MATHS

BOOKS - NTA MOCK TESTS

CONTINUITY AND DIFFERENTIABILITY TEST

Single Choice

1. Let $f(x) = \begin{cases} (x-1)\sin\frac{1}{x-1} & x \neq 1 \\ 0 & x = 1 \end{cases}$ Then which one of the following is true?

A. f is differentiable at x=1 but not at x=0

B. f is neither differentiable at x=0 nor at x=1

C. f is diffeentiable at x=0 and at x=1

D. f is differentiable at x=0 but not at x=1

Answer: D

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2. If $f(x) = |\sin x|$ and $g(x) = x^3$ then identify which of the following is correct for the function $f(g(x))$

A. Discontinuous at x=0

B. Non derivable at x=0

C. Continuous & derivable at x=0

D. None of he given option

Answer: C

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3. Consider the function $f(x) = x^2 \_ 2x$ and $g(x) = -|x|$

statement -1: The composite function $F(x) = f(g(x))$ is not derivable at x=0.

Statement 2: $F'(0^+) = 2$ and $F'(0^-) = -2$

A. Statement 1 is true, Statement -2 is true, Statement 2 is correct explanation for statement -1

B. Statement -1 is true Statement -2 is true

Statement -2 is not a corect explanation

for statement 1

C. Statement -1 is true, Statement -2 is false

D. Statement -1 is false, Statement -2 is true

Answer: A

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4. Let $g(x) = \frac{(x-1)^n}{\log \cos^m(x-1)}, 0 < x < 2$, m and n are integes $m \neq 0, n > 0$ and let p be the left hand derivative of $f(x) = |x-1|$ at x=1. If $\lim_{x \to 1^+} (g(x) = p$ then

A. $n = 1, m = 1$

B. $n = 1, m = -1$

C. $n = 2, m = 2$

D. $n > 2, m = n$

Answer: C

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5. Let $(x) = \sin x, g(x) = [x + 1]$ and $g(f(x)) = H(x)$, where [ ] is the greatest integer function. Then $H, \left(\frac{\pi}{2}\right)$ is

A. non-existent

B. 1

C. -1

D. None of these

Answer: A

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6. Let $f(x) = \begin{cases} x^2 e^{2(x-1)} & x \leq 1 \\ a\cos(2x-2) + bx^2 & x > 1 \end{cases}$

f(x) will be differentiable at x=1, if

A. $a = -1, b = 2$

B. $a = 1, b = -2$

C. $a = 1, b = 2$

D. None of these

Answer: A

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7. If $f(x) = p|\sin x| + qe^{|x|} + r|x|^3$ and if f(x) is differentiable at x=0 then

A. $p = q = r = 1$

B. $p + q = 0$, r is any real number

C. $q + r = 0$, r is any real number

D. $r = 0, p = 0, q$ is any real number

Answer: B

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8. If $f(x) = \begin{cases} \sin\left(\frac{\pi}{2}(x - [x])\right) & x < 5 \\ 5(b-1) & x = 5 \\ ab^{2\,\frac{+x^2-11x+24|}{x-3}} & x > 5 \end{cases}$ is continuous at $x = 5, a, b \in R$ then ([.] denotes the greatest integer function)

A. $a = \frac{25}{108}, b = \frac{6}{5}$

B. $a = \frac{6}{13}b, \frac{25}{36}$

C. $a = \frac{1}{2}, b = \frac{25}{36}$

D. $a = \frac{23}{100}, b = \frac{6}{5}$

Answer: A

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9. If the function $f(x) = \left|x^2 + a|x| + b\right|$ has exactly three points of no differentiability, then which of the following statement can be true?

A. $b = 0, a < 0$

B. $b < 0, a \in R$

C. $b > 0, a \in R$

D. $b < 0, a \in R^-$

Answer: A

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10. Column I below gives the function while Column II gives their behaviours at x=0. Which of the following pair is incorectly matched? ([x] represents the greatest iteger less than or equal to x)

A.

Column I	Column II
$\|x\| \ [1+x]$	Continuous at $x=0$

B.

Column I	Column II
$[x]\,[1-x]$	Right Continuous at $x=0$

C.

Column I	Column II
$[\cos\ x]$	$\lim_{x\to 0} f(x)$ exists

D.

Column I	Column II
$[-x]\,[1+x]$	Right Continuous at $x=0$

Answer: D

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11. If the function

$$f(x)=\begin{cases} x+a\sqrt{2}six & 0\le x<\frac{\pi}{4} \\ 2x\cot x+b & \frac{\pi}{4}\le x\le\frac{\pi}{2} \\ a\cos 2x-b\sin x & \frac{\pi}{4}<x\le\pi \end{cases}$$ is

continuous in $[0, \pi]$ then the values of a and b respectively are

A. $\frac{\pi}{6}, -\frac{\pi}{12}$

B. $-\frac{\pi}{6}, \frac{\pi}{4}$

C. $-\frac{\pi}{3}, \frac{\pi}{12}$

D. None of these

Answer: A

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12. The function $f(x) = 1\dfrac{1 - \sin x + \cos x}{1 + \sin x + \cos x}$ is not defied at $x = \pi$. The value of $f(\pi)$ so that $f(x)$ is continous at $x = \pi$ is

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

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

C. -1

D. 1

Answer: C

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13. The points of discontinuity of tan x aee

A. $n\pi, n \in I$

B. $2n\pi, n \in I$

C. $(2n+1)\frac{\pi}{2}, n \in I$

D. None of these

Answer: C

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14. If $f(x) = \begin{cases} mx + 1 & x \leq \frac{\pi}{2} \\ \sin x + n & x > \frac{\pi}{2} \end{cases}$ is continuous at $x = \frac{\pi}{2}$ then

A. $m = 1, n = 0$

B. $m = \frac{n\pi}{2} + 1$

C. $n = m\frac{\pi}{2}$

D. $m = n = \frac{\pi}{2}$

Answer: C

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15. If $f(x) = \begin{cases} x^p \cos\left(\frac{1}{x}\right) & x \neq 0 \\ 0 & x = 0 \end{cases}$ is differentiable at x=0 then

A. $p < 0$

B. $0 < p < 1$

C. $p = 1$

D. $p > 1$

Answer: D

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16. Let $f(x) = x^3 - x^{20_3x-1}, g(x) = (x+1)a$ and $h(x) = \frac{f(x)}{g(x)}$ where h(x) is a rational function such that

(i) it is continous everywhere except when x=-1

(ii) $\lim_{x \to \infty} h(x) = o$ and **(iii)** $\lim (x \to -1)h(x) = \frac{1}{2}$

The value of h(1) is

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

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

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

D. 1

Answer: C

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17. If f is an even function such that $\lim_{h \to 0} \frac{f(h) - f(0)}{h}, h > 0$ some finite non zero value then

A. f is continuous and derivable at x=0

B. f is continuous but not necessarily derivable at x=0

C. f may be discontinous at x=0

D. None of these

Answer: B

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18. If $f(x) = \frac{1}{1-x}$, then the points of discontinuity, of the function $f^{3n}(x)$ is /are (where $f^n = fof$.....of(n times))

A. $x = 2$

B. $x = \{0, 1\}$

C. $x = -1$

D. continuous everywheer

Answer: B

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19. A point where function $f(x) = [\sin[x]]$ is discontinuous of $(0, 2\pi)$ lies in (where [.] denotes greatest integer $\leq x$) is

A. (0,1)

B. (1,2)

C. (2,3)

D. None of these

Answer: D

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20. Let $f(x)$ be defined as follows

$$f(x) = \begin{cases} (\cos x - \sin x)^{\cos ecx} & -\frac{\pi}{2} < x < 0 \\ a & x = 0 \\ \frac{e^{1/x} + e^{2/x} + e^{3/x}}{ae^{\frac{2}{x}} be^{3/x}} & 0 < x < \frac{\pi}{2} \end{cases}$$

if f(x) is continuous at x=0 then (a,b)=

A. $\left(e, \frac{1}{e}\right)$

B. $\left(\frac{1}{e}, e\right)$

C. (e, e)

D. $\left(e^{-1}, e^{-1}\right)$

Answer: B

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21. If $f(x) = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$, then f(x) is differentiable on

A. $[-1, 1[$

B. $R - \{-1, 1\}$

C. $R - (-1, 1)$

D. None of these

Answer: B

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22. If

$$f(x) = \begin{cases} -4\sin x + \cos x & x < -\frac{\pi}{2} \\ a\sin x + b & -\frac{\pi}{2} \leq x < \frac{\pi}{2} \\ \cos x + 2 & x \geq \frac{\pi}{2} \end{cases}$$

is continous then a and b are

A. $a = -1, b = 3$

B. $a = 1, b = -3$

C. $a = 1, b - 3$

D. $a = -1, b = -3$

Answer: A

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23. The set of all points where time function $f(x) = \sqrt{1 - e^{-x^2}}$ is differentiable is

A. $(0, \infty)$

B. $(-\infty, \infty)$

C. $(-\infty, \infty) - \{0\}$

D. $(-1, \infty)$

Answer: C

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24. Let $f(x) = \max\{x+1, |x|+1\}$. Then f(x) is non differentiable at

A. 0.5

B. 1.0

C. 0

D. 2.0

Answer: C

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25. If $f(x) = \begin{cases} \frac{\sqrt{4+ax}-\sqrt{4-ax}}{x} & -1 \leq x < 0 \\ \frac{3x+2}{x-8} & 0 \leq x \leq 1 \end{cases}$

is continuous in [-1,1] then the value of a is

A. 1

B. -1

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

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

Answer: D

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26. $f(x) = \begin{cases} \left(x^2 + e^{\frac{1}{2-x}}\right)^{-1} & x \neq 2 \\ k & x = 2 \end{cases}$ is continous from right at the point x=2, then k equals

A. 0

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

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

D. None of these

Answer: B

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27. The function $f(x) = [x]^2 - [x^2]$ (where [y] is the greatest integer less than or equal to y) , is discontinuous at

A. all integers

B. All integers except 0 and 1

C. All integers except 0

D. All integers except 1

Answer: D

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28. If the function $f(x) = \frac{(128a + ax)^{\frac{1}{8}} - 2}{(32 + bx)^{\frac{1}{5}} - 2}$ is continuous at x=0, then the value of $\frac{a}{b}$ is

A. $\frac{3}{5} f(0)$

B. $2^{\frac{8}{5}} f(0)$

C. $\frac{64}{5} f(0)$

D. None of these

Answer: C

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29. The number of points at which the functin $f(x) = |x - 0.5| + |x - 1| + \tan x$ is not differentiable in the interval (0,2) is/are

A. 1

B. 2

C. 3

D. 4

Answer: C

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30. Let $f(x) = \begin{cases} x^2\left|\cos\frac{\pi}{x}\right| & x \neq 0 \\ 0 & x = 0 \end{cases}, x \in R$

then f(x) is

A. differentiable both at x=0 and x=2

B. differentiable at x=0 but not differentiable at x=2

C. not differentiable at x=0 but differentiable at x=2

D. differentiable neither at x=0 not at x=2

Answer: B

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