MATHS

BOOKS - OBJECTIVE RD SHARMA ENGLISH

INEQUALITIES

Illustration

1. $If -\frac{\pi}{2} < 0 < \frac{\pi}{2},$ then the minimum value of $\cos^3\theta + \sec^3 thets$ is

A. 1

B. 2

C. 0

D. none of these.

Answer: B

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2. If a > 1, b > 1 , then the minimum value of $\log_b a + \log_a b$ is :

A. 0

B. 1

C. 2

D. none of

Answer: C

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3. The minimum value of $9^{x}+9^{1-x}, x \in R,$ is

A. 2

B. 3

C. 4

D. none of these.

Answer: D

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4. If a, b, c are three non-zero numbers of the same sign, then the value of $\frac{a}{b}+\frac{b}{c}+\frac{c}{a}$ lies in the interval

A. $[2, \infty)$

B. $[3, \infty)$

C. $(3, \infty)$

D. $[-\infty, 3)$

Answer: B

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5. If a, b are postitive real numbers such that ab=1, then the least value of the expression $(1+a)(1+b)$ is

A. 2

B. 3

C. 4

D. none of these.

Answer: C

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6. $a = \log_5 3 + \log_7 5 + \log_9 7$

A. $a \in [3/2, \infty)$

B. $a \in \left[\dfrac{1}{2^{1/3}, \infty}\right.$

C. $a \in \left[\dfrac{3}{2^{1/3}, \infty}\right.$

D. none of these.

Answer: C

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7. If a,b,c are distinct positive real numbers, then

A. $a^2 + b^2 + c^2 > ab + bc + ca$

B. $a^2 + b^2 + c^2 < ab + bc + ca$

C. $a^2 + b^2 + c^2 \geq ab + bc + ca$

D. $a^2 + b^2 + c^2 \leq ab + bc + ca$

Answer: A

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8. If $a_1 > 0$ for all $i = 1, 2, \ldots\ldots, n$. Then, the least value of

$$(a_1 + a_2 + \ldots\ldots + a_n)\left(\frac{1}{a_1} + \frac{1}{a_2} + \ldots + \frac{1}{a_n}\right)$$

, is

A. n^2

B. 2n

C. n

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

Answer: B

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9. If a, b, c are three distinct positive real numbers such that $\frac{b+c}{a}+\frac{c+a}{b}+\frac{a+b}{c}>$ k, then the grealtest value of k, is

A. 6

B. 3

C. 4

D. 9

Answer: A

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10. If a, b, c are positive integers, then

$$\left(\frac{a^2+b^2+c^2}{a+b+c}\right)^{a+b+c} > a^x b^y c^z, \text{ then}$$

A. $x = a, y = b, z = c$

B. $x = b, y = a, z = c$

C. $x = \frac{1}{a}, y = \frac{1}{b}, z = \frac{1}{c}$

D. $x = y = z = 1$

Answer: A

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11. If x, y, z are positive real numbers such that $x + y + z = a$, then

A. $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} > \frac{a}{9}$

B. $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} > \frac{9}{a}$

C. $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} > \frac{9}{a^2}$

D. $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} > \frac{a^2}{9}$

Answer: B

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12. If $m > 1$ and $n \in N$, such that

$1^m + 2^m + 3^m + \ldots + n^m > n\left(\frac{n+1}{k}\right)^m$ Then,

k=

A. 2

B. n

C. m

D. 1

Answer: A

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13. Find the greatest value of x^2y^3, where x and y lie in the first quadrant on the line $3x + 4y = 5$.

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

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

C. $\frac{3}{16}$

D. $\frac{1}{16}$

Answer: C

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14. If x is a positive real number, then the greatest value of $(7-x)(x+5)^2$, is

A. 256

B. 128

C. 64

D. 16

Answer: A

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15. If $x + y = a$, then the greatest value of x^2y^3 is

A. $\frac{108a^5}{3125}$

B. $\frac{108a^5}{625}$

C. $\frac{54a^5}{3125}$

D. $\frac{108a^4}{3125}$

Answer: A

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16. If x and y are positive real numbers such that $x^2y^3 = 32$ then the least value of $2x + 3y$ is

