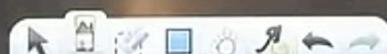


10:42

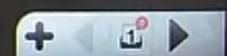
Beta, Gamma Functions

Click To solve different types of Gamma functions base Question

Lecture-02



MAXHUB



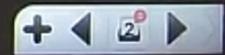
10:43

Type - I

$$\int_0^{\infty} e^{-ax^n} dx = \frac{1}{n\sqrt[n]{a}} \Gamma\left(\frac{1}{n}\right)$$

$$\int_0^{\infty} e^{-x} x^n dx = \Gamma(n+1)$$

Q. $\int_0^{\infty} e^{-x^4} dx =$



Type - I

$$\int_0^{\infty} e^{-ax^n} dx = \frac{1}{n \sqrt[n]{a}} \Gamma\left(\frac{1}{n}\right)$$

Q. $\int_0^{\infty} e^{-x^4} dx =$

put $x^4 = t$

$$x = t^{1/4}$$

$$\frac{dx}{dt} = \frac{1}{4} t^{-3/4}$$

$$dx = \frac{1}{4} t^{-3/4} dt$$

(n=4) (a=1)

$$\frac{1}{4} \frac{1}{\sqrt[4]{1}} \Gamma\left(\frac{1}{4}\right)$$

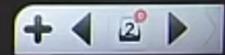
$$x = 0$$

$$x = \infty$$

$$\infty$$

10:49

$$\int_0^{\infty} e^{-t} dt$$



Type - I

$$\int_{-\infty}^{\infty} e^{-x^n} dx = \frac{1}{n \sqrt[n]{n}} \Gamma\left(\frac{1}{n}\right)$$

(n: 4) (a: 1)

$$\frac{1}{4} \frac{1}{\sqrt[4]{1}} \sqrt{\frac{1}{4}}$$

$$\frac{1}{4} \sqrt{\frac{1}{4}}$$

$$\int_0^{\infty} e^{-x} x^4 dx = \sqrt{n+1}$$

10:49

$$x = 0 \quad t = 0$$

$$x = \infty \quad t = \infty$$

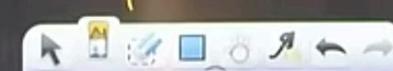
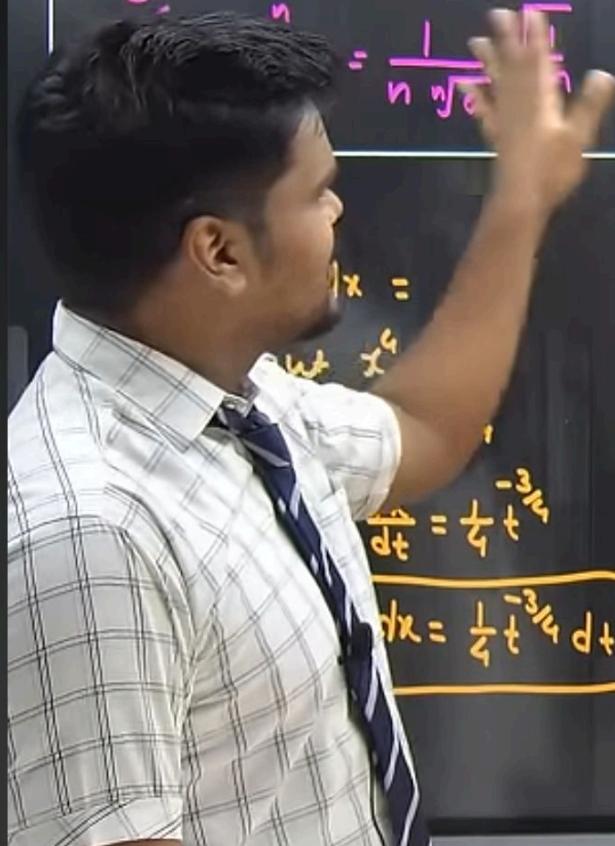
$$= \frac{1}{4} \sqrt{\frac{1}{4}}$$

"

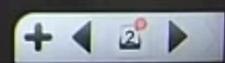
$$= \int_0^{\infty} e^{-t} \frac{1}{4} t^{-\frac{3}{4}} dt$$

$$= \frac{1}{4} \int_0^{\infty} e^{-t} t^{-\frac{3}{4}} dt$$

$$= \frac{1}{4} \sqrt{-\frac{3}{4} + 1}$$



MATHS



Type - II

$$\int_0^{\infty} x^m \sqrt{-ax^n} dx = \frac{1}{n} \frac{1}{a^{\frac{m+1}{n}}} \sqrt{\frac{m+1}{n}}$$

