ultimate kcet crash course 2026

maths

methods of differentiation

DPP: 2

Q1 If $y = \log_{10} x + \log_x 10 + \log_x x + \log_{10} 10$, then $\frac{dy}{dx} =$

(A) $\frac{1}{x \log_e 10} - \frac{\log_e 10}{x(\log_e x)^2}$

(B) $\frac{1}{x \log_e 10} - \frac{1}{x \log_{10} e}$

(C) $\frac{1}{x \log_e 10} + \frac{\log_e 10}{x(\log_e x)^2}$

(D) None of these

Q2 If $x^y = e^{x-y}$ then $\frac{dy}{dx} =$

(A) $\frac{\log x}{1+\log x}$

(B) $\frac{\log x}{(1+\log x)^2}$

(C) $\frac{-\log x}{(1+\log x)^2}$

(D) $\frac{-\log x}{1+\log x}$

Q3 If $y = 2^{2^x}$ then $\frac{dy}{dx} =$

(A) $y \times (\log 2)^2 \times 2^x$

(B) $y (\log 2) \times 2^x$

(C) $y^2 (\log 2)^2 \times 2^x$

(D) $-y (\log 2) \times 2^x$

Q4 If $y = \log\left(\frac{e^x}{1+e^x}\right)$ then $\frac{dy}{dx} =$

(A) $\frac{1}{e^x+1}$ (B) $\frac{1+e^x}{e^x}$

(C) $\frac{1}{e^x}$ (D) $\frac{e^x}{1+e^x}$

Q5 $\frac{d}{dx}\log_{\sqrt{x}}(1/x)$ is equal to

(A) $-\frac{1}{2\sqrt{x}}$ (B) –2

(C) $-\frac{1}{x^2\sqrt{x}}$ (D) 0

Q6 $\frac{d}{dx}\left(x^{\log_e x}\right) =$

(A) $2x^{(\log_e x - 1)} \cdot \log_e x$

(B) $x^{(\log_e x - 1)}$

(C) $\frac{2}{x}\log_e x$

(D) $x^{(\log_e x - 1)} \cdot \log_e x$

Q7 If $x^y \cdot y^x = 1$, then $\frac{dy}{dx} =$

(A) $\frac{y(y+x\log y)}{x(y\log x+x)}$

(B) $\frac{y(x+y\log x)}{x(y+x\log y)}$

(C) $-\frac{y(y+x\log y)}{x(x+y\log x)}$

(D) None of these

Q8 If $f(x) = (x-1)(x-2)(x-3)$ then $f'(0)$ is equal to

(A) 0 (B) 1

(C) 6 (D) 11

Q9 If $y = (\sin x)^{\tan x}$, then dy/dx is equal to

(A) $(\sin x)^{\tan x} \cdot \left(1 + \sec^2 x \cdot \log\sin x\right)$

(B) $\tan x \cdot (\sin x)^{\tan x - 1} \cdot \cos x$

(C) $(\sin x)^{\tan x} \cdot \sec^2 x \cdot \log\sin x$

(D) $\tan x \cdot (\sin x)^{\tan x - 1}$

Q10 If $y = \sqrt{x}^{\sqrt{x}^{\sqrt{x}\ldots\infty}}$, then $\frac{dy}{dx} =$

(A) $\frac{y^2}{2[x - xy\log x]}$

(B) $\frac{y^2}{2x+\log x}$

(C) $\frac{y^2}{2x+2y\log x}$

(D) None of these

Q11 Differentiate $(4)^{\log_2 \sin x} + (9)^{\log_3 \cos x}$ w.r.t. x.