A. 5

B. 10

C. 20

D. 15

Answer: B

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Section 1 Solved Mcq

1. If p,q,r be three distinct real numbers, then the value of $(p+q)(q+r)(r+p),$ is

A. $> 8pqr$

B. $< 8pqr$

C. $8pqr$

D. none of these

Answer: A

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2. If a, b, c are three positive real numbers then the minimum value of the expression $\frac{b+c}{a}+\frac{c+a}{b}+\frac{a+b}{c}$ is

A. 1

B. 2

C. 3

D. none of these

Answer: D

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3. If $a^2 + b^2 + c^2 = 1$ then $ab + bc + ca$ lies in the interval

A. [0,1]

B. $[-1/2, 1]$

C. $[0, 1/2]$

D. [1,2]

Answer: B

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4. If a, b, c are distinct positive real numbers such that $a+\frac{1}{b}=4, b+\frac{1}{c}=1, c+\frac{1}{d}=4$ and $d+\frac{1}{a}=1$, then

A. a=c and b=d

B. b=d and $a \neq c$

C. $ab=1 \quad \text{and} \quad cd \neq 1$

D. $cd=1 \quad \text{and} \quad ab= \neq 1$

Answer: A

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5. If the product of n positive numbers is 1, then their sum is

A. a positive integer

B. divisible by n

C. equal to $n + \frac{1}{n}$

D. greater than or equal to n.

Answer: D

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6. If a, b, c are positive real numbers, then the least value of $(a+b+c)\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)$, is

A. 9

B. 3

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

D. none of these

Answer: A

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7. If $a_i > 0$ for $iu = 1, 2, 3, \ldots, n$ and $a_1 a_2 \ldots a_n = 1$, then the minimum value of $(1 + a_1)(1 + a_2)\ldots(1 + a_n)$, is

A. $2^{n/2}$

B. 2^n

C. 2^{2n}

D. 1

Answer: B

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8. If a,b,c are the sides of a triangle then

$$\frac{a}{b+c-1}+\frac{b}{c+a-b}+\frac{c}{a+b-c}=$$

A. >3

B. <3

C. ≤ 2

D. ≥ 2

Answer: A

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9. If a, b, c are positive real number such that $lamba$ abc is the minimum value of $a(b^2+c^2)+b(c^2+a^2)+c(a^2+b^2)$, then λ=

A. 1

B. 2

C. 3

D. 6

Answer: D

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10. If P_n denotes the product of first n natural numbers, then for all $n \in N$.

A. $P_n \leq n^n$

B. $P_n + 1 \leq n^n$

C. $P_n \leq \left(\frac{n+1}{2}\right)^n$

D. none of these

Answer: C

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11. If $x_n > 1$ for all $n \in N$, then the minimum value of the expression

$$\log_{x_2} x_1 + \log_{x_3} x_2 + \dots + \log_{x_n} x_{n-1} + \log_{x_1} x_n$$

is

A. 0

B. 1

C. 2

D. none of these

Answer: D

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12. For all positive values of x and y, the value of

$$\frac{(1+x+x^2)(1+y+y^2)}{xy}, \text{is}$$

A. ≤ 9

B. < 9

C. ≥ 9

D. > 9

Answer: C

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13. If a, b, c are three distinct positive real numbers, then the least value of

$$\frac{(1+a+a^2)(1+b+b^2)(1+c+c^2)}{abc}, \text{ is}$$

A. 3

B. 9

C. 27

D. none of these

Answer: C

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14. If $x+y+z=1$, then the least value of $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}$, is

A. 3

B. 9

C. 27

D. 1

Answer: B

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15. If x, y, z are non-negative real numbers satisfying $x + y + z = 1$, then the minimum value of $\left(\frac{1}{x} + 1\right)\left(\frac{1}{y} + 1\right)\left(\frac{1}{z} + 1\right)$, is

A. 8

B. 16

C. 32

D. 64

Answer: D

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16. If a, b and c are positive real numbers such that $a \leq b \leq c$, then $\frac{a^2+b^2+c^2}{a+b+c}$ lies in the interval

A. $\left(\frac{a^2}{c}, \frac{c^2}{a}\right)$

B. $\left(\frac{a}{c^2}, \frac{c}{a^2}\right)$

C. $\left(\frac{c^2}{a}, \frac{a^2}{c}\right)$

D. $\left(\frac{b^2}{c}, \frac{c^2}{b}\right)$

Answer: A

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17. For any positive real number a and for any $n \in N$, the greatest value of $\frac{a^n}{1 + a + a^2 + \ldots + a^{2n}}$, is

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

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

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

D. none of these

Answer: B

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18. If $a+b+c=6$ then the maximum value of

$\sqrt{4a+1}+\sqrt{4b+1}+\sqrt{4c+1}=$

A. 9

B. 6

C. 4

D. 12

Answer: A

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19. If a, b and c are distinct positive numbers, then the expression $(a+b-c)(b+c-a)(c+a-b)-abc$ is:

A. positive

B. negative

C. non-positive

D. non-negative

Answer: B

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20. The least value of 2

$\log_{100} a - \log_{a} 0.0001, a > 1$

A. 2

B. 3

C. 4

D. none of these

Answer: C

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21. If a, b and c are positive, then the minimum value of $a^{\log b - \log c} + b^{\log c - \log a} + c^{\log a - \log b}$ is :

A. 3

B. 1

C. 9

D. 16

Answer: A

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22. If a, b, c $\in$ R, then which one of the following is true:

A. $\max(a, b) < \min(a, b, c)$

B. $\min(a, b) = \frac{1}{2}\{a + b - |a - b|\}$

C. $\min(a, b) < \min(a, b, c)$

D. none of these

Answer: B

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23. If $a_1, a_2, \ldots.., a_n$ are $n(>1)$ real numbers, then

A. $n\sum_{i=1}^{n} {a_i}^2 \leq \left(\sum_{i=1}^{n} a_i\right)^2$

B. $\sum_{i=1}^{n} {a_i}^2 \geq \left(\sum_{i=1}^{n} a_i\right)^2$

C. $\sum_{i=1}^{n} {a_i}^2 \leq \left(\sum_{i=1}^{n} a_i\right)^2$

D. none of these

Answer: D

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24. If $0 < x < \frac{\pi}{2}$, then the minimum value of

$(\sin x + \cos x + \cos ec 2x)$,is

A. 27

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

C. $\frac{25}{4}$

D. none of these

Answer: D

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25. If $x \in R$ and $\alpha = \frac{x^2}{1+x^4}$, then α lies in the interval

A. [0,2]

B. [0,1]

C. $[0, 1/2]$

D. $[1/2, 1]$

Answer: C

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26. If the equation $x^4 - 4x^3 + ax^2 + bx + 1 = 0$ has four positive roots, find the values of a and b.

A. a=6, b=-4

B. a=-4. b=6

C. a=-6, b=4

D. a=-6, b=-4

Answer: A

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27. about to only mathematics

A. $2^{1/\sqrt{2}}$

B. $2^{1-2^{-1/2}}$

C. $2^{1+2^{-1/2}}$

D. $2^{1-\sqrt{2}}$

Answer: B

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28. If $a_i \in (-\pi, 2\pi)$ for $i = 2, 3, ..., n,$ then the number of solutions of the inequailty

$2^{1/\sin^2 a_2}.3^{1/\sin^2 a_3}.4^{1/\sin^2 a_4}...n^{1/\sin^2 a_n} \leq n!,$ is

A. infinite

B. 2^{n-1}

C. 3^{n-1}

D. 3^n

Answer: C

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29. If x, y, z be three positive numbers such that xyz^2 has the greatest value $\frac{1}{64}$, then the value of $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}$ is

A. $a=b=\frac{1}{2}, c=\frac{1}{4}$

B. $a=b=\frac{1}{4}, c=\frac{1}{2}$

C. $a=b=c=\frac{1}{3}$

D. none of these

Answer: B

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30. If $a+b+c=1$ and a, b, c are positive real numbers such that

$(1-a)(1-b)(1-c) \geq \lambda \ \text{abc, then} \ \lambda$=

A. 2

B. 4

C. 6

D. 8

Answer: D

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31. If a,b,c are positive real numbers such that a + b +c=18, find the maximum value of $a^2b^3c^4$

A. $2^{19} \times 3^2$

B. $2^{19} \times 3^3$

C. $2^{18} \times 3^3$

D. none of these

Answer: B

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32. If x, y, z are positive real numbers such that $x^3y^2z^4 = 7$, then the least value of $2x + 5y + 3z$, is

A. $\left(\frac{525}{128}\right)^{1/9}$

B. $3\left(\frac{525}{128}\right)^{1/9}$

C. $9\left(\frac{525}{128}\right)^{1/9}$

D. none of these

Answer: C

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33. Let $a_1, a_2..., a_n$ be a non-negative real numbers such that $a_1 + a_2 + ... + a_n = m$ and let $S = \sum_{i<j} a_i a_j$, then

A. $S \leq \frac{m^2}{2}$

B. $S > \frac{m^2}{2}$

C. $S < \frac{m}{2}$

D. $S > \frac{m^2}{2}$

Answer: A

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34. If a, b, c, d are positive real umbers such that $a = b + c + d = 2, then M = (a + b)(c + d)$ satisfies the relation $0 \leq M \leq 1$ $1 \leq M \leq 2$ $2 \leq M \leq 3$ $3 \leq M \leq 4$

A. $0 \leq M \leq 1$

B. $1 \leq M \leq 2$

C. $2 \leq M \leq 3$

D. $3 \leq M \leq 4$

Answer: A

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35. If $a-1, a_2, , a_n$ are positive real numbers whose product is a fixed number $c,$ then the minimum value of $a_1+a_2++a_{n-1}+2a_n$ is $a_{n-1}+2a_n$ is b. $(n+1)c^{1/n}$ $2nc^{1/n}$ $(n+1)(2c)^{1/n}$

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

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

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

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

Answer: A

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36. If $\alpha \in \left(0, \frac{\pi}{2}\right), then \sqrt{x^2 + x} + \frac{\tan^2 \alpha}{\sqrt{x^2 + x}}$ is always greater than or equal to $2 \tan \alpha \; 1 \; 2 \sec^2 \alpha$

A. $2 \tan \alpha$

B. 1

C. 2

D. $\sec^2 \alpha$

Answer: A

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37. If $a_1, a_2, a_3, \ldots\ldots. a_n,$ are 'n', distinct odd natural numbers, not divisible by any prime number greater than 5, then $\frac{1}{a_1}+\frac{1}{a_2}+\frac{1}{a_3}+\ldots\ldots+\frac{1}{a_n}$ is less than

$(a)\,\frac{15}{8}\,(b)\,\frac{17}{8}\,(c)\,\frac{19}{8}\,(d)\,\frac{21}{8}$

A. 1

B. $15/8$

C. $1/2$

D. $3/4$

Answer: B

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38. For any n positive numbers $a_1, a_2, \ldots, a_n$ such that

$\sum_{i=1}^{n} a_i = \alpha$, the least value of $\sum_{i=1}^{n} a_i^{-1}$, is

A. $2n - \alpha$

B. $\frac{3n}{\alpha}$

C. $\frac{n(n-1)}{\alpha}$

D. $\frac{n^2}{\alpha}$

Answer: D

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39. If a, b, c denote the sides of a ΔABC such that

$a^2 + b^2 - ab = c^2$, then

A. $\min(a, b) \leq c \leq \max(a, b)$

B. $\min(a, b) < c < \max(a, b)$

C. $c \leq \min(a, b) \leq \max(a, b)$

D. $\min(a, b) \leq \max(a, b) \leq c$

Answer: B

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40. For $0 < x < \frac{\pi}{2}$, $(1 + 4\cos ecx)(1 + 8\sec x)$, is

A. ≥ 81

B. > 81

C. > 83

D. ≥ 83

Answer: B

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41. If a, b, c are distinct positive integers such that $ab + bc + ca \geq 74$, then the minimum value of $a^3 + b^3 + c^3 - 3abc$, is

A. 42

B. 46

C. 45

D. 48

Answer: C

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42. If $a + b + c = 1$, the greatest value of

$$\frac{ab}{a+b} + \frac{bc}{b+c} + \frac{ca}{c+a}$$, is

A. $\frac{1}{3}$

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

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

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

Answer: C

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43. If $a, b > 0, a + b = 1$, then the least value of $\left(1 + \frac{1}{a}\right)\left(1 + \frac{1}{b}\right)$, is

A. 3

B. 6

C. 9

D. 12

Answer: C

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44. If a,b,c are positive numbers and $a+b+=c1,$ then the maximum value of $(1-a)(1-b)(1-c)$ is :

