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MATHS

BOOKS - MTG MATHS (BENGALI ENGLISH)

QUESTION PAPER 2021

Multiple Choice Question

1. If $I = \lim_{x \to 0} \sin\left(\frac{e^x - x - 1 - \frac{x^2}{2}}{x^2}\right)$, then limit

A. does not exist

B. exists and equals 1

C. exists and equals 0

D. exists and equals $\frac{1}{2}$

Answer:

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2. Let $f: R \to R$ be such that $f(0) = 0$ and $|f'(x)| \leq 5$ for all x. Then f(1) is in

A. (5, 6)

B. [-5, 5]

C. $(-\infty, -5) \cup (5, \infty)$

D. $[-4, 4]$

Answer:

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3. If $\int \frac{\sin 2x}{(a + b\cos x)^2} dx = \alpha \left[\log_e |a + b\cos x| + \frac{a}{a + b\cos x}\right] + c,$ then $\alpha =$

A. $\frac{2}{b^2}$

B. $\frac{2}{a^2}$

C. $-\frac{2}{b^2}$

D. $-\frac{2}{a^2}$

Answer:

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4. Let f(x) = $\int_2^x f(t^2 - 3t + 2)dt$ then

A. g(x) is strictly increasing function

B. g(x) is strictly decreasing function

C. g(x) is constant function

D. g(x) is not derivable function

Answer:

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5. $\int_1^3 \frac{|x-1|}{|x-2|+|x-3|} dx =$

A. $1+\frac{4}{3}\log_e 3$

B. $1+\frac{3}{4}\log_e 3$

C. $1-\frac{4}{3}\log_e 3$

D. $1-\frac{3}{4}\log_e 3$

Answer:

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6. The value of the integral

$\int_{-1/2}^{1/2}\left\{\left(\frac{x+1}{x-1}\right)^2+\left(\frac{x-1}{x+1}\right)^2-2\right\}^{1/2} dx$ is equal to

A. $\log_e\left(\frac{4}{3}\right)$

B. $4\log_e(3/4)$

C. $4\log_e\left(\frac{4}{3}\right)$

D. $\log_e(3/4)$

Answer:

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7. If $\int_{\log_{e^2}}^{x}(e^x-1)^{-1}dx=\log_e\frac{3}{2}$ then the value of x is

A. 1

B. e^2

C. $\log 4$

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

Answer:

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8. The normal to a curve at P(x, y) meets the x-axis at G. If the distance of G from the origin is twice the abscissa of P then the curve is

A. a parabola

B. a circle

C. a hyperbola

D. an ellipse

Answer:

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9. The differential equation of all the ellipses centred at the origin and have axes as the co-ordinate axes is

where $y' = \frac{dy}{dx}, y'' = \frac{d^2y}{dx^2}$

A. $y^2 + xy^2 - yy' = 0$

B. $xyy'' + xy'^2 - yy' = 0$

C. $yy'' + xy'^2 - xy' = 0$

D. $x^2y' + xy'' - 3y = 0$

Answer:

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10. If $x\dfrac{dy}{dx} + y = \dfrac{xf(xy)}{f'(xy)}$, then $|f(xy)|$ is equal to

A. $ke^{x^2/2}$

B. $ke^{y^2/2}$

C. ke^{x^2}

D. ke^{y^2}

Answer:

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11. The straight line through the origin which divided the area formed by the curves $y = 2x - x^2$, $y = 0$ and $x = 1$ into two equal halves is

A. $y = x$

B. $y = 2x$

C. $y = \frac{3}{2}x$

D. $y = \frac{2}{3}x$

Answer:

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12. The value of $\int_0^5 \max\{x^2, 6x - 8\}dx$ is

A. 72

B. 125

C. 43

D. 69

Answer:

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13. The bulb is placed at the centre of a circular track of radius 10m. A vertical wall is erected touching the track at a point P. A man is running along the track with a speed of 10 m/sec. Starting from P the speed with which his shadow is running along the wall when he is at an angular distance of 60° form P is

A. 30 m/sec

B. 40 m/sec

C. 60 m/sec

D. 80 m/sec

Answer:

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14. Two particles A and B move from rest along a straight line with constant accelerations f and f' respectively. If A takes m sec. more than that of B and describes n units more than that of B acquiring the same velocity, then

A. $(f + f')m^2 = ff'n$

B. $(f - ff')m^2 = ff'n$

C. $(f' - f)n = \frac{1}{2}ff'm^2$

D. $\frac{1}{2}(f + f')m = ff'n^2$

Answer:

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15. Let $\vec{\alpha}, \vec{\beta}, \vec{\gamma}$ be three non-zero vectors which are pairwise non-collinear. If $\vec{\alpha} + 3\vec{\beta}$ is collinear with $\vec{\gamma}$ and $\vec{\beta} + 2\vec{\gamma}$ is collinear with

$\vec{\alpha}$, then $\vec{\alpha}+3\vec{\beta}+6\vec{\gamma}$ is

A. $\vec{\gamma}$

B. $\vec{0}$

C. $\vec{\alpha}+\vec{\gamma}$

D. $\vec{\alpha}$

Answer:

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16. Let $f: R \rightarrow R$ be given by $f(x)=\left|x^2-1\right|, x \in R$. Then

A. f has a local minimum at $x= \pm 1$ but no local maximum.

B. f has a local maximum at $x=0$ but no local minimum.

C. f has a local minima at $x= \pm 1$ & a local maxima at x = 0.

D. f has neither a local maxima nor a local minima at any point.

Answer:

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17. Let a, b, c be real numbers, each greater than 1, such that

$$\frac{2}{3}\log_b a+\frac{3}{5}\log_c b+\frac{5}{2}\log_a c=3.$$

If the value of b is 9, then the value of 'a' must be

A. $\sqrt[3]{81}$

B. $\frac{27}{2}$

C. 18

D. 27

Answer:

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18. Consider the real valued function $h:\{0, 1, 2. \dots .100\} \rightarrow R$ such that h(0)=5, h(100)=20 and satisfying $h(p) = \frac{1}{2}\{h(p+1) + h(p-1)\}$ for every p=1,2 .... 99. Then he value of h(1) +h(99) is

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19. If $|z| = 1$ and $z \neq \pm 1$ then all the values of $\frac{z}{1-z^2}$ lie on

A. a line not passing through the origin

B. the line y = x

C. the x-axis

D. the y-axis

Answer:

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20. If z be a complex number satisfying $z^4 + z^3 + 2z^2 + z + 1 = 0$ then $|z|$ is equal to

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21. Let α and β be the roots of the equation $x^2 - 6x - 2 = 0$. If $a_n = \alpha^n - \beta^n$, for $n \geq 1$, then the value of $\frac{a_{10} - 2a_8}{2a_9}$ is equal to

A. 1

B. 2

C. 3

D. 4

Answer:

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22. For $x \in R, x \neq -1$, if

$$(1+x)^{2016} + x(1+x)^{2015} + x^2(1+x)^{2014} + \ldots\ldots + x^{2016} = \sum_{i=0}^{2016} a_i \cdot x^i$$

, then a_{17} is equal to

A. $\frac{2016!}{17!1999!}$

B. $\frac{2016!}{16!}$

C. $\frac{2017!}{2000!}$

D. $\frac{2017!}{17!2000!}$

Answer:

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23. Five letter words, having distinct letters, are to be constructed using the letters of the word 'EQUATION' so that each word contains exactly three vowels and two consonants. How many of them have all the vowels together?

A. 3600

B. 1800

C. 1080

D. 900

Answer:

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24. What is the number of ways in which an examiner can assign 10 marks to 4 questions, giving not less than 2 marks to any question ?

A. 4

B. 6

C. 10

D. 16

Answer:

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25. The digit in the unit's place of the number $1! + 2! + 3! + \ldots\ldots + 99!$ is

A. 3

B. 0

C. 1

D. 7

Answer:

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26. If M is a 3×3 matrix such that (0 1 2)M = (1 0 0), (3 4 5) M = (0 1 0), then (6 7 8)M is equal to

A. (2 1 -2)

B. (0 0 1)

C. (-1 2 0)

D. (9 10 8)

Answer:

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27. Let A = $\begin{bmatrix} 0 & -\tan\alpha/2 \\ \tan\alpha/2 & 0 \end{bmatrix}$ and I, the indentity matrix of order 2.

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28. Let A and B be two non-singular skew symmetric matrices such that AB = BA, then $A^2B^2(A^TB)^{-1}(AB^{-1})^T$ is equal to

A. A^2

B. $-B^2$

C. $-A^2$

D. AB

Answer:

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29. If $a_n(>0)$ be the n^{th} term of a G.P. then

$$\begin{vmatrix} \log a_n, \log a_{n+1}, \log a_{n+2} \\ \log a_{n+3}, \log a_{n+4}, \log a_{n+5} \\ \log a_{n+6}, \log a_{n+7}, \log a_{n+8} \end{vmatrix}$$ is equal to

A. 1

B. 2

C. -2

D. 0

Answer:

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30. Let A, B, C be three non-void subsets of set S. Let $(A \cap C) \cup (B \cap C') = \phi$ where C' denote the complement of set C in S. Then

A. $A \cap B = \phi$

B. $A \cap B \neq \phi$

C. $A \cap C = A$

D. $A \cup C = A$

Answer:

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31. Let T & U be the set of all orthogonal matrices of order 3 over R & the set of all non-singular matrices of order 3 over R respectively.

Let A = {-1, 0, 1}, then

A. there exists bijective mapping between A and T, U.

B. there does not exist bijective mapping between A and T, U

C. there exists bijective mapping between A and T but not between A & U.

D. there exists bijective mapping between A and U but not between A & T.

Answer: B

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32. Four persons A, B, C and D throw an unbiased die, turn by turn, in succession till one gets an even number and win the game. What is the probability that A wins the game if A begins ?

A. $\frac{1}{4}$

B. $\frac{1}{2}$

C. $\frac{7}{15}$

D. $\frac{8}{15}$

Answer:

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33. The mean and variance of a binomial distribution are 4 and 2 respectively. Then the probability of exactly two successes is

A. $\frac{7}{64}$

B. $\frac{21}{128}$

C. $\frac{7}{32}$

D. $\frac{9}{32}$

Answer:

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34. Let $S_n = \cot^{-1}2 + \cot^{-1}8 + \cot^{-1}18 + \cot^{-1}32 + \ldots.$ to n^{th} term. Then $\lim_{n \to \infty} S_n$ is

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

B. $\frac{\pi}{4}$

C. $\frac{\pi}{6}$

D. $\frac{\pi}{8}$

Answer:

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35. If $a > 0, b > 0$ then the maximum area of the parallelogram whose three vertices are $O(0, 0), A(a\cos\theta, b\sin\theta)$ and $B(a\cos\theta, -b\sin\theta)$ is

A. ab when $\theta = \pi/4)$

B. 3ab when $\theta = \pi/4$

C. ab when $\theta = -\pi/2$

D. 2ab

Answer:

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36. Let A be the fixed point (0, 4) and B be a moving point on x-axis. Let M be the midpoint of AB and let the perpendicular bisector of AB meets the y-axis at R. The locus of the midpoint P of MR is

A. $y + x^2 = 2$

B. $x^2 + (y-2)^2 = \frac{1}{4}$

C. $(y-2)^2 - x^2 = \frac{1}{4}$

D. $x^2 + y^2 = 16$

Answer:

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37. A moving line intersects the lines $x+y=0$ and $x-y=0$ at the points A, B respectively such that the area of the triangle with vertices (0, 0), A & B has a constant area C. The locus of the mid-point AB is given by the equation

A. $\left(x^2+y^2\right)^2=C^2$

B. $\left(x^2-y^2\right)^2=C^2$

C. $(x+y)^2=C^2$

D. $(x-y)^2=C^2$

Answer:

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38. The locus of the vertices of the family of parabolas $6y=2a^3x^2+3a^2x-12a$ is

A. $xy = \frac{105}{64}$

B. $xy = \frac{64}{105}$

C. $xy = \frac{35}{16}$

D. $xy = \frac{16}{35}$

Answer:

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39. A ray of light along $x + \sqrt{3}y = \sqrt{3}$ gets reflected upon reaching x-axis , the equation of the reflected ray is

A. $y = x + \sqrt{3}$

B. $\sqrt{3}y = x - \sqrt{3}$

C. $y = \sqrt{3}x - \sqrt{3}$

D. $\sqrt{3}y = x - 1$

Answer:

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40. Two tangents to the circle $x^2 + y^2 = 4$ at the points A and B meet at M(-4, 0). The area of the quadrilateral MAOB, where O is the origin is

A. $4\sqrt{3}$ sq. units

B. $2\sqrt{3}$ sq. units

C. $\sqrt{3}$ sq. units

D. $3\sqrt{3}$ sq. units

Answer:

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41. From a point (d, 0) three normals are drawn to the parabola $y^2 = x$, then

A. $d = \frac{1}{2}$

B. $d > \frac{1}{2}$

C. $d < \frac{1}{2}$

D. $d = \frac{1}{3}$

Answer:

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42. If from a point P(a, b, c), perpendiculars PA and PB are drawn to YZ and ZX-planes respectively, then the equation of the plane OAB is

A. $bcx + cay + abz = 0$

B. $bcx + cay - abz = 0$

C. $bcx - cay + abz = 0$

D. $bcx - cay - abz = 0$

Answer:

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43. The co-ordinate of a point on the auxiliary circle of the ellipse $x^2 + 2y^2 = 4$ corresponding to the point on the ellipse whose eccentric angle is 60° will be

A. $(\sqrt{3}, 1)$

B. $(1, \sqrt{3})$

C. (1, 1)

D. (1, 2)

Answer:

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44. The locus of the center of a variable circle which always touches two given circles externally is

A. an ellipse

B. a hyperbola

C. a parabola

D. a circle

Answer:

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45. A line with positive direction cosines passes through the point P(2, -1, 2) and makes equal angle with co-ordinate axes. The line meets the plane $2x + y + z = 9$ at point Q. The length of the line segment PQ equals

A. 1 unit

B. $\sqrt{2}$ unit

C. $\sqrt{3}$ unit

D. 2 unit

Answer:

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46. For $y = \sin^{-1}\left\{\frac{5x + 12\sqrt{1-x^2}}{13}\right\}, |x| \leq 1,$ if $a(1-x^2)y_2 + bxy_1 = 0$ then (a, b) =

A. (2, 1)

B. (1, -1)

C. (-1, 1)

D. (1, 2)

Answer:

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47. f(x) is real valued function such that $2f(x) + 3f(-x) = 15 - 4x$ for all $x \in R$. Then f(2) =

A. -15

B. 22

C. 11

D. 0

Answer:

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48. Consider the functions $f_1(x) = x, f_2(x) = 2 + \log_e x, x > 0$. The graphs of the functions intersect

A. once in (0, 1) but never in $(1, \infty)$

B. once in (0, 1) and once in (e^2, ∞)

C. once in (0, 1) and once in $\left(e, e^2\right)$

D. more than twice in $(0, \infty)$

Answer:

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49. The equation $6^x + 8^x = 10^x$ has

A. no real root.

B. infinitely many rational roots.

C. exactly one real root.

D. two distinct real roots.

Answer:

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50. Let $f: D \to R$ where $D = [0, 1] \cup [2, 4]$ be defined by

$$f(x) = \begin{cases} x, & \text{if } \ x \in [0,1] \\ 4 - x, & \text{if } \ x \in [2,4] \end{cases}$$. Then,

A. Rolle's theorem is applicable to f in D.

B. Rolle's theorem is not applicable to f in D.

C. there exists $\xi \in D$ for which $f'(\xi) = 0$ but Rolle's theorem is not applicable.

D. f is not continuous in D.

Answer:

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51. Let f(x) be a continuous periodic function with period T. Let $I = \int_a^{a+T} f(x) dx$. Then

A. I is linear function in 'a'

B. I does not depend on 'a'

C. $0 < I < a^2 + 1$ where I depends on 'a'

D. I is linear function in 'a'

Answer:

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52. If $b = \int_0^1 \frac{e^t}{t+1} dt$, then $\int_{a-1}^{a} \frac{e^{-t}}{t-a-1}$ is

A. be^a

B. be^{-a}

C. $-be^{-a}$

D. $-be^a$

Answer:

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53. The differential of $f(x) = \log_e(1 + e^{10x}) - \tan^{-1}(e^{5x})$ at x = 0 and for dx = 0.2 is

A. 0.5

B. 0.3

C. -0.2

D. -0.5

Answer:

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54. Given that $f: S \to R$ is said to have a fixed point at c of S if f(c) = c . Let $f: [1, \infty) \to R$ be defined by $f(x) = 1 + \sqrt{x}$. Then

A. f has no fixed point in $[1, \infty)$

B. f has unique fixed point in $[1, \infty)$

C. f has two fixed point in $[1, \infty)$

D. f has infinitely many fixed points in $[1, \infty)$

Answer:

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55. The $\lim_{x \to \infty} \left(\frac{3x - 1}{3x + 1}\right)^{4x}$ equals

A. 1

B. 0

C. $e^{-8/3}$

D. $e^{-4/9}$

Answer:

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56. The area bounded by the parabolas $y=4x^2, y=\frac{x^2}{9}$ and the straight line y = 2 is

A. $\frac{20\sqrt{2}}{3}$ sq. unit

B. $10\sqrt{5}$ sq. unit

C. $\frac{10\sqrt{3}}{7}$ sq. unit

D. $10\sqrt{2}$ sq. unit

Answer:

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57. If $a\left(\vec{\alpha}\times\vec{\beta}\right)+b\left(\vec{\beta}\times\vec{\gamma}\right)+c\left(\vec{\gamma}\times\vec{\alpha}\right)=\vec{o}$, where a, b, c are non-zero scalars, then the vectors $\vec{\alpha}, \vec{\beta}, \vec{\gamma}$ are

A. parallel

B. non-coplanar

C. coplanar

D. mutually perpendicular

Answer:

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58. If the tangent at the point P with co-ordinates (h, k) on the curve $y^2 = 2x^3$ is perpendicular to the straight line 4x = 3y, then

A. $(h, k) = (0, 0)$ only

B. $(h, k) = \left(\frac{1}{8}, -\frac{1}{16}\right)$ only

C. $(h, k) = (0, 0) \text{ or } \left(\frac{1}{8}, -\frac{1}{16}\right)$

D. no such point P exists

Answer:

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59. The co-efficient of $a^3b^4c^5$ in the expansion of $(bc+ca+ab)^6$ is

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60. Three unequal positive numbers a, b, c are such that a, b, c are in G.P. while $\log\left(\frac{5c}{2a}\right), \log\left(\frac{7b}{5c}\right), \log\left(\frac{2a}{7b}\right)$ are in A.P. Then a, b, c are the lengths of the sides of

A. an isosceles triangle

B. an equilateral triangle

C. a scalene triangle

D. a right-angled triangle

Answer:

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61. The determinant

$$\begin{vmatrix} a^2+10 & ab & ac \\ ab & b^2+10 & bc \\ ac & bc & c^2+10 \end{vmatrix}$$ is

A. divisible by 10 but not by 100

B. divisible by 100

C. not divisible by 100

D. not divisible by 10

Answer:

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62. Let R be the real line. Let the relations S and T on R be defined by

$S = \{(x, y) : y = x + 1, 0 < x < 2\}, T = \{(x, y) : x - y \text{ is an integer}\}$

. Then

A. both S and T are equivalence relations on R

B. T is an equivalence on R but S is not

C. neither S nor T is an equivalence relation on R

D. S is an equivalence relation on R but T is not

Answer:

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63. The plane $lx+my=0$ is rotated about its line of intersection with the plane z= 0 through an angle α. The equation changes to

A. $lx+my\pm\tan\alpha\sqrt{l^2+m^2}=0$

B. $lx+my\pm z\tan\alpha\sqrt{l^2+m^2+1}=0$

C. $lx+my\pm z\tan\alpha\sqrt{l^2+1}=0$

D. $lx+my\pm z\tan\alpha\sqrt{l^2+m^2}=0$

Answer:

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64. The points of intersection of two ellipses $x^2 + 2y^2 - 6x - 12y + 20 = 0$ and $2x^2 + y^2 - 10x - 6y + 15 = 0$ lie on a circle. The center of the circle is

A. (8, 3)

B. (8, 1)

C. $\left(\frac{8}{3}, 3\right)$

D. (3, 8)

Answer:

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65. Let $I = \int_{\pi/4}^{\pi/3} \frac{\sin x}{x} dx$. Then

A. $\frac{\sqrt{3}}{8} \leq I \leq \frac{\sqrt{2}}{6}$

B. $\frac{\sqrt{3}}{2\pi} \leq I \leq \frac{2\sqrt{3}}{\pi}$

C. $\frac{\sqrt{3}}{9} \leq I \leq \frac{\sqrt{2}}{16}$

D. $\pi \leq I \leq \frac{4\pi}{3}$

Answer:

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66. If $|z+i| - |z-1| = |z| - 2 = 0$ for a complex number z, then z =

A. $\sqrt{2}(1+i)$

B. $\sqrt{2}(1-i)$

C. $\sqrt{2}(-1+i)$

D. $\sqrt{2}(-1-i)$

Answer:

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67. $\begin{vmatrix} x & 3x+2 & 2x-1 \\ 2x-1 & 4x & 3x+1 \\ 7x-2 & 17x+6 & 12x-1 \end{vmatrix} = 0$ is true for

A. only one value of x

B. only two values of x

C. only three values of x

D. infinitely many values of x

Answer:

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68. The remainder when $7^{7^{7^{\cdots 7}}}$ (22 times 7) is divided by 48 is

A. 21

B. 7

C. 47

D. 1

Answer:

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69. $\int \frac{dx}{(2+x)\sqrt{1+x}}$ =

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70. A plane meets the co-ordinate axes at the points A, B, C respectively in such a way that the centroid of ΔABC is $(1, r, r^2)$ for some real r. If the plane passes through the point (5, 5, -12) then r =

A. $\frac{3}{2}$

B. 4

C. -4

D. $-\frac{3}{2}$

Answer:

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71. Let P be a variable point on a circle C and Q be a fixed point outside C. If R is the midpoint of the line segment PQ, then locus of R is

A. a circle

B. a circle and a pair of straight lines

C. a rectangular hyperbola

D. a pair of straight lines

Answer:

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72. $\lim_{n \to \infty} \dfrac{\sqrt{1}+\sqrt{2}+\ldots\ldots+\sqrt{n-1}}{n\sqrt{n}}$ = ?

A. $\dfrac{5-\sqrt{5}}{10}$

B. $\dfrac{5+\sqrt{5}}{10}$

C. $\dfrac{2+\sqrt{3}}{2}$

D. $\dfrac{2-\sqrt{3}}{2}$

Answer:

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73. Let $f(x)=\begin{cases}0, \text{ if } -1\leq x<0\\ 1, \text{ if } \ x=0\\ 2, \text{ if } \ 0<x\leq 1\end{cases}$ and let $F(x)=\int_{-1}^{x} f(t)dt, \ -1\leq x\leq 1$, then

A. F is continuous function in [-1,1]

B. F is discontinuous function in [-1, 1]

C. F'(x) exists at x = 0

D. F'(x) does not exist at x = 0

Answer:

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74. The greatest and least values of $f(x) = \tan^{-1} x - \frac{1}{2} \ln x$ on $\left[\frac{1}{\sqrt{3}}, \sqrt{3}\right]$ are

A. $f_{\min} = \sqrt{3} - 1$

B. $f_{\max} = \frac{\pi}{6} + \frac{1}{4} \ln 3$

C. $f_{\min} = \frac{\pi}{3} - \frac{1}{4} \ln 3$

D. $f_{\max} = \frac{\pi}{2} + \ln 5$

Answer:

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75. Let f and g be periodic functions with the periods T_1 and T_2 respectively. Then $f+g$ is

A. periodic with period $T_1 + T_2$

B. non-periodic

C. periodic with the period T_1

D. periodic when $T_1 = T_2$

Answer:

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