(A) 0 (B) 1

(C) sin x + cos x (D) –1

Q12 If $y = x^{\sin x}$ then $\frac{dy}{dx} =$

(A) $y\left(\cos x \cdot \log x - \frac{\sin x}{x}\right)$

(B) $y\left(\cos x \cdot \log x + \frac{\sin x}{x}\right)$

(C) $y\left(\log x - \frac{\sin x}{x}\right)$

(D) $\frac{y}{x}$

Q13 If $y = a^{a^x}$ then $\frac{dy}{dx} =$

(A) y. a^x $(\log a)^2$ (B) y. a^x .log a

(C) $(y.a^x)^2$ (D) $(y.a^x)$

Q14 $\frac{d}{dx}\left[\log\left(\sqrt{x-a}+\sqrt{x-b}\right)\right] =$

(A) $\frac{1}{2\left[\sqrt{(x-a)}+\sqrt{(x-b)}\right]}$

(B) $\frac{1}{2\sqrt{(x-a)(x-b)}}$

(C) $\frac{1}{\sqrt{(x-a)(x-b)}}$

(D) None of these

Q15 If $f(x)=\left(\log_{\cot x} \tan x\right)\left(\log_{\tan x} \cot x\right)$, then $f'(2)=$

(A) 2 (B) 0

(C) 1/2 (D) –2

Q16 $\frac{d}{dx}\{x^n . \log x\}=$

(A) x^n (1+ n log x)

(B) x^{n-1} (1+ n log x)

(C) x^{n-1} (1- n log x)

(D) x^{n-1} (1– n log x)

Q17 The derivative of y = $x^{\ln x}$ is

(A) $x^{\ln x}$ ln x

(B) $x^{\ln x-1}$ ln x

(C) $2x^{\ln x-1}$ ln x

(D) $x^{\ln x-2}$

Q18 If y = log (sin (x^2)), 0 < x < π/2, then dy/dx at x = √π/2.

(A) 0 (B) 1

(C) π/4 (D) $\sqrt{\pi}$

Q19 If $y = x^{2x}$ then $\frac{dy}{dx} =$

(A) y(1+ log x) (B) 2y(1 + log x)

(C) 2y(1 - log x) (D) y(1 + 2 log x)

Q20 If $y = 2^{\frac{x}{\log x}}$, then $\frac{dy}{dx}$ at $x = e$ is

(A) e (B) $2^e\log_2$

(C) $\log_2$ (D) 0

Q21 $\frac{d}{dx}\left\{e^{n(\log(a+x)-\log(a-x))}\right\}=$

(A) $2an\left(\frac{a+x}{a-x}\right)^{n-1}$

(B) $\frac{-2an(a+x)^{n-1}}{(a-x)^{n+1}}$

(C) $\frac{2an(a+x)^{n-1}}{(a-x)^{n+1}}$

(D) $an\left(\frac{a+x}{a-x}\right)^{n}$

Q22 $\frac{d}{dx}[\log\{\log(\log x)\}]=$

(A) $\frac{1}{x \log x \log(\log x)}$

(B) $\frac{-1}{x \log x \log(\log x)}$

(C) $\frac{x}{x \log x \log(\log x)}$

(D) $\frac{\log x}{x \log x \log(\log x)}$

Q23 $\frac{d}{dx}\left\{\log\left(x+\sqrt{a^2+x^2}\right)\right\}=$

(A) $\frac{1}{\left(x+\sqrt{a^2+x^2}\right)}$ (B) $\frac{x}{\sqrt{a^2+x^2}}$

(C) $\frac{1}{x\left(x+\sqrt{a^2+x^2}\right)}$ (D) $\frac{1}{\sqrt{a^2+x^2}}$

Q24 If $y = \sqrt{(x+5)(x-3)(x-4)}$. Find $\frac{dy}{dx}$ at $x = 2$.

(A) $-\frac{19}{2\sqrt{14}}$ (B) $\frac{19}{2\sqrt{14}}$

(C) $\frac{19}{\sqrt{14}}$ (D) $\frac{19}{2}$

Q25 If $y = (\sin x)^x$ then $\frac{dy}{dx} =$

(A) y{log (sin x) + x cot x}

(B) y {log (sin x) – x cot x}

(C) {log (sin x) – x cot x}

(D) {log (sin x) + x cot x}

Q26 If $y = \tan^{-1}\left(\frac{3x-2}{2x+3}\right)$ then $\frac{dy}{dx}$ is equal to

(A) $\frac{2}{1+x^2}$
(B) $\frac{3}{1+x^2}$
(C) $\frac{1}{1+x^2}$
(D) $\frac{-1}{1+x^2}$

Q27 $\frac{d}{dx}\left\{\tan^{-1}\frac{\sqrt{x}+\sqrt{a}}{1-\sqrt{ax}}\right\}=$

(A) $\frac{1}{2\sqrt{x}(1+x)}$
(B) $\frac{-1}{2\sqrt{x}(1+x)}$
(C) $\frac{2}{\sqrt{x}(1+x)}$
(D) $\frac{-2}{\sqrt{x}(1+x)}$

Q28 If $y = \cot^{-1}(\operatorname{cosec} x - \cot x)$ then $\frac{dy}{dx}$ =

(A) 1
(B) $\frac{-1}{2}$
(C) –1
(D) 0

Q29 If $y = \tan^{-1}\left(\cot\left(\frac{\pi}{2} - x\right)\right)$ then $\frac{dy}{dx}$ =

(A) 1
(B) –1
(C) 0
(D) $\frac{1}{2}$

Q30 $\frac{d}{dx}\left[\sin^2\left(\cot^{-1}\sqrt{\frac{1+x}{1-x}}\right)\right]=$

(A) 1
(B) –1
(C) $\frac{1}{2}$
(D) $\frac{-1}{2}$

Vernacular

Answer Key

Q1	A
Q2	B
Q3	A
Q4	A
Q5	D
Q6	A
Q7	C
Q8	D
Q9	A
Q10	A
Q11	A
Q12	B
Q13	A
Q14	B
Q15	B
Q16	B
Q17	C
Q18	D
Q19	B
Q20	D
Q21	C
Q22	A
Q23	D
Q24	A
Q25	A
Q26	C
Q27	A
Q28	B
Q29	A
Q30	D

Hints & Solutions

Note: scan the QR code to watch video solution

Q1 Text Solution:

$$y=\frac{\log x}{\log_e 10}+\frac{\log_e 10}{\log_e x}+\frac{\log_e x}{\log_e x}+\frac{\log_e 10}{\log_e 10}$$

$$\therefore y=\frac{\log x}{\log_e 10}+\frac{\log_e 10}{\log_e x}$$

$$\frac{dy}{dx}=\frac{1}{x\log_e 10}-\frac{\log_e 10}{x\left(\log_e x\right)^2}$$

Video Solution:

Q2 Text Solution:

Applying logarithm on both sides and then differentiating with respect to x, we get

$$\frac{\mathrm{dy}}{\mathrm{dx}}=\frac{-\log \mathrm{x}}{(1+\log \mathrm{x})^2}$$

Video Solution:

Q3 Text Solution:

Applying logarithm on both sides and then differentiating with respect to x, we get

$$\frac{\mathrm{dy}}{\mathrm{dx}}=y\left(2^x(\log 2)^2\right)$$

Video Solution:

Q4 Text Solution:

$$y=\log_e e^x-\log_e\left(1+e^x\right)$$

$$y=x-\log_e\left(1+e^x\right)$$

Now differentiating both side w.r.t x

$$\frac{dy}{dx}=\frac{1}{1+e^x}$$

Video Solution:

Q5 Text Solution:

$$f(x)=\log_{\sqrt{x}}\left(\frac{1}{x}\right)=\frac{\log\left(\frac{1}{x}\right)}{\log\sqrt{x}}=\frac{(-1)\log x}{(1/2)\log x}=-2$$

$$\Rightarrow f'(x)=0$$

Video Solution:

Q6 Text Solution:

$$\frac{d}{dx}\left(x^{\log_e x}\right)=2x^{\left(\log_e x-1\right)}\cdot\log_e x$$

Video Solution:

Q7 Text Solution:

Given $x^y \cdot y^x = 1$

Applying logarithm on both sides

$\log(x^y \cdot y^x) = \log 1$

$y \cdot \log x + x \cdot \log y = \log 1$

Differentiating w.r.t. 'x' on both sides

$\frac{y}{x} + \log x \cdot \frac{dy}{dx} + \frac{x}{y} \cdot \frac{dy}{dx} + \log y = 0$