A. $\frac{1}{27}$

B. $\frac{8}{27}$

C. $\frac{4}{27}$

D. 9

Answer: B

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45. If a, b, c are sides of a triangle, then $\frac{(a+b+c)^2}{ab+bc+ca}$ always belongs to

A. [1,2]

B. [2,3]

C. [3,4]

D. [4,5]

Answer: C

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46. A straight line through the vertex P of a triangle PQR intersects the side QR at the points S and the cicumcircle of the triangle PQR at the point T. If S is not the center of the circumcircle, then $\frac{1}{PS}+\frac{1}{ST}<\frac{2}{\sqrt{QS\times SR}}$

$\frac{1}{PS}+\frac{1}{ST}>\frac{2}{\sqrt{QS\times SR}}$

$\frac{1}{PS}+\frac{1}{ST}<\frac{4}{QR}$ $\frac{1}{PS}+\frac{1}{ST}>\frac{4}{QR}$

A. $\frac{1}{PS}+\frac{1}{ST}<\frac{2}{\sqrt{QS\times SR}}$

B. $\frac{1}{PS}+\frac{1}{ST}\frac{2}{\sqrt{QS\times SR}}$

C. $\frac{1}{PS}+\frac{1}{ST}<\frac{4}{QR}$

D. $\frac{1}{PS}+\frac{1}{ST}>\frac{4}{QR}$

Answer: D

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47. The minimum value of the sum of real numbers $a^{-5}, a^{-4}, 3a^{-3}, 1, a^8$ and a^{10} with $a > 0$ is ________.

A. 6

B. 7

C. 8

D. 9

Answer: C

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48. Let $a, b, c, d \in R$ such that $a^2 + b^2 + c^2 + d^2 = 25$

A. $ab + bc + cd + da \leq \frac{25}{2}$

B. $ab + bc + cd + da \leq 25$

C. $ab + bc + cd + da \leq 5$

D. $ab + bc + cd + da \leq \frac{5}{2}$

Answer: B

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49. If a, b and c are distinct positive numbers, then the expression $(a+b-c)(b+c-a)(c+a-b)-abc$ is:

A. positive

B. negative

C. non-positive

D. non-negative

Answer: B

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50. If x,yz are variables and

$3\tan x+4\tan y+5\tan z=20,$

then the minimum value of

$\tan^2 x+\tan^2 y+\tan^2 z,$ is

A. 10

B. 15

C. 8

D. 12

Answer: C

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51. If $a > 0, b > 0, c > 0,$ then the minimum value of

$$\sqrt{\frac{4a}{b}} + \sqrt[3]{\frac{27b}{c}} + \sqrt[4]{\frac{c}{108a}},$$ is

A. 4

B. 5

C. 3

D. 9

Answer: D

52. If $x+y+z=1$, then the minimum value of $xy(x+y)^2+yz(y+z)^2+zx(z+x)^2$ is , where x,y,z $\in R^+$

A. 4 xyz

B. 3 xyz

C. 2 xyz

D. 6 xyz

Answer: A

53. If $a, b > 0$ then the maximum value of $\frac{a^3b}{(a+b)^4}$, is

A. $\frac{81}{512}$

B. $\frac{27}{256}$

C. $\frac{27}{512}$

D. $\frac{81}{256}$

Answer: B

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54. Let x, y, z be positive real numbers such that $x+y+z=12$ and $x^3y^4z^5=(0.1)(600)^3$. Then $x^3+y^3+z^3$ is

A. 270

B. 258

C. 216

D. 342

Answer: C

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Section 2 Assertion Reason Type

1. Statement-1 : For any real number $x, \frac{2x^2}{1+x^4} \leq 1$

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

A. 1

B. 2

C. 3

D. 4

Answer: A

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2. Statement-1 : If angles A, B, C of ΔABC are acute,

then $\cot A \cot B \cot C \leq \frac{1}{3\sqrt{3}}$.

