Ultimate KCET Crash Course 2026

Maths

DPP: 1

Trigonometry and ITF for Differentiation and Integration

Q1 $\frac{d}{dx}\left\{\sec^{-1}\frac{\sqrt{x}+1}{\sqrt{x}-1}+\sin^{-1}\frac{\sqrt{x}-1}{\sqrt{x}+1}\right\}=$

(A) –1 (B) 0

(C) 1 (D) 2

Q2 If $y=\sin^{-1}\sqrt{\frac{1-x}{2}}$ then $\frac{dy}{dx}=$

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

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

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

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

Q3 If $y=\tan^{-1}\left(\frac{2x-3}{3x+2}\right)$ 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) None of these

Q4 If $y=\sin^{-1}\left[\frac{3\cos x-4\sin x}{5}\right]$, then y' is

(A) 1 (B) –1

(C) 3 (D) 4

Q5 $\frac{d}{dx}\left\{\tan^{-1}\left(\frac{a\sin x+b\cos x}{a\cos x-b\sin x}\right)\right\}=$

(A) 0 (B) 1

(C) –1 (D) $\frac{1}{1+x^2}$

Q6 If $y=\sin^{-1}\left[\frac{\sqrt{1+x}-\sqrt{1-x}}{2}\right]$ then $\frac{dy}{dx}$ is

(A) $\frac{1}{\sqrt{1-x}}$

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

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

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

Q7 if $y=t\,an^{-1}\left(\frac{(3-x)\sqrt{x}}{1-3x}\right)$ then $\frac{dy}{dx}$

(A) $\frac{3}{(1+x)\sqrt{x}}$ (B) $\frac{3}{2(1+x)\sqrt{x}}$

(C) $\frac{-3}{2(1+x)\sqrt{x}}$ (D) 0

Q8 If $y=\tan^{-1}\left(\cot\left(\frac{\pi}{2}-x\right)\right)$ then $\frac{dy}{dx}=$

(A) 1 (B) –1

(C) 0 (D) $\frac{1}{2}$

Q9 If $y=\sin^{-1}(\cos x)$ then $\frac{dy}{dx}=$

(A) 1 (B) –1

(C) 0 (D) 2

Q10 $\frac{d}{dx}\left[\tan^{-1}\left(\frac{a-x}{1+ax}\right)\right]$ is

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

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

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

(D) $\frac{1}{1+a^2}-\frac{1}{1+x^2}$

Q11 If $f(x)=\tan^{-1}(\tan 2x)$ then $f(1)$ and $f'(1)$ are respectively

(A) 1, –2 (B) 2, 2

(C) 0. 2 (D) $\frac{1}{2}$, 1

Q12 $\frac{d}{dx}\left(x\sqrt{a^2-x^2}+a^2\sin^{-1}\frac{x}{a}\right)=$

(A) $\sqrt{a^2-x^2}$ (B) $2\sqrt{a^2-x^2}$

(C) $\sqrt{a^2+x^2}$ (D) $2\sqrt{a^2+x^2}$

Q13 $\frac{d}{dx}\left\{\tan^{-1}\frac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right\}=$

(A) 0 (B) 1

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

Q14 If $y = \cot^{-1}\left[\frac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right]$ where $0 < x < \frac{\pi}{2}$, then $\frac{dy}{dx}$ is equal to

(A) 1/2

(B) 2

(C) sin x + cos x

(D) sin x – cos x

Q15 If $y = \cos^{-1}\left(\frac{x-x^{-1}}{x+x^{-1}}\right)$ then y' is

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

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

Q16 $\frac{d}{dx}\left(\cot^{-1}\left(\frac{3-2\tan x}{2+3\tan x}\right)\right) =$

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

(C) 0 (D) 1

Q17 Differential coefficient of sec ($\tan^{-1} x$) w.r.t. x is

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

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

Q18 If $y = \cot^{-1}$ (cosec x – cot x) then $\frac{dy}{dx}$ =

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

(C) –1 (D) 0

Q19 If $y = \sin^{-1}\left(\frac{19}{20}x\right)+\cos^{-1}\left(\frac{19}{20}x\right)$, then $\frac{dy}{dx}$ =

(A) 0 (B) 1

(C) –1 (D) None of these

Q20 $\frac{d}{dx}\left\{\tan^{-1}\frac{\sqrt{x}+\sqrt{a}}{1-\sqrt{ax}}\right\} =$

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

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

Q21 $\int \frac{1+\cos^2 x}{1+\cos 2x}dx =$

(A) tan x – x + c

(B) cot x + x + c

(C) $\frac{\tan x}{2} + x + c$

(D) $\frac{1}{2}(\tan x + x)+c$

Q22 $\int \sqrt{1+\sin 2x}\,dx$ if $x \in \left(\frac{\pi}{2}, \frac{3\pi}{4}\right) =$