$\therefore \frac{dy}{dx} = -\frac{y}{x} \frac{(y+x\log y)}{(x+y\log x)}$

Video Solution:

Q8 Text Solution:

$f(x) = (x-1)(x-2)(x-3)$

Applying logarithm on both sides and differentiating we get

$f'(x) = f(x)\left[\frac{1}{x-1} + \frac{1}{x-2} + \frac{1}{x-3}\right]$

$f'(0) = 11$

Video Solution:

Q9 Text Solution:

Given $y = (\sin x)^{\tan x}$

log y = tan x log (sin x)

Differentiating both sides w.r.t. x

$\frac{1}{y}\frac{dy}{dx} = 1 + \sec^2 x \cdot \log(\sin x)$

$\therefore \frac{dy}{dx} = (\sin x)^{\tan x}\left[1 + \sec^2 x \cdot \log(\sin x)\right]$

Video Solution:

Q10 Text Solution:

Let $y = \left(\sqrt{x}\right)^y$

$\Rightarrow \log y = y \cdot \left(\log\left(\sqrt{x}\right)\right)$

$\frac{1}{y}\frac{dy}{dx} = y \cdot \frac{1}{\sqrt{x}} \cdot \frac{1}{2\sqrt{x}} + \log\sqrt{x} \cdot \frac{dy}{dx}$

$\frac{dy}{dx}\left(\frac{1}{y} - \log\sqrt{x}\right) = \frac{y}{2x}$

$\Rightarrow \frac{dy}{dx}\left[\frac{1-y\log\sqrt{x}}{y}\right] = \frac{y}{2x}$

$\therefore \frac{dy}{dx} = \frac{y^2}{2\left[x-xy\log\sqrt{x}\right]}$

Video Solution:

Q11 Text Solution:

Let $f(x) = 4^{\log_2 \sin x} + 9^{\log_3 \cos x}$

$= \sin x^{\log_2^4} + \cos x^{\log_3^9}$

$f(x) = (\sin x)^2 + (\cos x)^2$

$f'(x) = 2\sin x \ \cos x - 2\cos x \ \sin \ x$

$f'(x) = 0$

Video Solution:

Q12 Text Solution:

Applying logarithm on both the sides and differentiating with respect to x

$\frac{dy}{dx} = y\left(\cos x . \log x + \frac{\sin x}{x}\right)$

Video Solution:

Q13 Text Solution:

$y = a^{a^x}$

Applying Logarithm on both sides we get

$\log y = a^x \log a$

Differentiating both sides with respect to x.

$\frac{1}{y}\frac{dy}{dx} = a^x . (\log a)^2$

$\frac{dy}{dx} = y . a^x . (\log a)^2$

Video Solution:

Q14 Text Solution:

$\frac{d}{dx}\left[\log\left(\sqrt{x-a} + \sqrt{x-b}\right)\right]$

$= \frac{1}{\sqrt{x-a}+\sqrt{x-b}} \times \left\{\frac{1}{2\sqrt{x-a}} + \frac{1}{2\sqrt{x-b}}\right\}$

$= \frac{1}{2\sqrt{x-a}.\sqrt{x-b}} = \frac{1}{2\sqrt{(x-a)(x-b)}}$

Video Solution:

Q15 Text Solution:

Obviously.

$f(x) = \left(\log_{\cot x} \tan x\right)^2$

$= \left(\log_{\cot x} (\cot x)^{-1}\right)^2 \Rightarrow f'(x) = 0$

$\Rightarrow f'(2) = 0$

Video Solution:

Q16 Text Solution:

The required differentiation is x^{n-1} (1+ *n* log *x*)

Video Solution:

Q17 Text Solution:

y = $x^{\ln x}$

Applying ln on both sides

ln y = ln x . ln x

ln y = $(\ln x)^2$

Differentiating w.r.t. 'x' on both sides

$\frac{1}{y}\frac{dy}{dx} = 2\ln(x)\cdot\frac{1}{x}$

$\therefore \frac{dy}{dx} = 2x^{\ln x-1}\cdot\ln x$

Video Solution:

Q18 Text Solution:

$y = \log\sin(x^2)$

$\frac{dy}{dx} = 2x\ \cot(x^2)$

At $x = \frac{\sqrt{\pi}}{2}$

$\frac{dy}{dx} = 2\left(\frac{\sqrt{\pi}}{2}\right)\ \cot\left(\frac{\pi}{4}\right) = \sqrt{\pi}$

Video Solution:

Q19 Text Solution:

Applying logarithm on both the sides and differentiating with respect we get

$\frac{dy}{dx} = 2y\left(1 + \log x\right)$

Video Solution:

Q20 Text Solution:

$\frac{dy}{dx} = y.\log_{e^2}\left(\frac{\log_e x-1}{(\log_e x)^2}\right)$

then at x = e

$\frac{dy}{dx} = 0$

Video Solution:

Q21 Text Solution:

$\frac{d}{dx}\left\{e^{n(\log(a+x)-\log(a-x))}\right\} = \frac{2an(a+x)^{n-1}}{(a-x)^{n+1}}$

Video Solution:

Q22 Text Solution:

The required differentiation is $\frac{1}{x\log x\log(\log x)}$

Video Solution:

Q23 Text Solution:

The reuired differentiation is $\frac{1}{\sqrt{a^2+x^2}}$

Video Solution:

Q24 Text Solution:

$y = [(x+5)(x-3)(x-4)]^{1/2}$

Take log on B.S.

$\log y = \frac{1}{2}\log[(x+5)(x-3)(x-4)]$

$\frac{1}{y}\frac{dy}{dx} = \frac{1}{2}\left[\frac{1}{x+5} + \frac{1}{x-3} + \frac{1}{x-4}\right]$

$\frac{dy}{dx} = \frac{\sqrt{(x+5)(x-3)(x-4)}}{2}\left[\frac{1}{x+5} + \frac{1}{x-3} + \frac{1}{x-4}\right]$

$\left.\frac{dy}{dx}\right]_{x=2} = \frac{\sqrt{7(-1)(-2)}}{2}\left[\frac{1}{7} - \frac{1}{1} - \frac{1}{2}\right]$

$= \frac{\sqrt{14}}{2}\left[\frac{2-14-7}{14}\right]$

$= \frac{\sqrt{14}}{2}\left[\frac{-19}{14}\right] = \frac{-19}{2\sqrt{14}}$

Video Solution:

Q25 Text Solution:

Applying logarithm on both the sides and differentiating with respect we get

$\frac{dy}{dx} = y\left\{\log\left(\sin x\right) + x\cot x\right\}$

Video Solution:

Q26 Text Solution:

By using the formula

$\tan^{-1} x - \tan^{-1} y = \tan^{-1}\left(\frac{x-y}{1+xy}\right)$

Video Solution:

Q27 Text Solution:

$\frac{d}{dx}\left\{\tan^{-1}\frac{\sqrt{x}+\sqrt{a}}{1-\sqrt{ax}}\right\} = \frac{1}{2\sqrt{x}(1+x)}$

Video Solution:

Q28 Text Solution:

$y = \cot^{-1}(\operatorname{cosec} x - \cot x) = \cot^{-1}\left(\cot\left(\frac{\pi}{2} - \frac{x}{2}\right)\right) = \frac{\pi}{2} - \frac{x}{2}$

$dy/dx = \frac{-1}{2}$

Video Solution:

Q29 Text Solution:

$y = \tan^{-1}\left(\cot\left(\frac{\pi}{2} - x\right)\right) = y = \tan^{-1}(\tan x)$

$= x$

$\frac{dy}{dx} = 1$

Video Solution:

Q30 **Text Solution:**

put x=$put\ x=\cos\theta$

$$\sin^2\left(cot^{-1}\sqrt{\frac{1+\cos\theta}{1-\cos\theta}}\right)=$$

$$\sin^2\left(\frac{\theta}{2}\right)$$

$$\frac{d}{dx}\left(\sin^2\left(\frac{\cos^{-1}x}{2}\right)\right)=\frac{-1}{2}$$

Video Solution: