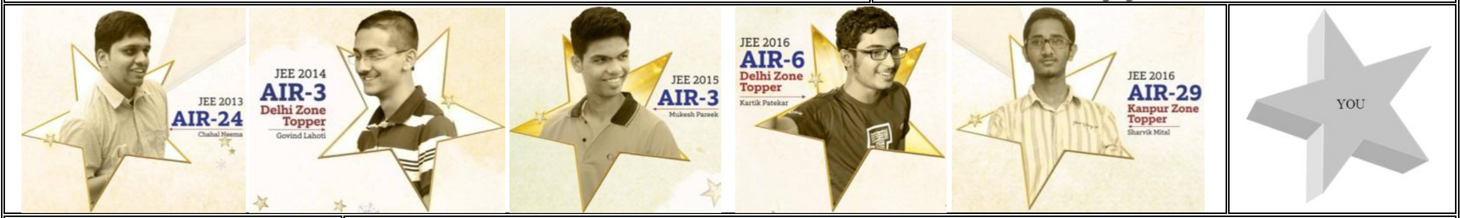
ADVANCED REVISION SHEET



MATHEMATICS | **LCD**

Part – 1 (One Option Correct)

1. The value of $\lim\limits_{x \to \frac{\sqrt{3}}{2}} \dfrac{\frac{\pi}{3} - \sin^{-1}\left(2x\sqrt{1-x^2}\right)}{x - \frac{\sqrt{3}}{2}}$ is

(A) 1 (B) 2 (C) 3 (D) 4

2. If $f(x) = \dfrac{1}{3}\left(f(x+1) + \dfrac{5}{f(x+2)}\right)$, f(x) > 0 0$\forall x \in R$ and $\lim\limits_{x\to\infty} f(x)$ exist finitely then $\lim\limits_{x\to\infty} f(x) =$

(A) 0 (B) $\sqrt{\dfrac{2}{5}}$ (C) $\sqrt{\dfrac{5}{2}}$ (D) ∞

3. The value of $\lim\limits_{n\to\infty}\left(\dfrac{\sin\left\{\frac{2}{n}\right\}}{\left[2n\tan\frac{1}{n}\right]\left(\tan\frac{1}{n}\right)} + \dfrac{1}{n^2+\cos n}\right)^{n^2}$ where [.] = GIF and {.} = FPF, is

(A) 1 (B) 2 (C) 3 (D) 0

4. The number of real valued continuous functions f(with domain R) such that if x is rational then f(x) is

(A) 0 (B) 2 (C) 4 (D) Infinite

5. Set of all values of x such that $\lim\limits_{n\to\infty} \dfrac{1}{1+\left(\dfrac{4\tan^{-1}2x}{\pi}\right)^{2n}}$ is non-zero and finite number, where n □ N, is

(A) $\left[-\dfrac{1}{2}, \dfrac{1}{2}\right]$ (B) $\left[0, \dfrac{1}{2}\right]$ (C) (–1, 1) (D) $\left[-\dfrac{1}{2}, 0\right]$

6. Range of the function y = h(x) is

(A) $\left(0, \dfrac{\pi}{2}\right)$ (B) $\left(-\dfrac{\pi}{2}, 0\right)$ (C) R (D) $\left(-\dfrac{\pi}{2}, \dfrac{\pi}{2}\right)$

7. If f(x) = [x] $(\sin kx)^p$ is continuous for real x, then

(A) $k \in \{n\pi, n \in I\}$, $p > 0$ (B) $k \in \{2n\pi, n \in I\}$, $p > 0$

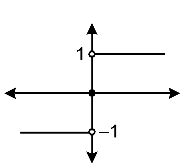
(C) $k \in \{n\pi, n \in I\}$, $p \in R - \{0\}$ (D) $k \in \{n\pi, n \in I, n \neq 0\}$, p $\in$ R $-$ {0}

8. A function $f : R \to R$ is defined as f(x) = 15 – |x – 10|

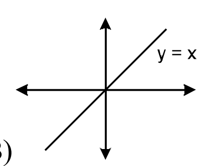
The number of points at which the function g(x) = f(f(x)) is not differentiable is

(A) 0 (B) 1 (C) 2 (D) 3

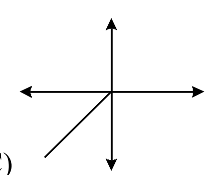
9. The graph of the function f(x) = $\lim\limits_{t\to 0}\left(\dfrac{2x}{\pi}\cot^{-1}\dfrac{x}{t^2}\right)$, is



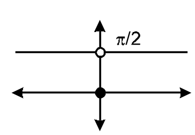
(A)



(B)



(C)



(D)

Part – 2 (One or More than One Option Correct)

10. Let $f(x)=\frac{3}{4}x+1$ and $f^{n+1}(x)=f(f^n(x))\ \forall n\ge 1,\ n\in n.$ If $\lim\limits_{n\to\infty} f^n(x)=\lambda$, then

(A) λ is independent of x.
(B) λ is linear polynomial in x.
(C) line y = λ has slope 0.
(D) line 4y = λ touches a circle of unit radius with centre at origin.

11. If f(x) = $\lim\limits_{x\to\infty} x \sin b\ \ell n\left(\frac{\sin a+\frac{1}{x}}{\sin a}\right)$ where a, b $\in\left(0,\frac{\pi}{2}\right)$, then f(x) can take value(s)

(A) 0 (B) 1 (C) –2 (D) 5

12. $\lim\limits_{x\to\infty}\left(\frac{ax+3}{bx+2}\right)^{bx}$ is equal to (a and b are positive)

(A) 0 if a < b (B) e if a = b (C) ∞ if a > b (D) 1 if a > b

13. If f(x) = [4x] + {3x} where [.] denotes GIF and {.} denotes FPF then for x $\in$ [0, 5]

(A) number of points of discontinuity of f(x) are 25
(B) f' (0) = 0
(C) f' (x) = 3 wherever defined
(D) f(x) < 20

14. If p = $\lim\limits_{n\to\infty} n^{-n^2}\{(n+2^{\circ})(n+2^{-1})(n+2^{-2})....(n+2^{-n+1})\}^n$ then which of the following is true?

(A) p is irrational (B) integer nearest to p is 7 (C) $p>\lim\limits_{x\to\infty}\left(\frac{1+x}{x}\right)^{\ell nx-x}$ (D) all of these

15. If f(x) = $\left|\left|\sin\left(|x|-1\right)\right|-2\right|$ then

(A) f(x) is continuous at x = 2
(B) f(x) is differentiable at x = 2
(C) f' (2) = cos 1
(D) f(x) is non-differentiable at x = 0

16. If f(x) = $\begin{cases}\frac{1}{x^2}-\frac{1}{x^2}, & x<0\\ \sin^{-1}(x+b), & x\ge 0\end{cases}$ then at x = 0, f(x) is

(A) continuous if b = 0
(B) discontinuous for any areal b
(C) differentiable for $b=\pm 1$
(D) non-differentiable for any real b

17. If f(x) = $\begin{cases}\frac{[\tan x]}{[x]}, & [x]\ne 0\\ 0, & [x]=0\end{cases}$, where [.]. = GIF, then

(A) $\lim\limits_{x\to 0^-} f(x)=1$ (B) $\lim\limits_{x\to 0^+} f(x)=1$ (C) $\lim\limits_{x\to 0^+} f(x)=0$ (D) f(x)= 0

18. If x = a satisfies equation $\tan^{-1}(x+2)+\cot^{-1}\sqrt{4x+20}$ $\lim\limits_{x\to\frac{\pi}{2}}\frac{\sin(x\cos x)}{\cos(x\sin x)}$ and $\lim\limits_{x\to 0}\frac{\sqrt[a]{1+x}-\frac{(1+x)^{\frac{1}{x}}}{e}-bx}{5x+kx^2+x^3}=0$ then

(A) a = 2 (B) ab = 3 (C) a = 1, b = 3 (D) $k\in R$

19. $\lim\limits_{x\to 0}\left[m\frac{\sin x}{x}\right]$, where m $\in$ I and [.] denotes greatest integer function, is

(A) m if m $\le$ 0 (B) m – 1 if m > 0 (C) m – 1 if m < 0 (D) m if m > 0

20. f (x) = $\frac{[x]+1}{\{x\}+1}$ for f : [0, $\frac{5}{2}$) → ($\frac{1}{2}$, 3] , where [.] represents greatest integer function and { . } represents fractional part of x , then which of the following is true.

(A) f (x) is injective discontinuous function
(B) f (x) is surjective non differentiable function
(C) min$\left(\lim\limits_{x\to 1-} f(x), \lim\limits_{x\to 1+} f(x)\right)$ = f (1)
(D) max (x values of point of discoutinuity) = f (1)

21. Given f(x)= $\begin{cases} 3-\left[\cot^{-1}\left(\dfrac{2x^3-3}{x^2}\right)\right] & for\ \ x>0 \\ \{x^2\}\cos\left(e^{1/x}\right) & for\ \ x<0 \end{cases}$ where { } & [ ] denotes the fractional part and the integral part functions respectively, then which of the following statement does not hold good.

(A) $f(0^-)=0$ (B) $f(0^+)=3$

(C) f(0) = 0 ⇒ continuity of f at x = 0 (D) irremovable discontinuity of f at x=0

Part – 3 (Paragraph Type Question)

Comprehension # 2

Let f(x) $=\lim_{n\to\infty}\left(\cos\sqrt{\dfrac{x}{n}}\right)^n$, $g(x)=\lim_{n\to\infty}\left(1-x+x\sqrt[n]{e}\right)^n$. Now, consider the function y = h(x), where h(x) = $\tan^{-1}(g^{-1}f^{-1}(x))$.

22. $\lim_{x\to 0}\dfrac{\ell n\,(f(x))}{\ell n\,(g(x))}$ is equal to

(A) $\dfrac{1}{2}$ (B) $-\dfrac{1}{2}$ (C) 0 (D) 1

23. Domain of the function y = h(x) is

(A) (0, ∞) (B) R (C) (0, 1) (D) [0, 1]

Part – 4 (Matrix Match Type Question)

24.

Column - I	Column - II
(A) Number of points of discontinuity of f(x) = $\tan^2 x - \sec^2 x$ in (0, 2π) is	(p) 1
(B) Number of points at which f(x) = $\sin^{-1}x+\tan^{-1}x+\cot^{-1}x$ is non-differentiable in (–1, 1) is	(q) 2
(C) Number of points of discontinuity of y = [sin x], x ∈ [0, 2π) where [.] represents greatest integer function	(r) 0
(D) Number of points where $y=\left\|(x-1)^3\right\|+\left\|(x-2)^5\right\|+\left\|(x-3)\right\|$ is non-differentiable	(s) 3

25.

Column - I	Column - II
(A) Number of points where the function $f(x)=\begin{cases} 1+\left[\cos\dfrac{\pi x}{2}\right] & 1<x\le 2 \\ 1-\{x\} & 0\le x<1 \\ \|\sin\pi x\| & -1\le x<0 \end{cases}$ and f(1) = 0 is continuous but non-differentiable	(p) 0
(B) f(x) = $\begin{cases} x^2 e^{1/x} & , \ x\ne 0 \\ 0 & , \ x=0 \end{cases}$, then f′(0⁻) =	(q) 1
(C) The number of points at which g(x) = $\dfrac{1}{1+\dfrac{2}{f(x)}}$ is not differentiable where f(x) = $\dfrac{1}{1+\dfrac{1}{x}}$, is	(r) 2

(D)	Number of points where tangent does not exist for the curve y = sgn $(x^2 - 1)$	(s) 3

26. **Column – I** | **Column – II**

For $x \in R$,

	Column – I		Column – II
(A)	f(x) = {sin(px)} is discontinuous for $x \in$	(p)	[0, 1)
(B)	$g(x) = \left\{\frac{\sin x}{x}\right\}$ is discontinuous for $x \in$	(q)	{1, 2}
(C)	$h(x) = \frac{\{\sin x\}}{\{x\}}$ is non-differentiable for $x \in$	(r)	{0}
(D)	$u(x) = \frac{(\sin x)}{[x]}$ is discontinuous function for $x \in$	(s)	$\left\{\frac{1}{2}\right\}$

27.

	Column – I		Column – II
(A)	Point of discontinuity of $y = \frac{1}{t^2 - t - 2}$ where $t = \frac{1}{x+1}$	(p)	$-\frac{1}{2}$
(B)	Points of continuity of y = [x] + [–x]	(q)	– 2
(C)	y = [sin(π x)] is non differentiable at	(r)	– 1
(D)	f(x) = |2x + 1| + |x + 2| – |x + 1| – |x – 4| is non differentiable at	(s)	4

ANSWER KEY

Que.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Ans.	D	C	A	A	A	D	A	D	C	ACD
Que.	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Ans.	BD	AC	AC	ABCD	ABD	AD	ABD	BD	AB	ABD
Que.	**21**	**22**	**23**	**24**	**25**	**26**	**27**			
Ans.	BD	B	C	(A)$\rightarrow$(q), (B)$\rightarrow$(r), (C)$\rightarrow$(q), (D)$\rightarrow$(s)	(A)$\rightarrow$ (q), (B)$\rightarrow$(p), (C)$\rightarrow$(s), (D)$\rightarrow$(p)	(A)$\rightarrow$(r, s), (B)$\rightarrow$(r), (C)$\rightarrow$(q, r), (D)$\rightarrow$(p,q,r)	(A)$\rightarrow$p,q,r), (B)$\rightarrow$(p), (C)$\rightarrow$(q,r,s), (D)$\rightarrow$(p,q,r,s)			