Δ-M LQ MAT121

NOTE:- Students are expected to go through the below questions and try to attempt them. [30 questions from the L and F and differentiation respectively].

Limits and functions

1) The limit of the function $f(x)+g(x)$ as x approaches a can be written as ——

Ans $\lim_{x\to a} f(x) + \lim_{x\to a} g(x)$

[Hint; Since we're dealing with two functions $f(x)$ and $g(x)$ just take their limit at a specific approaching]

2) $\lim_{x\to 0} \frac{2x^3+3x-2}{x^2+4x-8}$

[Hint; Direct Substitution and you will have a true answer]

Ans $\frac{1}{4}$

3) $\lim_{x\to -2} \sqrt{x^4+3x+6}$

[Hint; Direct substitution and you will have a true answer.
Note; If your answer is false you will have to either differentiate or factorize]

Ans 4

4) $\lim_{x\to 0} \frac{x^3+2x^2+x}{x^2+3x}$

[Hint; A false function, therefore apply L'Hopital principle (i.e differentiate)]

Ans $\frac{1}{3}$

5) $\lim_{a\to \frac{2}{3}} \frac{a^2-7a+17}{a-\frac{2}{3}}$

[Hint; A false function, then differentiate.
Note; A false function can either be a $\frac{0}{0}$ (undefined) or $\frac{a}{0}$ where $a=0,1,\ldots n$]

6) $\lim_{y\to 0} \frac{e^{9y}-e^{-9y}}{y}$

[A false function., then differentiate mind you anything raise to power of zero = 1 except $0^0 = 0$]

Ans 18

7) $\lim_{x\to 1} \frac{\ln x}{x^2-1}$

[mind you $\ln(1)$ is zero so it is a false function, therefore we'll differentiate]

Ans $\frac{1}{2}$

NOTE: we can apply 3 methods in limit and function

1) Substitution method
2) factorization method
3) L'hopital principle

* There are some functions that we can substitute direct at a required approaching value of a variable and it will give us a True answer (all except an undefined functions). If you come across this, just check the options and you will surely see your answer (No need to differentiate).

** for factorization; we have some false functions that require factorization. If you come across such then use your (No 32)

*** L'hopital principle: This is the easiest way to tackle a false function. As it is also applicable in factorization. It is advisable to use or apply l'hopital principle for a false function to avoid wracking of brain.

8) $\lim_{x\to 2} \frac{(x-2)(x^2+3x-2)}{x^2-4}$

Ans 2

[Hint; A false function. As we have a common factor, $(x-2)$ we can go for factorization. Remember $(x^2-4) = (x-2)(x+2)$]

9) $\lim_{x\to 0} \frac{\sin x - x}{x^3}$

Ans $-\frac{1}{6}$

[Hint; A false function because $\sin(0)=0$ & (undefined). Using l'hopital principle differentiate the function till you have a false answer]

10) $\lim_{x\to 2} \frac{x^2-x-2}{x-2}$

Ans 3

[Hint; A false function, then apply either factorization or l'hopital principle]

11) $\lim_{x\to 3} \frac{\sqrt{x}-3}{x^2-9}$

Ans $\frac{1}{12\sqrt{3}}$

[Hint; TO avoid rationalization, you can differentiate directly]

12) $\lim_{h\to 0} \frac{(x+h)^4 - x^4}{h}$

Ans $4x^3$

[Hint; A false function, then going by d' Shortcut, I will differentiate the standing variable and ignore the sign i.e x^4]

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13) $\lim_{y \to -1} \frac{y^2 - 3y - 4}{y+1}$

Hint; A false function, then apply L'hopital rule

Ans -5

14) $\lim_{p \to 3} \frac{p^2 - 9}{p - 3}$

Hint; A false function, then we can apply factorization.
Note; $p^2 - 9 = (p-9)(p+9)$

15) $\lim_{t \to 0} \left[\frac{1}{t} - \frac{1}{t^2 + t}\right]$

Hint; A false fun fon, then we can either simplify or differentiate. Simplify (i.e by taking the L.c.m (by taking g L.c.m)

Ans 1

16) $\lim_{h \to 0} \frac{(3+h)^2 - 9}{h}$

mind you the question's form is different from (x+h), you can see now dat a number is now conneding with a variable.;- Differentiate d function (chain rule).

Ans 6

17) $\lim_{y \to 0} \frac{y^3}{y - \sin y}$

false function; then differentiate till you have a true answer.
Yes! it is necessary your first derivate to s fill be undefined ($\frac{0}{0}, \frac{a}{0}$ a=91...
you will just continue with your differentiation until you have a true answer

Ans 6

18) $\lim_{m \to -3} \frac{m^2 - 9}{2m^2 + 7m + 3}$

A false function, then apply L'hopital principle.
Make sure you always differentiate with your durameta

Ans $\frac{6}{5}$

Don't forget these are likely questions and you are expected to attempt them. No need to

19) $\lim_{y \to -4} \dfrac{\frac{1}{4} + \frac{1}{y}}{4+y}$

Ans $-\dfrac{1}{16}$

[Hint; A false function, then apply l'hopital principle i.e differentiate the function.]

20) $\lim_{n \to \infty} \dfrac{1}{n}$

Ans 0

[have it in your mind dat anything +, x and − by infinity is equals to ∞
i.e
$5 - \infty = \infty$
$4 + \infty = \infty$
$2 \times \infty = \infty$
Also anything divided by d infinity will be zero
i.e $\frac{1}{\infty} = 0 \Rightarrow \frac{n}{\infty} = 0$ (where $n = 1, 2, 3 \ldots$)]

21) $\lim_{n \to \infty} \dfrac{3n^3 + 2n^2 + 8}{2n^3 + n^2 - 4}$

Ans $\dfrac{3}{2}$

[Hint; going by d Shortcut: Check the highest power of d variable present in d function (and which n^3) then compare the coefficient of it (i.e both d numerator and denomerator

22) $\lim_{n \to 0} \dfrac{\tan n - n}{\sin n - n}$

[Hint; A false function; Then apply l'hopital rule (i.e differentiate) mind you; it is not compulsory your first derivate to give a true function If happens, then continue differentiating

23) $\lim_{n \to \infty} \dfrac{n^2 - 3n + 5}{2n^2 + 8n - 2}$

Ans $\dfrac{1}{2}$

[Hint; going by d Shortcut compare d coefficient of highest power of d present variable (i.e n^2)]

24) $\lim_{m \to -4} \dfrac{m^2 + 5m + 4}{m^2 + 3m - 4}$

Ans $\dfrac{3}{5}$ //

[Hint; A false function. Then you can either apply l'hopital rule (differentiate) or cancel out the common terms from the question i.e m^2 cancel m^2 and 4 cancel 4 but because of the negative sign you aren't expected to go with dat :- differentiate d function]

25) $\lim_{x \to 2} \frac{x^2+x-6}{x-2}$

Ans 5

Hint; A false function. So it's either you differentiate this or factorize this because there is a common factor which is $(x-2)$. But for those that can't recall their quadratic equation you are expected to differentiate.

26) $\lim_{x \to -2} \frac{x^3+8}{x+2}$

Hint; A false function, then apply l'hopital rule (i.e differentiate d function).

27) $\lim_{x \to 0} \frac{x^{500}}{x^2+3x+5}$

Ans 0

Hint; A True function then Substitute directly.
Mind you $0^{500} = 0$

28) $\lim_{x \to 1} \frac{\ln x}{x^2+x-2}$

Ans $\frac{1}{3}$

Hint; A false function, then differentiate.
mind you $\ln 1 = 0$

29) $\lim_{y \to 0} \frac{\sin zy + \sin y}{y}$

Hint; A false function, then apply l'hopital principle.
Recall; our first derivative too may be undefined. Therefore, you are expected to continue with d differentiation if you come across such.

30) $\lim_{m \to \infty} \frac{4m^4+3m^3+2m+1}{8m^4+2m^3+3m-3}$

Hint; ~~Anfractuosanfanation~~ Going by d Short cut. take d highest power of d variable (m) i.e m^4 and compare their coefficient
Mind you this is only applicable if and if a variable tends to ∞ i.e $m \to \infty$

PART B

DIFFERENTIATION

NOTE:- Differentiation is linear stuff (100%) but you have to be very careful when differentiating because it's well with whatever way you decide to take (i.e if you differentiate rubbish you will still see your rubbish answer.

Again! be careful when differentiating.

① find $\frac{d}{dx}$ of $5e^{\sin x}$

Ans $5\cos x\, e^{\sin x}$

[Hint; (function of a function) then by going with d shortcut, differentiate the first function as if d other other one doesn't exist (i.e keep it) then go to d second function and differentiate then take their product (i.e $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$)]

② what is second derivative (y'') of $y = px^q$

Ans $pq(q-1)x^{(q-1)(q-2)}$

[Hint; Apply the general monomial formula [i.e nax^{n-1}]]

③ $y = 3x^3 + 9x^2 + 8x - 4$

find $\frac{d^3y}{dx^3}$

Ans 18

[Hint; Differentiate d function 3 times]

④ find $\frac{dy}{dx}$ if $y = \frac{4}{\sqrt[3]{x^2}}$

Ans $\frac{-8}{3\sqrt[3]{x^5}}$

[Hint; change the question form to a differentiable one then differentiate and change your answer back to d initial form]

⑤ find d differential coefficient of $y = 4x^2 \tan x$

Ans $4x(x\sec^2 x + 2\tan x)$

[Hint; Mind you differential coefficient also means derivative And this function is an UV function (Product Rule). Then - going by d shortcut, leave d 1st function and differentiate d second one + leave d second one and differentiate d 1st one i.e $\frac{dy}{dx} = u\frac{dv}{dx} + v\frac{du}{dx}$]

(6) If $y = p(x)q(x)$ find y'

[Hint; product Rule]

Ans $p(x)\frac{dq(x)}{dx} + q(x)\frac{dp(x)}{dx}$

(7) Find d derivative of $\cos(\sin x)$

[Hint; mind you we're applying chain rule here because it's just a single variable]

Ans $-\sin^2 x \cos x$

8) Find y' if $y = 4\cos(7x+2)$

[Hint; A Chain Rule function Apply your short cut]

Ans $-28\sin(7x+2)$

(9) If $y = \frac{1+x}{1-x}$ find $\frac{dy}{dx}$

[Hint; A quotient function, then apply your Shortcut i.e leave d denomerator, differentiate d numerator — (minus) leave d numerator, differentiate d denomerato everything divided by d denomerator square (i.e $\frac{V\frac{dy}{dx} - U\frac{dy}{dx}}{V^2}$)]

Ans $\frac{2}{(1-x)^2}$

10) Find $\frac{dy}{dx}$ if $y = (mx+b)^n$

[Hint; A Chain Rule function then apply your Shortcut]

Ans $nm(mx+b)^{n-1}$

11) Find the differential coefficient of $x^3\sin x$

[Hint; A product function then apply your Shortcut]

Ans $x^2(x\cos x + 3\sin x)$

NOTE;
Recall dat students are expected to solve these for building his/her confidence and for improvement.
I'm very sure you are getting this, if NO then whatsapp (09061421379)

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12) find y' if $y = \ln(3-4\cos x)$

Ans $\dfrac{4\sin x}{3-4\cos x}$

{Hint; A chain Rule function then apply your Shortcut}

98) find m' if $m = \dfrac{\sin x}{x^2}$

Ans $\dfrac{x(\cos x - 2\sin x)}{x^4}$

{Hint; A quotient function then apply your shortcut}

14) Find $\dfrac{dy}{dx}$ if $y = x^3 e^{2x}$

Ans $x^2 e^{2x}(2x+3)$

{Hint; A product Function (product Rule) den apply your shortcut}

15) Find $\dfrac{dy}{dx}$ of $x^2+2xy+3y^2=4$

Ans $-\dfrac{(x+y)}{x+3y}$

{Hint; Implicit function Don't forget dat when differentiating y it will follow by $\frac{dy}{dx}$ then collect d likes term and get your $\frac{dy}{dx}$. (Simple)}

16) If $y = \dfrac{p(x)}{q(x)}$ find y'

Ans $\dfrac{q\frac{dp}{dx} - p\frac{dq}{dx}}{q^2}$

{Hint; A quotient Function den compare it with $\frac{u}{v}$ and differentiate}

17) find d slope of d curve $x^2-xy+y^2=7$ at $x=3, y=2$

Ans -4

{Hint; firstly apply implicit rule then Substitute d value of x and y after differentiating}

NOTE;
Also Students are not allow 2 memorize these answers Study them well and make use of them incase You are dealing with the same set of questions but of different Variable

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18) $y = \frac{\sin 2x}{2x+5}$ find y'

Ans $\frac{2(2x+5)\cos 2x - 2\sin 2x}{(2x+5)^2}$

{Hint; A quotient function
Apply your Shortcut}

19) Find d derivative of $(4x-3)^5$

Ans $20(4x-3)^4$

{Hint; A Chain function
Apply your Shortcut}

20) If $y = \sin^2(2x^2+4)^4$ find y'

Ans $32x \sin(2x^2+4)^4 \cos(2x^2+4)^4 (2x^2+4)^3$

{Hint; A Chain function
Apply your Shortcut
It's simple now (LoL)}

21) If $y = \sin^{-1} x$ find y'

Ans $\frac{1}{\sqrt{1-x^2}}$

{Hint; derivative of inverse trigonometric function. Then by shortcut ←}

NOTE;

$\sin^{-1} x = \frac{1}{\sqrt{1-x^2}}$

$\cos^{-1} x = \frac{-1}{\sqrt{1-x^2}}$

$\tan^{-1} x = \frac{1}{1+x^2}$

& hyperbolic function

$\sinh^{-1} x = \frac{1}{\sqrt{1+x^2}}$

$\cosh^{-1} x = \frac{1}{\sqrt{x^2-1}}$

$\tanh^{-1} x = \frac{1}{\sqrt{1-x^2}}$

22) If $y = \cosh^{-1} 3-2x$ find y'

Ans $\frac{-2}{\sqrt{(3-2x)^2-1}}$

{Hint; derivative of inverse hyperbolic function. Then by Shortcut $\cosh^{-1} u = \frac{1}{\sqrt{u^2-1}}$ then apply Chain Rule.
As simple as that (100%)✓}

23) If $x^2+y^2 = 5$ find $\frac{dy}{dx}$

Ans $-\frac{x}{y}$

{Hint; An implicit function. Don't forget add $\frac{dy}{dx}$ when differentiating y, try to collect the like terms then find or make $\frac{dy}{dx}$ the subject of d formula}

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24) The equivalent 2 d forth derivation of $y = \sin x$

Ans y

{ mind you if you differentiate sinx four times, you will still get sinx and which is = y my bro and sis 2 No time O!!!

25) If $y = 3u^4 + 2u^3 + 8u + 8$
find $\frac{d^3y}{du^3}$

Ans 72u

{ Hint; Differentiate d function 3 times
Note; $\frac{d^3y}{du^3} = y'''$

26) If $y = 3\tan^2 2x$ Find y'

Ans $12 \tan 2x \sec^2 2x$

{ Hint; Chain function
Apply d shortcut and get your answer

27) If $y = \sin^{-1} x^2$ find y'

Ans $\frac{2x}{\sqrt{1-(x^2)^2}}$

{ Hint; Inverse trig function
Apply d shortcut

28) find d/derivative of $xy = 1$

Ans $-\frac{y}{x}$

{ Hint; Implicit function
Apply d normal process and get your $\frac{dy}{dx}$

29) If $y = \ln x^2$ find y'

Ans $\frac{2}{x}$

{ Hint; Chain function
Apply d shortcut

30) If $y = x^5 e^x$ find y'

Ans $x^4 e^x (x+5)$

{ Hint; A product function
Apply d shortcut

Please make sure you attempt them and compare your answers with mine. In case any of it is not correct, fine - Put the correct one (Nobody is above mistake)

WISHING YOU GUYS ALL THE VERY BEST!!!

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