Statement-2: If a, b, c are positive real numbers and $\prec m < 1$, then

$$\frac{a^m + b^m + c^m}{3} < \left(\frac{a+b+c}{3}\right)^m$$

A. 1

B. 2

C. 3

D. 4

Answer: B

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3. Statement-1: If x, y are positive real number satisfying $x+y=1$, then $x^{1/3}+y^{1/3}>2^{2/3}$

Statement-2: $\dfrac{x^n+y^n}{2}<\left(\dfrac{x+y}{2}\right)^n$, if $0<n<1$ and $x, y>0$.

A. 1

B. 2

C. 3

D. 4

Answer: D

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4. Statement-1: If a, b are positive real numbers such that $a^3 + b^3 = 16$, then $a + b \le 4$.

Statement-2: If a, b are positive real numbers and $n > 1$, then

$$\frac{a^n + b^n}{2} \ge \left(\frac{a+b}{2}\right)^n$$

A. 1

B. 2

C. 3

D. 4

Answer: B

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5. Statement-1: $1^3 + 3^3 + 5^3 + 7^3 + \ldots + (2n-1)^3 < n^4, n \in N$

Statement-2: If $a_1, a_2, a_3, \ldots, a_n$ are n distinct positive real numbers and $m > 1$, then

$$\frac{a_1^m + a_2^m + \dots + a_n^m}{n} > \left(\frac{a_1 + a_2 + \dots + a_b}{n}\right)^m$$

A. 1

B. 2

C. 3

D. 4

Answer: D

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6. Statement -1: If $n \in N,$ then

$$\sqrt{1}+\sqrt{2}+\sqrt{3}+\ldots+\sqrt{n}<\sqrt{\frac{n^2(n+1)}{2}}$$

Statement-2: If $0<m<1,$ then

Arithmetic mean of m^{th} powers $<$ mth power of

Arthmetic mean

A. 1

B. 2

C. 3

D. 4

Answer: A

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7. Statement -1 For every natural number $n \geq 2\frac{1}{\sqrt{1}} + \frac{1}{\sqrt{2}} + \ldots . + \frac{1}{n} \geq \sqrt{n},$

Statement -2 For every natural number $n \geq 2\sqrt{n(n+1)} < n+1$

A. 1

B. 2

C. 3

D. 4

Answer: B

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8. Statement-1: If a, b, c are positive numbers in AP such that $\frac{1}{ab}+\frac{1}{bc}+\frac{1}{ca}=1$, then the least value of b is $\sqrt{3}$.

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

A. 1

B. 2

C. 3

D. 4

Answer: A

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9. If a, b, c are three unequal positive numbers, then

Statement-1: The product of their sum and the sum of their reciprocals exceeds 9.

Statement-2: AM of n positive numbers exceeds their HM

A. 1

B. 2

C. 3

D. 4

Answer: A

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Section I Mcqs

1. If $0 < \theta < \pi$, then the minimum value of $\sin^5 \theta + \operatorname{cosec}^5 \theta$, is

A. 0

B. 1

C. 2

D. none of these

Answer: C

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2. If $a, b, c, d \in R^{+} - \{1\}$, then the minimum value of $\log_d a + \log_b + \log_c + \log_c b$ is

A. 1

B. 2

C. 3

D. 4

Answer: D

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3. the minimum value of $4^{x} + 4^{1-x}, x \in R$ is

A. 1

B. 2

C. 4

D. none of these

Answer: C

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4. If

$$x = \log_{2^2} 2 + \log_{2^3} 2^2 + \log_{2^4} 2^3 + \ldots + \log_{2^{n+1}} 2^n,$$

then

A. $x \geq \left(\frac{1}{n+1}\right)^{1/n}$

B. $x \geq n\left(\frac{1}{n+1}\right)^{1/n}$

C. $x \geq \left(\frac{n}{n+1}\right)^{1/n}$

D. none of these

Answer: B

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5. The least value of $5^{\sin x - 1} + 5^{-\sin x - 1}$, is

A. 10

B. $\frac{5}{2}$

C. $\frac{2}{5}$

D. $\frac{1}{5}$

Answer: C

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6. If a_1, a_2, a_3 be any positive real numbers, then which of the following statement is not true.

A. $3a_1, a_2, a_3 \leq a_1^3 + a_2^3 + a_3^3$

B. $\frac{a_1}{a_2} + \frac{a_2}{a_3} + \frac{a_3}{a_1} \geq 3$

C. $(a_1 + a_2 + a_3)\left(\frac{1}{a_1} + \frac{1}{a_2} + \frac{1}{a_3}\right) \geq 9$

D. $(a_1 + a_2 + a_3)\left(\frac{1}{a_1} + \frac{1}{a_2} + \frac{1}{a_3}\right)^3 \leq 27$

Answer: C

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7. For $\theta > \frac{\pi}{3}$, the value of $f(\theta) = \sec^2\theta + \cos^2\theta$ always lies in the interval

A. 0,2

B. 0,1

C. 1,2

D. $2, \infty$

Answer: D

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8. If a and b are two different positive real numbers then which of the following statement is true?

A. $2\sqrt{ab} > a + b$

B. $2\sqrt{ab} < a + b$

C. $2\sqrt{ab} = a + b$

D. none of these

Answer: B

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9. If $0 < x < \frac{\pi}{2}$ then the minimum value of $\frac{\cos^3 x}{\sin x} + \frac{\sin^3 \ x}{\cos x \ x}$, is

A. $\sqrt{3}$

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

C. $\frac{1}{3}$

D. 1

Answer: D

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10. If a, b, c are positive real numbers such that $a+b+c=2$ then, which one of the following is true?

A. $(2-a)(2-b)(2-c) \geq 8abc$

B. $\frac{1}{a}+\frac{1}{b}+\frac{1}{c} \geq 2$

C. $(2-a)(2-b)(2-c) < 8abc$

D. $\frac{1}{a}+\frac{1}{b}+\frac{1}{c} = 2$

Answer: A

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11. If a, b, c are positive real numbers such that $a+b+c=p$ then, which of the following is true?

A. $(p-a)(p-b)(P-c) \leq \frac{8}{27}p^3$

B. $(p-a)(p-b)(P-c) \geq 8abc$

C. $\frac{bc}{a}+\frac{ca}{b}+\frac{ab}{c} \geq p$

D. none of these

Answer: A

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12. Evaluate $\int \frac{x^3}{(x-1)(x-2)} dx$

A. a positive integer

B. divisible by n

C. equal to $n+\frac{1}{n}$

D. never less than n^2

Answer: D

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13. If roots of the equation $x^4 - 8x^3 + bx^2 + cx + 16 = 0$ are positive, then

A. $b = 8 = c$

B. $b = -24, c = -32$

C. $b = 24, c = -32$

D. $b = 24, c = 32$

Answer: C

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14. If a,b,c are distinct positive real numbers, then

A. $a^4 + b^4 > a^3 b + ab^3$

B. $a^4 + b^4 < a^3 b + ab^3$

C. $a^3 + b^3 < a^2 b + ab^2$

D. none of these

Answer: A

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15. $2^{\sin^2 x} + 2^{\cos^2 x}$ is

A. ≤ 2

B. ≥ 2

C. ≤ 1

D. ≥ 1

Answer: B

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16. If $xyz = abc$, then the least value of $bcx + cay + abz$, is

A. 3abc

B. 6abc

C. abc

D. 4abc

Answer: A

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17. The number of orded 4-tuples (x, y, z, w) where $x, y, z, w \in [0, 10]$ which satisfy the inequality

$2^{\sin^2 x} \times 3^{\cos^2 y} \times 4^{\sin^2 z} \times 5^{\cos^2 w} \geq 120,$ is

A. 81

B. 144

C. 0

D. infinite

Answer: B

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18. The range of ab if $|a| \leq 1$ and $a + b = 1, (a, b \in R),$ is

A. $[0, 1/4]$

B. $[-2, 1/4]$

C. $[1/4, 2]$

D. $[0, 2]$

Answer: B

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19. If $A = x^2 + \frac{1}{x^2}, B = x - \frac{1}{x}$ then minimum value of $\frac{A}{B}$ is

A. $\sqrt{2}$

B. $2\sqrt{2}$

C. $\sqrt{2}+2$

D. none of these

Answer: A

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20. The least perimeter of a cyclic quadrilateral of given area A square units, is

A. $\sqrt{A}$

B. $2\sqrt{A}$

C. $3\sqrt{A}$

D. $4\sqrt{A}$

Answer: D

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21. A stick of length 20 units is to be divided into n parts so that the product of the length of the parts is greater than unity. The maximum possible value of n, is

A. 18

B. 19

C. 20

D. 21

Answer: B

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22. If $x. y, z$ are positive real numbers such that $x^2 + y^2 + z^2 = 27,$ then $x^3 + y^3 + z^3$ has

A. minimum value 81

B. maximum value 81

C. minimum value 27

D. maximum value 27

Answer: A

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23. If $x_1, x_2, \ldots, x_n$ are real numbers, then the largest value of the expression

$\sin x_1 \cos x_2 + \sin x_2 \cos x_3 + \ldots + \sin x_n \cos x_1$,

is

A. n

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

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

D. $\sqrt{n^2 - 1}$

Answer: B

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24. The minimum value of the sum of the lengths of diagonals of a cyclic quadrilateral of area a^2 square units, is

A. $\sqrt{2}a$

B. $2\sqrt{2}a$

C. 2a

D. none of these

Answer: B

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25. The minimum value of

$$|\sin x+\cos x+\tan x+\sec x+\operatorname{cosec} x+\cot x|,$$

is

A. $2\sqrt{2}-1$

B. $2\sqrt{2}+1$

C. $\sqrt{2}-1$

D. $\sqrt{2}+1$

Answer: A

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26. The expression $(a+b+c)(b+c-a)(c+a-b)(a+b-c)$ $\leq kb^2c^2$ then k can take the value

A. 4

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

C. 1

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

Answer:

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27. If n is even and $n \geq 4, x_1, x_2, \ldots, x_n \geq 0$ and $x_1 + x_2 + \ldots + x_n = 1$, then $P = x_1 x_2 x_3 \ldots x_n$ cannot exceed

A. $\frac{1}{n+1}$

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

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

D. none of these

Answer: D

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28. Find the least value of n such that $(n-2)x^2 + x + n + 4 > 0, \forall x \in R, where n \in N$.

A. 2

B. 3

C. 4

D. 5

Answer: D

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29. The number of solution (s) of equation $\sin \sin^{-1}([x]) + \cos^{-1} \cos x = 1$ (where denotes the greatest integer function) is

A. 1

B. 2

C. 3

D. none of these

Answer: D

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30. Number of solutions of $\left|\frac{1}{|x|-1}\right| = x + \sin x,$ is

A. 1

B. 2

C. 3

D. none of these

Answer: A

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31. The solution set of equation

$(x+2)^2 + [x-2]^2 = (x-2)^2 + [x+2]^2,$

where [.] represents the greatest integer function, is

A. R

B. N

C. I

D. Q

Answer: C

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32. The number of pairs of positive integers (x,y) where x and y are prime numbers and $x^2 - 2y^2 = 1$, is

A. 1

B. 2

C. 3

D. 4

Answer: A

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33. The number of solution of the equation

$16(x^2+1)+\pi^2=|\tan x|+8\pi x$ is equal to

A. 2

B. 4

C. 1

D. infinite

Answer: A

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34. The set of values of 'a' for which $ax^2-(4-2a)x-8<0$ for exactly three integral values of x, is

A. $2\leq a<4$

B. $1\leq a<2$

C. $2<a<4$

D. $1<a<2$

Answer: A

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35. The number of positive integral solutions (x, y) of the equation $2xy - 4x^2 + 12x - 5y = 11$, is

A. 0

B. 1

C. 2

D. infinitely many

Answer: C

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36. Number of integers, which satisfy the inequality $\frac{(16)^{\frac{1}{x}}}{\left(2^{x+3}\right)} > 1,$ is equal to

A. 0

B. 3

C. 4

D. infinite

Answer: D

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37. The numbers of integral solutions of the equations

$y^2(5x^2+1) = 25(2x^2+13)$ where $x, y \in I$, is

A. 2

B. 4

C. 8

D. infinite

Answer: B

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Section Ii Assertion Reason Type

1. If $\log_4(x+2y)+\log_4(x-2y)=1,$ then

Statement-1: $(|x|-|y|)_{\min}=\sqrt{3}$

Statement-2: $AM \geq GM$

A. 1

B. 2

C. 3

D. 4

Answer:

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Exercise Section Ii Assertion Reason

1. In a triangle ABC , if AB , BC and AC are the three sides of the triangle , then which of the following statements is necessarily true ?

A. 1

B. 2

C. 3

D. 4

Answer:

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