(A) sin x – cos x + c

(B) sin x + cos x + c

(C) cos x – sin x + c

(D) $\frac{(\sin x+\cos x)^2}{2} + c$

Q23 $\int \frac{1}{1+\sin ax}dx =$

(A) $\frac{1}{a}[\tan ax - \sec ax]+c$

(B) $\frac{1}{a}[\text{cosec}ax - \cot ax]+c$

(C) $\frac{1}{2}[\sec ax - \cot ax]+c$

(D) $2\tan\left(\frac{ax}{2}\right)+c$

Q24 $\int \frac{1}{\cos^2 x(1-\tan x)^2}dx$

(A) $\frac{1}{\tan x-1} + c$

(B) $\frac{1}{1-\tan x} + c$

(C) $-\frac{1}{3}\frac{1}{(1-\tan x)^3} + c$

(D) none of these

Q25 $\int x^{51}\left(\tan^{-1}x + \cot^{-1}x\right)dx =$

(A) $\frac{x^{52}}{52}\left(\tan^{-1}x + \cot^{-1}x\right)+c$

(B) $\frac{x^{52}}{52}\left(\tan^{-1}x - \cot^{-1}x\right)+c$

(C) $\frac{\pi x^{52}}{104} + \frac{\pi}{2} + c$

(D) None of these

Q26 $\int \frac{\cos 2x+2\sin^2 x}{\cos^2 x}dx =$

(A) 2 sec x + c (B) 2 tan x + c

(C) tan x + c (D) None of these

Q27 $\int e^x(1+x)\cos^2(xe^x)dx$ is equal to

(A) $\frac{1}{2}xe^x + \frac{1}{4}\sin(2xe^x)+c$

(B) $\frac{1}{2}xe^x - \frac{1}{4}\sin(2xe^x)+c$

(C) $\frac{1}{2}xe^x + \frac{1}{2}\sin(2xe^x)+c$

(D) $\frac{1}{2}xe^x - \frac{1}{2}\sin(2xe^x)+c$

Q28 $\int \frac{dx}{1+\cos x-\sin x}$ is equal to

(A) $\log\left|\frac{\cos(x/2)}{\cos(x/2)-\sin(x/2)}\right|+c$

(B) log |1 + tan x/2| + c

(C) log |1 - tan x/2| + c

(D) log |1 - cot x/2| + c

Q29 $\int \frac{dx}{\sin x+\sqrt{3}\cos x} =$

(A) $\log\left|\tan\left(\frac{x}{2}+\frac{\pi}{2}\right)\right|+c$

(B) $\frac{1}{2}\log\left|\tan\left(\frac{x}{2}+\frac{\pi}{6}\right)\right|+c$

(C) $\log\left|\cot\left(\frac{x}{2}+\frac{\pi}{6}\right)\right|+c$

(D) $\frac{1}{2}\log\left|\cot\left(\frac{x}{2}+\frac{\pi}{6}\right)\right|+c$

Q30 $\int \frac{dx}{\sin x+\cos x} =$

(A) $\log\tan\left(\frac{\pi}{8}+\frac{x}{2}\right)+c$

(B) $\log\tan\left(\frac{\pi}{8}-\frac{x}{2}\right)+c$

(C) $\frac{1}{\sqrt{2}}\log\tan\left(\frac{\pi}{8}+\frac{x}{2}\right)+c$

(D) None of these

Answer Key

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

Hints & Solutions

Note: scan the QR code to watch video solution

Q1 Text Solution:

$$\frac{d}{dx}\left\{\sec^{-1}\frac{\sqrt{x}+1}{\sqrt{x}-1}+\sin^{-1}\frac{\sqrt{x}-1}{\sqrt{x}+1}\right\}$$

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

$$=0$$

Video Solution:

Q2 Text Solution:

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

Use substitution $x = \cos\theta \Rightarrow \theta$

$$=\cos^{-1}x$$

$$y=\theta/2=\frac{\cos^{-1}x}{2}$$

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

Video Solution:

Q3 Text Solution:

$$y=\tan^{-1}\left(\frac{3x-2}{2x+3}\right)=\tan^{-1}\frac{x-\frac{2}{3}}{1+\frac{2x}{3}}$$

$$=\tan^{-1}x-\tan^{-1}\frac{2}{3}$$

$$\therefore \frac{dy}{dx}=\frac{1}{1+x^2}-0=\frac{1}{1+x^2}.$$

Video Solution:

Q4 Text Solution:

$$\frac{3}{5}\cos x-\frac{4}{5}\sin x=\sin\theta\cos x-\cos\theta\sin x$$

$$=\sin\left(\theta-x\right)$$

$$Now,\ y=\sin^{-1}\left[\sin\left(\theta-x\right)\right]$$

$$\Rightarrow y=\theta-x$$

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

Video Solution:

Q5 Text Solution:

$\frac{d}{dx}\left\{\tan^{-1}\left(\frac{a\sin x+b\cos x}{a\cos x-b\sin x}\right)\right\}$

Dividing Nr and Dr both by acosx

$$\frac{d}{dx}\left\{\tan^{-1}\left(\frac{\frac{asinx+bcosx}{acosx}}{\frac{acosx-bsinx}{acosx}}\right)\right\}$$

$$=\frac{d}{dx}\left\{\tan^{-1}\left(\frac{tanx+\frac{b}{a}}{1-\frac{b}{a}tanx}\right)\right\}$$

$$=\frac{d}{dx}\left\{\tan^{-1}(tanx)+\tan^{-1}(b/a)\right\}$$

$$=\frac{d}{dx}\left\{x+b/a\right\}=1$$

Video Solution:

Q6 **Text Solution:**

$y=\sin^{-1}\left[\frac{\sqrt{1+x}-\sqrt{1-x}}{2}\right]=\frac{1}{2\sqrt{1-x^2}}$

Video Solution:

Q7 **Text Solution:**

Let $\sqrt{x}=\tan\theta\Rightarrow\theta=\tan^{-1}\sqrt{x}$

Also, $x=\tan^2\theta$ & $x\sqrt{x}=\tan^3\theta$

$y = = t\,an^{-1}\left(\frac{3\tan\theta-\tan^3\theta}{1-3\tan^2\theta}\right)$

$=t\,an^{-1}\left(\tan 3\theta\right)=3\theta$

$y=3\tan^{-1}\sqrt{x}$

$\frac{dy}{dx}=\frac{3}{2(1+x)\sqrt{x}}$

Video Solution:

Q8 **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:

Q9 **Text Solution:**

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

$Hence,\ \frac{dy}{dx}=-1$

Video Solution:

Q10 **Text Solution:**

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

Now differentiating both sides w.r.t 'x'

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

Video Solution:

Q11 **Text Solution:**

$f(x)=2x \Rightarrow f(1)=2$

&

$f'(x)=2 \Rightarrow f'(1)=2$

Video Solution:

Q12 **Text Solution:**

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

$=2\sqrt{a^2-x^2}$

Video Solution:

Q13 **Text Solution:**

$\frac{d}{dx}\left\{\tan^{-1}\frac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right\}$

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

$\Rightarrow \frac{d}{dx}\left\{\tan^{-1}\left(\tan\left(\frac{\pi}{2}-\frac{x}{2}\right)\right)\right\}$

$\Rightarrow \frac{d}{dx}\left(\frac{\pi}{2}-\frac{x}{2}\right)=\frac{-1}{2}$

Video Solution:

Q14 **Text Solution:**

$\sqrt{1+\sin x}$

$=\sqrt{\sin^2\frac{x}{2}+\cos^2\frac{x}{2}+2\sin\frac{x}{2}\cos\frac{x}{2}}=\cos\frac{x}{2}+\sin\frac{x}{2}$

Similarly; $\sqrt{1-\sin x}=\cos\frac{x}{2}-\sin\frac{x}{2}$

$\therefore \sqrt{1+\sin x}=\sqrt{1-\sin x}=2\cos\frac{x}{2}$

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

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

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

Video Solution:

Q15 **Text Solution:**

Given that : $y=\cos^{-1}\left(\frac{x-x^{-1}}{x+x^{-1}}\right)$

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

$y=\cos^{-1}\left(\frac{x^2-1}{x^2+1}\right)$

$y=\cos^{-1}\left(\frac{-(1-x^2)}{1+x^2}\right)$

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

Take $x = \tan\theta \Rightarrow \theta = \tan^{-1} x$

$y = \pi - \cos^{-1}\left(\frac{1-\tan^2\theta}{1+\tan^2\theta}\right)$

$y = \pi - \cos^{-1}(\cos 2\theta)$

$y = \pi - 2\theta$

$y = \pi - 2\tan^{-1} x \Rightarrow \frac{dy}{dx} = \frac{-2}{1+x^2}$

Video Solution:

Q16 **Text Solution:**

$\frac{d}{dx}\left(\cot^{-1}\left(\frac{3-2\tan x}{2+3\tan x}\right)\right) = 1$

Video Solution:

Q17 **Text Solution:**

$\frac{d}{dx}\left[sec\left(\tan^{-1} x\right)\right]$

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

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

Video Solution:

Q18 **Text Solution:**

y = $\cot^{-1}$ (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:

Q19 **Text Solution:**

$y = \sin^{-1}\left(\frac{19x}{20}\right) + \cos^{-1}\left(\frac{19x}{20}\right) = \frac{\pi}{2}$

– by property of ITF

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

Video Solution:

Q20 **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:

Q21 **Text Solution:**

$$\int \frac{1+\cos^2 x}{1+\cos 2x} = \int \frac{1+\cos^2 x}{2\cos^2 x} = \frac{1}{2}$$

$$\int \left(\frac{1}{\cos^2 x} + 1\right) dx = \frac{1}{2}\int \left(sec^2 x + 1\right) dx$$

$$= \frac{1}{2}\left(\tan x + x\right) + C$$

Video Solution:

Q22 **Text Solution:**

$$\int \sqrt{1+\sin 2x}\, dx =$$

$$\int \sqrt{\sin^2 x + \cos^2 x + 2\sin x.\cos x}\, dx$$

$$= \int \sqrt{(\cos x + \sin x)^2}$$

$$= \int \cos x\, dx + \int \sin x\, dx$$

$$= \sin x - \cos x + C$$

Video Solution:

Q23 **Text Solution:**

$$\int \frac{1}{1+\sin ax}\, dx = \frac{1}{a}\left[\tan ax - secax\right] + C$$

Video Solution:

Q24 **Text Solution:**

$$\int \frac{1}{\cos^2 x(1-\tan x)^2} dx = \int \frac{\sec^2 x dx}{(\tan x - 1)^2}$$

Put $\tan x - 1 = t \Rightarrow \sec^2 x dx$

$= dt$, then it reduces to

$$\int \frac{1}{t^2} dt = \frac{-1}{\tan x - 1} + c = \frac{1}{1-\tan x} + c$$

Video Solution:

Q25 **Text Solution:**

$$\int x^{51}\left(\tan^{-1} x + \cot^{-1} x\right) dx = \int x^{51} \cdot \frac{\pi}{2} dx$$

$$\left\{\because \tan^{-1} x + \cot^{-1} x = \frac{\pi}{2}\right\}$$

$$= \frac{\pi x^{52}}{104} + c = \frac{x^{52}}{52}\left(\tan^{-1} x + \cot^{-1} x\right) + c$$

Video Solution:

Q26 **Text Solution:**

$$\int \frac{\cos 2x + 2\sin^2 x}{\cos^2 x} dx = \int \frac{2\cos^2 x - 1 + 2\sin^2 x}{\cos^2 x} dx$$

$$= \int \sec^2 x dx = \tan x + c$$

Video Solution:

Q27 **Text Solution:**

Let $I = \int e^x(1+x)\cos^2(xe^x)dx$

Put $xe^x = t \Rightarrow e^x(1+x)dx = dt$

$\therefore I = \int \cos^2 t\, dt = \int\left(\frac{1+\cos 2t}{2}\right)dt = \frac{t}{2} + \frac{\sin 2t}{4} + c$

$= \frac{1}{2}xe^x + \frac{1}{4}\sin(2xe^x) + c$

Video Solution:

Q28 **Text Solution:**

$I = \int \frac{dx}{2\cos^2\frac{x}{2} - 2\sin\frac{x}{2}\cos\frac{x}{2}}$

$I = \int \frac{\frac{1}{2}\sec^2\frac{x}{2}}{1-\tan\frac{x}{2}}dx$

Put $1 - \tan\frac{x}{2} = t \quad -\left(\sec^2\frac{x}{2}\right)\times\frac{1}{2}dx = dt$

$I = -\int \frac{1}{t}dt$

$= -\log|t| + c$

$= -\log\left|1 - \tan\frac{x}{2}\right| + c.$

$= \log\left|\frac{\cos x/2}{\cos x/2 - \sin\frac{x}{2}}\right| + c.$

Video Solution:

Q29 **Text Solution:**

$\int \frac{dx}{\sin x + \sqrt{3}\cos x} = \frac{1}{2}\int \frac{dx}{\frac{\sin x}{2} + \frac{\sqrt{3}}{2}\cos x}$

$= \frac{1}{2}\log\left|\tan\left(\frac{x}{2} + \frac{\pi}{6}\right)\right| + c$

Video Solution:

Q30 **Text Solution:**

$\int \frac{dx}{\sin x + \cos x} = \frac{1}{\sqrt{2}}\int \frac{dx}{\sin x\ \cos\frac{\pi}{4} + \cos x\ \sin\frac{\pi}{4}}$

$= \frac{1}{\sqrt{2}}\int \operatorname{cosec}\left(x + \frac{\pi}{4}\right)dx$

$= \frac{1}{\sqrt{2}}\log\ \tan\left(\frac{\pi}{8} + \frac{x}{2}\right) + c$

Video Solution: