# MATHS

# BOOKS - KVPY PREVIOUS YEAR

# MOCK TEST 1

## Exercise

**1.** The locus of the centre of a circle,which touches the circles $|z-z_1|=a$ and $|z-z_2|=b$ externally can be

A. an ellipse

B. a hyperbola

C. a circle

D. parabola

**Answer:**

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**2.** Which of the following number (s) is/are rational?

A. $\sin 15^{\circ}$

B. $\cos 15^{\circ}$

C. $\sin 15^{\circ} \cos 15^{\circ}$

D. $\sin 15^{\circ} \cos 75^{\circ}$

**Answer:**

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**3.** From a fixed point $A$ on the circumference of a circle of radius $r$, the perpendicular $AY$ falls on the tangent at $P$. Find the maximum area of triangle $APY$.

A. $r^2$

B. $\frac{3\sqrt{3}}{4}r^2$

C. $\frac{3\sqrt{3}}{8}r^2$

D. $\sqrt{3}r^2$

**Answer:**

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**4.** Let $f: R \rightarrow R$ be a function defined by $f(x) = \min\{x+1, |x|+1\}$, then which of the following is true?

A. f(x) is differentiable everywhere

B. f(x) is not differentiable at x=0

C. $f(x) \geq 1$ for all $x \in R$

D. f(x) is not differentiable at x=1

**Answer:**

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**5.** Let $f:\mathbb{R}\to\mathbb{R}$, $g:\mathbb{R}\to\mathbb{R}$ and $h:\mathbb{R}\to\mathbb{R}$ be differentiable functions such that $f(x)=x^3+3x+2$, $g(f(x))=x$ and $h(g(g(x)))=x$ for all $x\in\mathbb{R}$. Then,

A. g'(2)=1/15

B. h'(1)=666

C. h(g(3))=36

D. None of these

**Answer:**

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**6.** Two points $P$ and $Q$ are taken on the line joining the points $A(0.0)$ and $B(3a,0)$ such that $AP=PQ=QB$. Circles are drawn on $AP, PQ$ and $QB$ as diameters. The locus of the point S from which, the sum ofsquares of the lengths of the tangents to the three circles is equal to $b^2$ is

A. $x^2 + y^2 - 3ax + 2a^2 - b^2 = 0$

B. $3(x^2 + y^2) - 9ax + 8a^2 - b^2 = 0$

C. $x^2 + y^2 - 5ax + 6a^2 - b^2 = 0$

D. $x^2 + y^2 - ax - b^2 = 0$

**Answer:**

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**7.** Let $P = \{\theta : \sin\theta - \cos\theta = \sqrt{2}\cos\theta\}$ 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. $Q \subset P$

C. $P \subset Q$

D. P=Q

**Answer:**

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**8.** If the focus of the parabola $(y-k)^2 = 4(x-h)$ always lies between the lines $x+y=1$ and $x+y=3$, then

A. 0lth+klt2

B. 0lth+klt1

C. 1lth+klt2

D. 1lth+klt3

**Answer:**

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**9.** Let us define a region R is xy-plane as a set of points (x,y) satisfying $[x^2] = [y]$ (where [x] denotes greatest integer $\leq x$),then the region R defines

A. a parabola whose axis is horizontal

B. a parabola whose axis is vertical

C. integer point of the parabola$y = x^2$

D. None of these

**Answer:**

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**10.** The chance that doctor A will diagnose disease X correctly is 60%.The chance that a parient of doctor A dies after correct treatment is 75% while it is 80% after wrong diagnosis.A patient of doctor A having disease X dies.The probability that his disease is correctly diagnosed is

A. $\frac{8}{17}$

B. $\frac{9}{17}$

C. $\frac{11}{17}$

D. $\frac{6}{17}$

**Answer:**

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**11.** Let $f: \{x, y, z\} \to \{1, 2, 3\}$ be a one-one mapping such that only one of the following three statements is true and remaining two are false: $f(x) \neq 2,\ f(y) = 3,\ f(z) \neq 1$,then-

A. f(x)gtf(y)gtf(z)

B. f(x)ltf(y)ltf(z)

C. f(y)ltf(x)ltf(z)

D. f(y)ltf(z)ltf(x)

**Answer:**

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**12.** For hyperbola $\frac{x^2}{\cos^2\alpha} - \frac{y^2}{\sin^2\alpha} = 1$which of the following remains constant with change in $\alpha$

A. abscissa of vertices

B. abscissa of foci

C. eccentricity

D. directrix

**Answer:**

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**13.** The equation `2cos^2x/2sin^2x=x^2+x^(-2);0

A. no real solution

B. one real solution

C. more than one solution

D. none of these

**Answer:**

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**14.** The value of $\int_{\pi}^{2\pi} [2\sin x]dx$ where $[.]$ represents the greatest integer function is

A. $\frac{-5\pi}{3}$

B. $-\pi$

C. $\frac{5\pi}{3}$

D. $-2\pi$

**Answer:**

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**15.** If $f(x) = x^3 + 3x^2 + 6x + 2\sin x$ then the equation $\frac{1}{x - f(1)} + \frac{2}{x - f(2)} + \frac{3}{x - f(3)} = 0$ has

A. No real roots

B. 1 real roots

C. 2 real roots

D. More than 2 real roots

**Answer:**

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**16.** If f and g are two continuous functions being even and and odd, respectively, then $\int_{-a}^{a} \frac{f(x)}{b^{g(x)+1}} dx$ is equal to (a being any non-zero number and b is positive real number, $b \neq 1$ )

A. independent of f

B. independent of g

C. independent of both f and g

D. none of these

**Answer:**

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**17.** A determinant of the second order is made with the elements 0 and 1. If $\frac{m}{n}$ be the probability that the determinant made is non negative, where m and n are relative primes, then the value of n-m is

A. 4

B. 3

C. 5

D. 8

**Answer:**

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**18.** Let $f:[0,\infty)\overrightarrow{0,\infty} and g:[0,\infty)\overrightarrow{0,\infty}$ be non-increasing and non-decreasing functions, respectively, and $h(x)=g(f(x))\cdot$ If $f and g$ are differentiable functions, $h(x)=g(f(x))\cdot$ If $f and g$ are differentiable for all points in their respective domains and $h(0)=0,$ then show $h(x)$ is always, identically zero.

A. $h(x)=0\forall x\geq 0$

B. $h(x)>0\forall x>\neq 0$

C. $h(x)<0\forall x>\neq 0$

D. None of these

**Answer:**

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**19.** The number of such points $\left(a+1, \sqrt{3}a\right)$, where a is any integer, lying inside the region bounded by the circles $x^2+y^2-2x-3=0$ and $x^2+y^2-2x-15=0$, is

A. 2

B. 1

C. 3

D. 0

**Answer:**

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**20.** If$x^4+px^3+qx^2+rx+5=0$ has four positive roots,then the minimum value of pr is equal to

A. 5

B. 25

C. 80

D. 100

**Answer:**

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**21.** If the area bounded by the curve y=f(x), x-axis and the ordinates x=1 and x=b is (b-1) $\sin(3b+4)$, then-

A. (x-1)cos(3x+4)

B. sin(3x+4)

C. sin(3x+4)+3(x-1)cos(3x+4)

D. None of these

**Answer:**

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**22.** Let $n$ be a positive integer such that $\frac{\sin \pi}{2n} + \frac{\cos \pi}{2n} = \frac{\sqrt{n}}{2}$. Then

$6 \le n \le 8$ (b) `4

A. $6 \le n \le 8$

B. $4 < n \leftarrow 8$

C. $4 \le n \le 8$

D. $4 < n < 8$

**Answer:**

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**23.** The value of $Lt_{x \to 0} \left\{ \frac{\int_0^{x^2} \sec^2 t dt}{x \sin x} \right\}$ is (A) $0$ (B) $3$ (C) $2$ (D) $1$

A. 0

B. 3

C. 2

D. 1

**Answer:**

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**24.** Tangents are drawn to the circle $x^2 + y^2 = 50$ from a point 'P' lying on the x-axis. These tangents meet the y-axis at points $P_1'$ and $P_2'$. Possible coordinates of 'P' so that area of triangle $PP_1P_2$ is minimum, is/are

A. (10,0)

B. $(10\sqrt{2}, 0)$

C. $(-10\sqrt{2}, 0)$

D. None of these

**Answer:**

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**25.** LEt $F: R \rightarrow R$is a differntiable function $f(x+2y) = f(x) + f(2y) + 4xy$ for all $x, y \in R$

A. f'(1)=f'(0)+1

B. f'(1)=f'(0)-1

C. f'(0)=f'(1)+2

D. f'(0)=f'(1)-2

**Answer:**

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**26.** If $|z-1| + |z+3| \leq 8$, then the range of values of $|z-4|$ is

A. 1(0,7)

B. `(1,8)

C. (1,9)

D. (2,5)

**Answer:**

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**27.** Statement-1 : If $a_1, a_2, a_3$,..... $a_n$ are positive real numbers , whose product is a fixed number c, then the minimum value of $a_1 + a_2 + \ldots. + a_{n-1} + 2a_n$ is $n(2C)^{\frac{1}{n}}$

Statement-2 :A.M. $\geq$ G.M.

A. $n(2c)^{1/n}$

B. $(n+1)c^{1/n}$

C. $2nc^{1/n}$

D. $(n+1)(2c)^{1/n}$

**Answer:**

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**28.** Let $S_n = \sum_{k=1}^{4n} (-1)^{\frac{k(k+1)}{2}} k^2$. Then $S_n$ can take values

A. 1056

B. 1088

C. 1120

D. None of these

**Answer:**

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**29.** The triangle PQR is inscribed in the circle $x^2 + y^2 = 25$. If Q and R have co-ordinates(3,4) and(-4, 3) respectively, then $\angle QPR$ is equal to

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

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

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

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

**Answer:**

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**30.** The ellipse $E_1 : \frac{x^2}{9} + \frac{y^2}{4} = 1$ is inscribed in a rectangle $R$ whose sides are parallel to the coordinate axes. Another ellipse $E_2$ passing through the point (0, 4) circumscribes the rectangle $R$. The eccentricity of the ellipse $E_2$ is $\frac{\sqrt{2}}{2}$ (b) $\frac{\sqrt{3}}{2}$ (c) $\frac{1}{2}$ (d) $\frac{3}{4}$

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

B. $\frac{\sqrt{3}}{2}$

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

D. $\frac{3}{4}$

**Answer:**

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**31.** The smaller radius of the sphere passing through (1, 0,0),(0,1,0) and (0,0, 1)is:

A. $\sqrt{\frac{3}{5}}$

B. $\sqrt{\frac{3}{8}}$

C. $\sqrt{\frac{2}{3}}$

D. $\sqrt{\frac{5}{12}}$

**Answer:**

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**32.** The number of real values of the parameter $k$ for which $(\log_{16} x)^2 - (\log)_{16}x + (\log)_{16}k = 0$ with real coefficients will have exactly one solution is 2 (b) 1 (c) 4 (d) none of these

A. 0

B. 2

C. 1

D. 4

**Answer:**

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**33.** Let S be the set of complex number a which satisfyndof $\log_{\frac{1}{3}}\left\{\log_{\frac{1}{2}}\left(|z|^2+4|z|+3\right)\right\}<0$, then S is (where $i=\sqrt{-1}$)

A. [-1,3]

B. $\{z: Re(z)\geq 1\}$

C. $\{z: i(z)\leq 2\}$

D. All ofthese

**Answer:**

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34. $(\lim)_{x \to 0}\left[\min\left(y^2-4y+11\right)\frac{\sin x}{x}\right](where[.]de\neg esthe$ greatest integer function is 5 (b) 6 (c) 7 (d) does not exist

A. 5

B. 6

C. 7

D. does not exist

**Answer:**

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**35.** If $P(x)$ is a polynomial of the least degree that has a maximum equal to 6 at $x=1$, and a minimum equalto 2 at $x=3$,then $\int_0^1 P(x)dx$ equals:

A. $\frac{17}{4}$

B. $\frac{13}{4}$

C. $\frac{19}{4}$

D. $\frac{5}{4}$

**Answer:**

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**36.** if $10! = 2^p 3^q 5^r 7^s$ then

A. p=7

B. q=4

C. r=3

D. s=2

**Answer:**

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**37.** Show that the height of the cylinder of maximum volume that can be inscribed in a sphere of radius $R$ is $\frac{2R}{\sqrt{3}}$ .

A. 2a/3

B. $\frac{2a}{\sqrt{3}}$

C. a/3

D. a/5

**Answer:**

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**38.** If $\left(\vec{a} \times \vec{b}\right)^2 + \left(\vec{a} . \vec{b}\right)^2$ = 676 and $\left|\vec{b}\right| = 2$, then $\left|\vec{a}\right|$ is equal to

A. 13

B. 26

C. 39

D. None of these

**Answer:**

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**39.** The equation $\frac{x^2}{1-r}-\frac{y^2}{1+r}=1, r>1,$ represents an ellipse (b) a hyperbola a circle (d) none of these

A. an ellipse

B. a hyperbola

C. a circle

D. None of these

**Answer:**

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**40.** The graph of the function, $\cos x \cos(x+2) - \cos^2(x+1)$ is

A. A straight line passing through (0,0)

B. A straight line passing through $\left(\frac{\pi}{2}, -\sin^2 1\right)$ and paralles to x-axis

C. A straight line passing through (0,$\sin^2$ 1)

D. not a straight line

**Answer:**

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**41.** If $f(x) = \cos\left\{\frac{\pi}{2}[x] - x^3\right\}, 1 < x < 2$, and [x] denotes the greatest integer less than or equal to x, then the value of

$f'\left(\sqrt[3]{\frac{\pi}{2}}\right)$, is

A. 0

B. 1

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

D. $\frac{1}{\sqrt{2}}$

**Answer:**

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**42.** The number of real solutions of the equation $1+|e^x-1|=e^x(e^x-2)$ is :

A. 0

B. 1

C. 2

D. infinitely many

**Answer:**

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**43.** If $2x - y + 1 = 0$ is a tangent to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{16} = 1$ then which of the following CANNOT be sides of a right angled triangle? $a, 4, 2$

(b) $a, 4, 1$ $2a, 4, 1$ (d) $2a, 8, 1$

A. a,4,1

B. a,4, 2

C. 2a,8,1

D. 2a,4,1

**Answer:**

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**44.** If the equation $\frac{x^2}{3} - 4x + 13 = \sin\left(\frac{a}{x}\right)$ has a solution then a is equal to

A. $(2n+1)\frac{\pi}{2}$

B. $3(4n+1)\frac{\pi}{2}$

C. $3(1+4n)\pi$

D. None of these

**Answer:**

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**45.** If $m$ be the slope of common tangent of $y=x^2-x+1$ and $y=x^2-3x+1$. Then $m$ is equal to

A. 2

B. -1

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

D. -2

**Answer:**

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**46.** If $S_n = {}^nC_0 . {}^nC_1 + {}^nC_1 . {}^nC_2 + \ldots . + {}^nC_{n-1} . {}^nC_n$ and if $\frac{S_{n+1}}{S_n} = \frac{15}{4}$, then the sum of all possible values of n is (A) $2$ (B) $4$ (C) $6$ (D) $8$

A. 3

B. 6

C. 7

D. 5

**Answer:**

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**47.** The value of integrals $\int_{-2}^{2} \max\{x + |x|, x - [x]\} dx$ where [.] represents the greatest integer function is

A. 4

B. 5

C. $\frac{7}{2}$

D. $\frac{9}{4}$

**Answer:**

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**48.** One hundred identical coins, each with probability 'p' of showing heads are tossed once. If $0 < p < 1$ and the probability of heads showing on 50 coins is equal to that of heads showing on 51 coins, then the value of p is

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

B. $\frac{49}{101}$

C. $\frac{50}{101}$

D. $\frac{51}{101}$

**Answer:**

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49. If $\omega$ is a complex nth root of unity, then $\sum_{r=1}^{n}(a+b)\omega^{r-1}$ is equal to $\frac{n(n+1)a}{2}$ b. $\frac{nb}{1+n}$ c. $\frac{na}{\omega-1}$ d. none of these

A. $\frac{n(n+1)a}{2\omega}$

B. $\frac{nb}{1-n}$

C. $\frac{na}{\omega-1}$

D. None of these

**Answer:**

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50. If $f(n+1)=\frac{1}{2}\left\{f(n)+\frac{9}{f(n)}\right\}, n \in N,$ and $f(n)>0f \text{ or } al \ln \in N,$ then find $(\lim)_{n \overrightarrow{\infty}} f(n)\cdot$

A. 3

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

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

D. not finite

**Answer:**

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**51.** An arch way is in the shape of a semi-ellipse, the road level being the major axis. If the breadth of the arch way is 30 feet and a man 6 feet tall just touches the top when 2 feet from the side, find the greatest height of the arch.

A. 10

B. 8

C. 6

D. 5

**Answer:**

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**52.** Let $f(x)$ be positive, continuous, and differentiable on the interval $(a, b) and (\lim)_{x \to a^+} f(x) = 1, (\lim)_{x \to b^-} f(x) = 3^{\frac{1}{4}} \dot{I} f f f'(x) \geq f^3(x) + \frac{1}{f(x)}$ then the greatest value of $b - a$ is $\frac{\pi}{48}$ (b) $\frac{\pi}{36}$ $\frac{\pi}{24}$ (d) $\frac{\pi}{12}$

A. 1

B. $3^{1/4}$

C. $\left(3^{1/4} - 1\right)\frac{\pi}{24}$

D. $\frac{\pi}{24}$

**Answer:**

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