Here, \( a + b = a_1 + a_2 = a_3 + a_4 = \ldots = a_n + a_{n+1} \) and \( ab = g_1 \). \( g_2 = g_3 = g_4 = \ldots = g_n \) and \( h = \frac{2ab}{a + b} \).
77. (2) \( \sin^2 \phi = \cos \theta \cdot \sin \theta \)
\( \therefore \cos 2\phi = 1 - \sin 2\theta = (\cos \theta - \sin \theta)^2 \).
\( D = 4\cos^2 \phi - 4 = 4 \cdot \frac{\cos 2\phi}{\sin^2 \phi} \).
\( = 4 \cdot \frac{(\cos \theta - \sin \theta)^2}{\sin \phi} > 0 = 0 \).
\( \Rightarrow \) three numbers are equal which is a special case.
78. (3) \( (x + 1) \cdot (x^2 + z + 2) = 0 \): non-real complex roots are found from \( x^2 + z + 2 = 0 \).
79. (4) \( C_3 \to C_3 + C_2 - C_1 \) gives \( \Delta(x) = \begin{vmatrix} 1 & \cos x & 0 \\ 1 + \sin x & \cos x & 0 \\ \sin x & \sin x & 1 \end{vmatrix} \).
\( \Rightarrow \int_0^\pi \Delta(x) dx = \left[-\frac{\pi^2}{2}\sin 2\pi \cdot dx\right] \).
\( = \left[\frac{1}{2} \left( \frac{\cos 2\pi}{z} \right) \right] \).
\( = \frac{1}{4} \cdot \frac{(\cos \pi - \cos 0)}{\cos \alpha} = \frac{1}{2} \).
80. (3) \( 3^{2n} = (1 + 8)^n = C_0 + C_1 \cdot 8 + C_2 \cdot 8^2 + \ldots + C_n \cdot 8^n \).
\( = \frac{2^{2n}}{8} = 1 + \left( \frac{C_1}{C_1} + C_2 \cdot 8 + \ldots + \frac{C_n \cdot 8^n}{8^n} \right) \).
\( = \frac{1}{8} + \text{integer} \).
81. (3) \( \text{Fraction} = \frac{1}{(1+x)(1-x)(1+2x)} \).
\( = A + \frac{B}{1-x} + \frac{C}{1+2x} \), where \( A = \frac{1}{(1+x)(1-x)(1+2x)} \).
\( \therefore A = \frac{1}{1+2x} + \frac{B}{1-x} + \frac{C}{1+2x} \).
82. (4) Clearly \( \alpha \neq \pm \frac{\pi}{2} \).
\( \sec \alpha - \tan \alpha = \frac{1 - \sin \alpha}{\cos \alpha} \) and \( \sqrt{1 - \sin \alpha} = \sqrt{\frac{(1 - \sin \alpha)^2}{\cos^2 \alpha}} \).
\( = \frac{1}{\cos \alpha} - \frac{1}{\sin \alpha} = \frac{1 - \sin \alpha}{\cos \alpha} \).
Hence, these will be equal if \( \cos \alpha > 0 \), i.e., \( -\frac{\pi}{2} < \alpha < \frac{\pi}{2} \).
83. (2) Here, \( x^2 + (x + 2)^2 + 2\sin x > 4 \).
Clearly, \( x = 0 \) satisfies the equation.
If \( 0 < x \leq \pi \), \( x^2 + (x + 2)^2 + 2\sin x > 4 \).
If \( x < \pi \leq 2\pi \), \( x^2 + (x + 2)^2 + 2\sin x > 27 + 25 - 2 \).
So, \( x = 0 \) is the only solution.
84. (3) Let \( \cos^{-1} x = \theta \). Then the expression
\( = \frac{1 + \tan \frac{\theta}{2}}{2} + \frac{1 - \tan \frac{\theta}{2}}{2} \).
85. \( \log_{16} x = \frac{1 \pm \sqrt{1-41 \log_{16} k}}{2} \) For exactly one solution, \( 4 \log_{16} k = 1 \).
\( k^2 = 16 \)
\( k = 2, -2, 2i, -2i \).
But \( k \) is positive and real.

86. \( (2) \frac{1}{3} \cos \sin \frac{2\pi}{3} \)
\( = \frac{2}{3} \cos \frac{\sqrt{3}}{2} \cdot \frac{1}{2} \cos \frac{\sqrt{3}}{2} \cos \cos \frac{\sqrt{3}}{2} \)
\( = \frac{2}{3} \cos \frac{\sqrt{3}}{2} \)
\( \Rightarrow bc = 18 \).
Also, \( \cos \frac{2\pi}{3} = \frac{b^2 + c^2 - a^2}{2bc} \)
\( \Rightarrow 1 = \frac{(b-c)^2 + 2bc - a^2}{2bc} \)
\( \Rightarrow (b-c)^2 + 3bc - a^2 = 0, \) or, \( 27 + 54 = a^2 \).

87. (4) The diagonals are perpendicular to each other.

