



MATHS

BOOKS - IPUCET PREVIOUS YEAR PAPERS MATHS (HINGLISH)

IPU QUESTION PAPER 2018

Mathematics

1. In how many ways can 10 identical objects be put in 8 distinct boxes in such that no box is empty?

- A. 9
- B. 36
- C. 45
- D. 10

Answer: B



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2. Choose the most appropriate option.

$\lim_{x \rightarrow 1} x^{\frac{1}{1-x}}$ is equal to

A. 0

B. 3

C. $1/e$

D. ∞

Answer: C



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3. In how many ways can 3 blue, 4 white and 2 red balls be distributed into 4 distinct boxes?

A. 49000

B. 36750

C. 126

D. 7000

Answer: D



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4. Choose the most appropriate options.

If α and β are non-real numbers satisfying

$$x^3 - 1 = 0, \text{ then the value of } \begin{vmatrix} \lambda + 1 & \alpha & \beta \\ \alpha & \lambda + \beta & 1 \\ \beta & 1 & \lambda + \alpha \end{vmatrix} \text{ is}$$

A. 0

B. λ^3

C. $\lambda^3 + 1$

D. $\lambda^3 - 1$

Answer: B



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5. In how many ways can 5 men and 3 women be seated in a row such that no two women sit adjacently?

A. 720

B. 2400

C. 1440

D. 14400

Answer: D



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6. Choose the most appropriate option.

$\int_{-2}^2 \frac{3x^7 - 2x^5 + x^3 - 3}{x^4 + 3x^2 + 1} dx$ is equal to

A. does not exist

B. 3

C. $1/e$

D. ∞

Answer: A



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7.
$$\begin{vmatrix} x + 1 & x + 2 & x + 4 \\ x + 3 & x + 5 & x + 8 \\ +7 & x + 10 & x + 14 \end{vmatrix}$$
 is equal to

A. 2

B. -4

C. 0

D. None of the above

Answer: D

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8. Choose the most appropriate option.

In a class, there are 10 boys and 8 girls. When 3 students are selected at random, the probability that 2 girls and 1 boy are selected, is

A. $\frac{35}{102}$

B. $\frac{15}{102}$

C. $\frac{55}{102}$

D. $\frac{25}{102}$

Answer: A

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9.
$$\begin{vmatrix} b^2 + c^2 & c^2 & b^2 \\ c^2 & c^2 + a^2 & a^2 \\ b^2 & a^2 & a^2 + b^2 \end{vmatrix}$$
 is equal to

A. $4a^2b^2c^2$

B. $(a + b + c)^2$

C. $a^2 + b^2 + c^2$

D. $a^4 + b^4 + c^4$

Answer: A

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10. Choose the most appropriate option.

If $y = b^{ax}$ then

A. $y_n = a^n b^{ax} (\log_e b)^{n-1}$

B. $y_n = (-1)^n a^n b^{ax} (\log_e b)^n$

C. $y_n = a^{n+1} b^n (\log_e b)^n$

D. $y_n = a^n b^{ax} (\log_e b)^n$

Answer: D



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11. Let S be the set of all points with coordinates (x, y, z) , where x, y and z are each chosen from the set $[0, 1, 2]$. How many equilateral triangles have all their vertices in S ?

A. 72

B. 76

C. 80

D. 84

Answer: A



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12. . Choose the most appropriate option.

The value of the integral $\int_{-3}^5 |x - 3| dx$ is

A. 20

B. 21

C. 18

D. 22

Answer: A



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13. Six ants simultaneously stand on the six vertices of a regular octahedron with each ant at a different vertex. Simultaneously and independently, each ant moves from its vertex to one of the four adjacent vertices, each with equal probability. What is the probability that no two ants arrive at the same vertex?

A. $\frac{5}{256}$

B. $\frac{21}{1024}$

C. $\frac{11}{512}$

D. $\frac{23}{1024}$

Answer: B



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14. Choose the most appropriate options.

If A and B are independent events such that

$$P(B) = \frac{2}{7}, P(A \cup \bar{B}) = 0.8 \text{ then } P(A) =$$

A. 0.1

B. 0.2

C. 0.3

D. 0.4

Answer: C



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15. $1 + 1 + \frac{3}{2^2} + \frac{4}{2^3} + \frac{5}{2^4} + \dots$ is equal to

A. 1

B. 2

C. 3

D. 4

Answer: D



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16. Choose the most appropriate option.

The line $y = mx + C$ will be tangent to the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ if c is equal to

A. $\frac{3}{m}$

B. $\sqrt{9m^2 + 4}$

C. $\sqrt{1 + m^2}$

D. $\sqrt{4m^2 + 9}$

Answer: B



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17. Determine the form of the conic section described by the equation

$$x^2 + y^2 + 2xy - 8x + 8y = 0$$

A. Circle

B. Parabola

C. Hyperbola

D. A pair of straight lines

Answer: B



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18. Choose the most appropriate options.

Let

$$P = \{\theta: \sin \theta - \cos \theta = \sqrt{2} \cos \theta\} \text{ and } , Q = \{\theta \sin \theta + \cos \theta = \sqrt{2} \sin \theta\}$$

be two sets . Then,

A. $P \subset Q$ and $Q - P \neq \phi$

B. $Q \not\subset P$

C. $P \not\subset Q$

D. $P = Q$

Answer: D



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19. $8 \cos^4 x - 8 \cos^2 x + 1$ is equal to

A. $\cos 4x$

B. $\sin 4x$

C. $\cos 2x - \sin 4x$

D. $\cos 2x + \sin 4x$

Answer: A



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20. Choose the most appropriate options.

If a, b, c are positive real numbers, then $\frac{1}{\log_{ab}^{abc}} + \frac{1}{\log_{ca}^{abc}} + \frac{1}{\log_{ca}^{abc}} =$

A. 0

B. 1

C. 2

D. 3

Answer: C



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21. Find the distance from the point A(2, 3, -1) to the given straight lines

$2x - 2y + z + 3 = 0$ and $3x - 2y + 2z + 17 = 0$.

A. $1/\sqrt{5}$

B. 19.13

C. $3/\sqrt{5}$

D. $6/\sqrt{5}$

Answer: B



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22. Choose the most appropriate options.

If $\sin \theta + \csc \theta = 2$ then the value of $\sin^{10} \theta + \csc^{10} \theta$

A. 2

B. 2^4

C. 2^8

D. 2^{10}

Answer: A



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23. $\begin{vmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{vmatrix}$ is equal to

A. -1

B. 0

C. 1

D. None of these

Answer: B



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24. Choose the most appropriate options.

The standard deviation of a data is 6, when each observation is increased by 1, then the standard deviation of new data is

A. 5

B. 7

C. 6

D. 8

Answer: C



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25. Compute the determinant of the $n \times n$ matrix whose elements are identified by the condition $a_{ij} = \min(i, j)$ where i is the row number and j is the column number.

A. -1

B. $(-1)^n$

C. 1

D. 0

Answer: C



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26. Choose the most appropriate options.

Let T_n denote the number of triangles which can be formed using the vertices of a regular polygon of n sides. If $T_{n+1} - T_n = 21$ then n equals

A. 5

B. 7

C. 6

D. 8

Answer: B



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27. Find $\frac{dy}{dx}$ where $a^{\frac{x}{y}} = \left(\frac{x}{y}\right)^a$

A. xy

B. $\frac{y}{x}$

C. $\frac{x}{y}$

D. Does not exist

Answer: B



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28. Choose the most appropriate options.

If the arithmetic mean of the following data is 7 then $a+b=$

| | | | | |
|-------|---|---|---|---|
| x_i | 4 | 6 | 7 | 9 |
| f_i | a | 4 | b | 5 |

A. 4

B. 2

C. 3

D. cannot be determined

Answer: D



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29. $\int 3^{4x} dx$ is equal to

A. $\frac{3^{6x}}{4} + C$

B. $\frac{3^{4x}}{\ln 3} + C$

C. $\frac{3^{4x}}{3 \ln 4} + C$

D. $\frac{3^{4x}}{4 \ln 3} + C$

Answer: D



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30. $\int e^{\sec x} \tan x \sec x \, dx$ is equal to

A. $e^{\tan x} + C$

B. $e^{\sec x} + C$

C. $e^{\sec x} \sec x + C$

D. $e^{\sec x} \tan x + C$

Answer: B



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31. Choose the most appropriate option.

Solve for x ($a \neq 0$)

$$\sqrt[3]{(a+x)^2} + 4\sqrt[3]{(a-x)^2} = 5\sqrt[3]{a^2 - x^2}$$

A. $x_1 = \frac{43}{45}a, x_2 = \frac{63}{65}a$

B. $x_1 = \frac{43}{45}a, x_2 = 0$

C. $x_1 = \frac{63}{65}a, x_2 = 0$

D. $x_1 = -\frac{63}{65}a, x_2 = 0$

Answer: C

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32. $\int_0^{\pi/2} e^x \cos x dx$ is equal to

A. $\frac{1}{2}(e - 1)$

B. $\frac{1}{2}(e^x - 1)$

C. $\frac{1}{2}(e^{\pi/2} - 1)$

D. $\frac{1}{2}(1 - e^{\pi/2})$

Answer: C

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33. Find the area of the figure bounded by the parabola

$$y^2 = 4x \text{ and } x^2 = 4y$$

A. 16

B. 8

C. $16/3$

D. 4

Answer: C



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34. Choose the most appropriate options.

The eccentricity of the hyperbola $\frac{\sqrt{1999}}{3}(x^2 - y^2) = 1$ is

A. $\sqrt{2}$

B. 2

C. $2\sqrt{2}$

D. $\sqrt{3}$

Answer: A



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35. Consider sequences of positive real numbers of the form $x, 2000, y, \dots$, in which every term after the first is 1 less than the product of its two immediate neighbours. For how many different values of x does the term 2001 appear somewhere in the sequence?

A. 1

B. 2

C. 3

D. 4

Answer: D



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36. Choose the most appropriate options.

The exradii of a triangle r_1, r_2, r_3 are in harmonic progression, then the sides a, b and c are in

A. $(-0, 1)$

B. $(2, 3)$

C. $(-0, 3)$

D. $(-0, 1) + (2, 3)$

Answer: B



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37. Let $f(x) = x^2 + 6x + 1$ and let R denotes the set of points (x,y) in the coordinate plane such that $f(x) + f(y) \leq 0$ and $f(x) - f(y) \leq 0$.

Which of the following is closest to the area of R ?

A. 22

B. 23

C. 24

D. 25

Answer: D



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38. Let n be a 5-digit number and let q and r be the quotient and remainder respectively, when n is divided by 100. For how many values of n is $q+r$ divisible by 11?

A. 8180

B. 8181

C. 8182

D. 9000

Answer: B



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39. Choose the most appropriate options

If $\tan \frac{2\pi}{18}$, x and $\tan \frac{7\pi}{18}$ are in AP and $\tan \frac{2\pi}{18}$, y and $\tan \frac{5\pi}{18}$ are in

AP then the value of x/y will be

A. $1/2$

B. 2

C. 1

D. $1/4$

Answer: B



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40. A line segment with the end points A (3,-2) and B (6, 4) is divided into three equal parts. Find the coordinates of the division points.

A. (4, 0), (5, 2)

B. (0, 4), (5, 2)

C. (4, 0), (2, 5)

D. (0, 4), (2, 5)

Answer: A



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41. Three mutually, tangent spheres of radius 1 rest on a horizontal plane. A sphere of radius 2 rests on them. What is the distance from the plane to the top of the larger sphere?

A. $3 + \frac{\sqrt{30}}{2}$

B. $3 + \frac{\sqrt{69}}{3}$

C. $3 + \frac{\sqrt{123}}{4}$

D. $\frac{52}{9}$

Answer: B



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42. Choose the most appropriate options.

If the line $x-1=0$ is the directrix of the parabola $y^2 - kx + 8 = 0$ then one of the value of k is

A. $1/8$

B. 8

C. 4

D. $1/4$

Answer: C



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43. $\lim_{x \rightarrow 0} (1 + \tan^2 \sqrt{x})^{3/2}$ is equal to

A. 0

B. ∞

C. e

D. e^3

Answer: D



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44. $\lim_{x \rightarrow a} \frac{\log a^x - 1}{x - a}$ is equal to

A. 0

B. ∞

C. $\log_a e$

D. $\frac{1}{a} \log_a e$

Answer: D

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45. Choose the most appropriate options.

For real x , let $f(x) = x^3 + 5x + 1$, then

A. f is one-one but not onto \mathbb{R}

B. f is onto \mathbb{R} but not one-one

C. f is one-one and onto \mathbb{R}

D. f is neither one-one nor onto \mathbb{R}

Answer: C

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46. $\lim_{x \rightarrow 0} \frac{1 - \cos 4x}{2 \sin^2 x + c \tan 7x}$ is equal to

A. $8/9$

B. 0

C. $9/8$

D. ∞

Answer: A



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47. Choose the most appropriate options.

Negation of the statement $(p \wedge r) \rightarrow (r \vee q)$ is

A. $(p \wedge r) \wedge (\neg r \wedge \neg q)$

B. $\neg(p \wedge r) \rightarrow \neg(r \vee q)$

C. $\neg(p \vee r) \rightarrow \neg(r \wedge q)$

D. $(p \wedge r) \vee (r \vee q)$

Answer: A



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48. Given the vertices of a triangle are A (1,-1, -3), B (2, 1, -2) and C (-5, 2, -6).

Compute the length of the bisector of the interior angle at vertex A.

A. 3

B. $\sqrt{10}/4$

C. $\frac{3\sqrt{10}}{4}$

D. $3\sqrt{10}$

Answer: C



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49. It is known that $AB=2a-6b$ and $AC = 3a + b$, where a and b are mutually perpendicular unit vectors. Determine the angles of the $\triangle ABC$.

A. $\pi/6$

B. $\pi/4$

C. $\pi/2$

D. π

Answer: C



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50. Choose the most appropriate options.

The value of $\int \frac{\sin^2 x \cos^2 x}{(\sin^3 x + \cos^3 x)} dx$, is

A. $\frac{1}{3(1 + \tan^3 x)} + C$

B. $-\frac{1}{3(1 + \tan^5 x)} + C$

C. $\frac{1}{1 + \tan^3 x} + C$

$$D. \frac{-1}{1 + \tan^3 x} + C$$

Answer: B



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