88. (2) The lines are \( y = x, y = -x \) and \( x + 2y = 2 \) as shown in the figure.
Solving \( y = x, x + 2y = 2 \), the point \( A = \left( \frac{2}{3}, \frac{2}{3} \right) \)
\( \Rightarrow OA = \sqrt{\frac{4}{a} + \frac{4}{a}} = \frac{2\sqrt{2}}{3} \)
Solving \( y = -x, x + 2y = 2 \), the point \( B = (-2, 2) \)
\( \Rightarrow OB = \sqrt{4 + 4} = 2\sqrt{2} \)
\( \Rightarrow ar(\triangle OAB) = \frac{1}{2} \cdot OA \cdot OB \)
\( = \frac{1}{2} \cdot \frac{2\sqrt{2}}{3} \cdot 2\sqrt{2} = \frac{4}{3} \).

89. (3) The line passes through the interior point \( (1, 1) \). So, \( m \) can have any real value.

90. (1) \( R = \left( \frac{1 + 3\lambda}{1 + \lambda} \right) \) It is an interior point of \( y^2 - 4x = 0 \) if \( \left( \frac{1 + 3\lambda}{1 + \lambda} \right)^2 - 4 < 0 \).
Therefore, \( \frac{3}{5} < \lambda < 1 \).
But \( \lambda > 0 \).

91. (3) \( a^2 - 2 \alpha = 1 \) and \( b^2 = a^2 \cdot (e^2 - 1) = a^2 \cdot 3 \).
\( \frac{4}{a} - \frac{9}{3a^2} = 1 \)
\( \Rightarrow a^2 = 1 \).
Transverse axis = \( 2a = 2 \).

92. (4) \( x > 0 \) and \( \log_e x > 0 \).
\( \Rightarrow x > 0 \) and \( x \neq 1 \).
\( \Rightarrow \) domain = \( (0, 1) \cup (1, +\infty) \).

93. (1) \( y = f(x^2) \Rightarrow \frac{dy}{dx} = \frac{df}{dx} \cdot \frac{dx}{dx} = f'(x^2) \cdot 2x \)
\( = \sqrt{2(x^2 - 1)} \)
At \( x = 1, \frac{dy}{dx} = \frac{2}{3} \cdot 1 - 2 = 1 \).

94. (1) Limit = \( \lim_{x \to 0} \frac{2f'(x) - 6f'(2x) + 4f'(4x)}{2x} \)
\( \Rightarrow \lim_{x \to 0} \frac{2f'(x) - 12f'(2x) + 16f'(4x)}{2x} \)
\( \Rightarrow \frac{6f'(0)}{2} = 6 \)

95. (1) RH derivative = \( \lim_{h \to 0} \frac{\lambda + \mu(0 + h) + \mu(0 + h)^2 - \lambda}{h} \)
\( \Rightarrow \lim_{h \to 0} \frac{\mu h + \mu h^2}{h} = \mu \)
LH derivative = \( \lim_{h \to 0} \frac{\lambda + \mu(0 - h) + \mu(0 - h)^2 - \lambda}{-h} \)
\( \Rightarrow \lim_{h \to 0} \frac{\mu h + \mu h^2}{-h} = -\mu \)

96. (3) \( \frac{dy}{dx} = \frac{x^2}{\sqrt{x^2 + 1}} \)
\( \Rightarrow \frac{dy}{dx}_{x=1} = \frac{1}{\sqrt{1 + 1}} = \frac{1}{\sqrt{2}} \)

97. (2) \( f'(x) = x(4 + 4 \cdot 2^2 \cdot x^2 + \ldots + 20 \cdot 2^{10} \cdot x^{10}) \)
\( \Rightarrow f'(x) = 0 \Rightarrow x = 0 \) only.
Also, \( f''(0) > 0 \)

98. (2) Differentiating w.r.t.x:
\( 1 + \frac{dy}{dx} = e^{\frac{3y}{x}} \left( y + x \frac{dy}{dx} \right) \)
or, \( \frac{dy}{dx} = \frac{ye^{\frac{3y}{x}} - 1}{1 - xe^{\frac{3y}{x}}} \)
\( \Rightarrow \frac{dy}{dx} = \frac{y}{1 - xe^{\frac{3y}{x}}} \)
\( \Rightarrow 1 - xe^{\frac{3y}{x}} = 0 \)
\( \Rightarrow x = \frac{1}{3} \cdot \frac{3y}{x} = 0 \)
This holds for \( x = 1, y = 0 \)

99. (1) Around \( x = 1, 3 \) we have \( |x| = x \)
\( \Rightarrow f(x) = a \log x + bx + y + x \)
\( \Rightarrow f'(x) = \frac{a}{x} + 2bx + 1 \)
From the question, \( f'(1) = 0, f'(3) = 0 \).
\( \Rightarrow a + 2b + 1 = 0, \)
\( \Rightarrow a + 6b + 1 = 0 \).

100. (2) \( f'(x) = 6 \sin^2 x \cos x - 6 \sin x \cos x + 12 \cos x \)
\( = 6 \cos x (\sin^2 x - \sin x + 2) \)
\( \Rightarrow \ln \left[ \cos x \left( \frac{1}{2} - \frac{7}{4} \right) \right] \geq 0 \)
\( \Rightarrow \frac{\lambda + \mu(0 - h) + \mu(0 - h)^2 - \lambda}{-h} \)
\( \Rightarrow \frac{\mu h + \mu h^2}{-h} = -\mu \)
\( f'(x) \) exists.
\( \Rightarrow \) RH derivative = LH derivative \( \Rightarrow \mu = -\mu \).

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