C. $\int_0^{\infty} x \cdot e^{-x^4} dx$

Put $x^4 = t$

$$x = t^{1/4}$$

$$\frac{dx}{dt} = \frac{1}{4} t^{-3/4}$$

$$dx = \frac{1}{4} t^{-3/4} dt$$

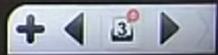
$$x=0$$

$$x=\infty$$

$$= \int_0^{\infty}$$

$$\begin{aligned} a \times a^n &= a^{m+n} \\ t^{\frac{1}{4}} \times t^{-3/4} &= t^{\frac{1}{4} + (-\frac{3}{4})} \\ &= t^{\frac{1-3}{4}} = t^{-\frac{2}{4}} = t^{-\frac{1}{2}} \end{aligned}$$

10:53



$$Q. \int_0^{\infty} x \cdot e^{-x^4} dx$$

$$x^4 = t$$

$$x = t^{1/4}$$

$$\frac{dx}{dt} = \frac{1}{4} t^{-3/4}$$

$$dx = \frac{1}{4} t^{-3/4} dt$$

$$x=0 \quad t=0$$

$$x=\infty \quad t=\infty$$

$$= \int_0^{\infty} t^{1/4} e^{-t} \cdot \frac{1}{4} t^{-3/4} dt$$

$$= \frac{1}{4} \int_0^{\infty} e^{-t} t^{1/4} dt$$

$$= \frac{1}{4} \int_0^{\infty} e^{-t} t^{-3/4} dt = \frac{1}{4} \int_0^{\infty} e^{-t} t^{-1/2} dt$$

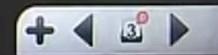
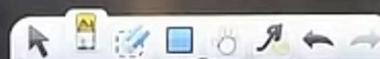
$$= \frac{1}{4} \sqrt{-\frac{1}{2} + 1} = \frac{1}{4} \sqrt{\frac{1}{2}} = \frac{1}{4} \sqrt{\pi},$$

$$t \wedge t = t \frac{1-3}{4} = \frac{-2}{4} = t^{-1/2}$$

10:55

$$\frac{-1+2}{2} = \frac{1}{2}$$

$$\sqrt{\frac{1}{2}} = \sqrt{\pi}$$



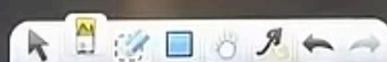
10:56

$$\text{S.T } \underbrace{\int_0^8 x \cdot e^{-x^4} dx}_{I_1} \cdot \underbrace{\int_0^8 x^2 \cdot e^{-x^4} dx}_{I_2} = \frac{\pi}{16\sqrt{2}}$$

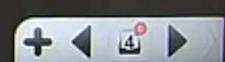
 $I_1 \cdot I_2$

$$I_1 = \int_0^8 x \cdot e^{-x^4} dx$$

$$I_2 = \int_0^8 x^2 \cdot e^{-x^4} dx$$



MAXHUB



10:57

$$\underbrace{\int_0^8 x \cdot e^{-x^8} dx}_{I_1} \cdot \underbrace{\int_0^8 x^2 \cdot e^{-x^4} dx}_{I_2} = \frac{\pi}{16\sqrt{2}}$$

 I_1, I_2

$$I_1 = \int_0^8 x \cdot e^{-x^8} dx$$

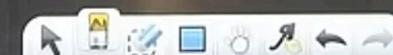
$$\text{put } x^8 = t \quad x = t^{1/8}$$

$$\frac{dx}{dt} = \frac{1}{8} t^{-7/8}$$

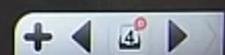
$$dx = \frac{1}{8} t^{-7/8} dt$$

$$I_1 = \int_0^8 t^{1/8} \cdot -$$

$$I_2 = \int_0^8 x^2 \cdot e^{-x^4} dx$$



MAXHUB



10:58

$$I_1 = \int_0^{\infty} x^8 e^{-t} dt$$

put $x^8 = t$ $x = t^{1/8}$

$$\frac{1-7}{8} = -\frac{6}{8}$$

$$\frac{dx}{dt} = \frac{1}{8} t^{-7/8}$$

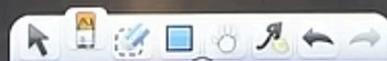
$$dx = \frac{1}{8} t^{-7/8} dt$$

$$I_1 = \int_0^{\infty} t^{1/8} e^{-t} \frac{1}{8} t^{-7/8} dt$$

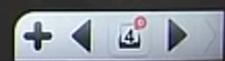
$$I_1 = \frac{1}{8} \int_0^{\infty} e^{-t} t^{-3/2} dt$$

$$I_1 = \frac{1}{8} \sqrt{-\frac{3}{4} + 1} = \frac{1}{8} \sqrt{\frac{1}{4}}$$

$$I_2 = \int_0^{\infty} x^5 e^{-t} dt$$



MAXHUB



11:00

$$I_1 = \int_0^8 x \cdot e^{x^8} dx$$

$$\text{put } x^8 = t \quad x = t^{\frac{1}{8}}$$

$$\frac{1-7}{8} = -\frac{6}{8}$$

$$I_1 = \int_0^8 t^{\frac{1}{8}-1} e^t dt$$

$$I_1 =$$

$$I_1 =$$

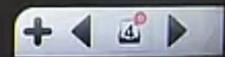
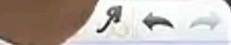
$$I_2 = \int_0^8 x^2 e^{-x^4} dx$$

$$\text{put } x^4 = t \quad x = t^{\frac{1}{4}}$$

$$\frac{dx}{dt} = \frac{1}{4} t^{-\frac{3}{4}}$$

$$dx = \frac{1}{4} t^{-\frac{3}{4}} dt$$

$$I_2 = \int_0^8 \left(t^{\frac{1}{4}}\right)^2 e^{-t} \cdot \frac{1}{4} t^{-\frac{3}{4}} dt$$



11:01

$$dt = \frac{1}{8} t^{-\frac{7}{8}} dt$$

$$I_1 = \int_0^\infty t^{\frac{1}{8}} e^{-t} \perp \frac{1}{8} t^{-\frac{7}{8}} dt$$

$$I_1 = \frac{1}{8} \int_0^\infty$$

$$I_1 = \frac{1}{8} \sqrt{-2}$$

$$dt = \frac{1}{4} t^{-\frac{3}{4}} dt$$

$$I_2 = \int_0^\infty (t^t)^2 \cdot e^{-t} \perp \frac{1}{4} t^{-\frac{3}{4}} dt$$

$$I_2 = \frac{1}{4} \int_0^\infty t^{\frac{3}{4}} \cdot e^{-t} + \frac{1}{4} t^{-\frac{3}{4}} dt$$

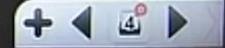
$$\frac{2-3}{4} = -\frac{1}{4}$$

$$= \frac{1}{4} \int_0^\infty e^{-t} + \frac{1}{4} dt$$

$$-\frac{1+4}{4} = \frac{3}{4}$$

$$= \frac{1}{4} \left[-t + \frac{1}{4} \right]$$

$$= \frac{1}{4} \left[\frac{3}{4} \right]$$



11:05

$$\zeta | \zeta + 1$$

$$= \frac{1}{4} \sqrt{\frac{3}{4}}$$

$$I_2 = \frac{1}{4} \sqrt{\frac{1}{\zeta}} \times \frac{1}{4} \sqrt{\frac{3}{\zeta}}$$

$$= \frac{1}{32} \sqrt{\frac{1}{\zeta}} \sqrt{\frac{3}{\zeta}}$$

$$= \frac{1}{32} \times \sqrt{2} \pi$$

$$= \frac{\sqrt{2} \pi \times \sqrt{2}}{32 \sqrt{2}}$$

$$= \frac{\pi}{32 \sqrt{2}} = \frac{\pi}{16 \sqrt{2}},$$

A man in a plaid shirt stands at a chalkboard, pointing at a mathematical derivation. The derivation shows the simplification of a term involving the Riemann zeta function and square roots, leading to a final result of $\pi/(16\sqrt{2})$. The chalkboard has a yellow circle highlighting the product of the two square root terms.

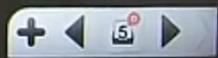
11:05

Type - 3

put $\log x = -t$

$$\textcircled{1} \int_0^1 x^m (\log x)^n dx = \frac{(-1)^n}{(n+1)^{n+1}} \sqrt{n+1}$$

$$\text{evaluate } \int_0^1 (x \log x)^4 dx$$



11:07

$$\int_0^1 x (\log x)^n dx = \frac{1}{(n+1)^{n+1}} | n+1 |$$

Evaluate $\int_0^1 (x \log x)^n dx$

$$= \int_0^1 x^n \cdot (\log x)^n dx$$

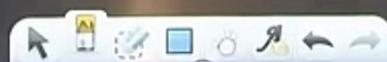
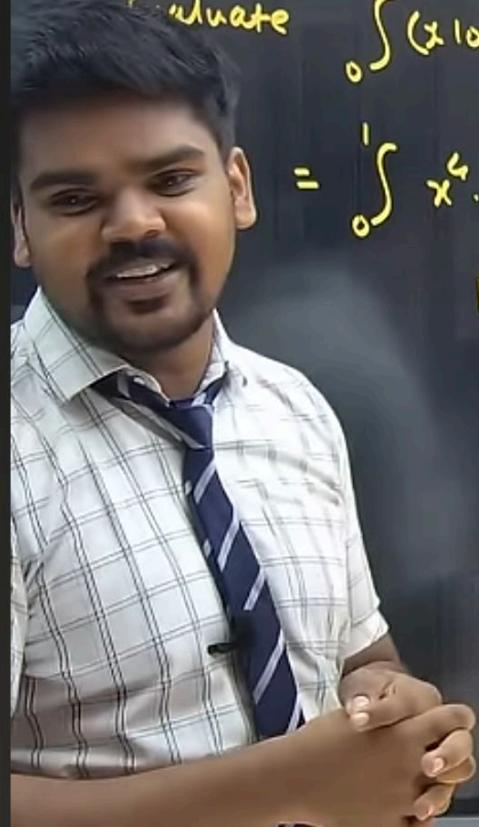
put $\log x = -t$

$$x = e^{-t}$$

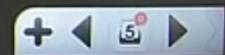
$$\frac{dx}{dt} = e^{-t} (-1)$$

$$dx = -e^{-t} dt$$

$$\begin{array}{ll} x=0 & t=\infty \\ x=1 & t=0 \end{array}$$



MAXHUB



$$\text{Q) } \int x (\ln x) dx = \frac{1}{(n+1)^{n+1}} | n+1 |$$

evaluate

$$x^4 dx$$

$$\ln x^4 dx$$

$$\ln x = -t$$

$$x = e^{-t}$$

$$\frac{dx}{dt} = e^{-t} (-1)$$

$$dx = -e^{-t} dt$$

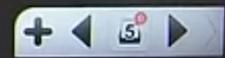
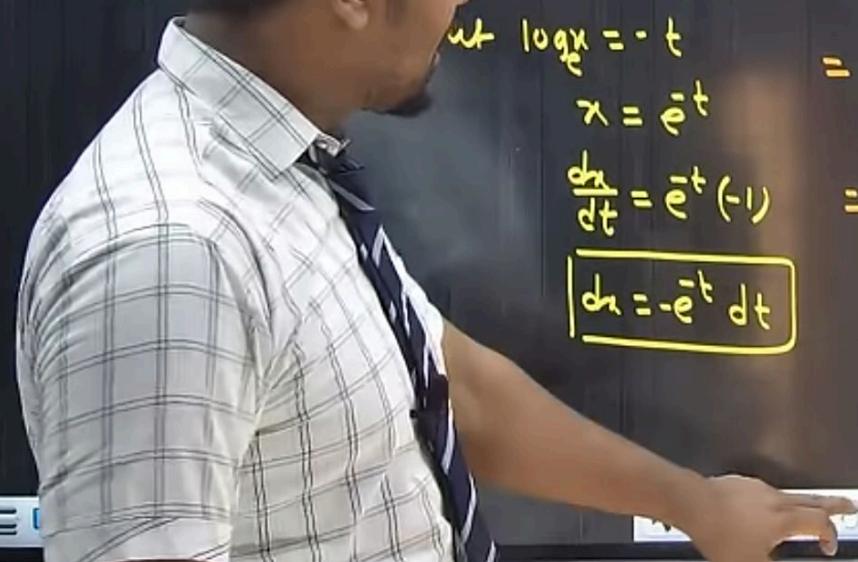
$$x=0 \quad t=\infty$$

$$x=1 \quad t=0$$

$$= \int_{\infty}^0 (e^{-t})^4 (-t)^4 (-e^{-t} dt)$$

$$= - \int_{\infty}^0 e^{4t} t^4 e^{-st} dt$$

$$= \int_0^{\infty} e^{-st} t^4 dt$$



$$\text{put } \log_e x = -t$$

$$x = e^{-t}$$

$$\frac{dx}{dt} = e^{-t}(-1)$$

$$= - \int_{\infty}^0 (-4t) t^4 \cdot e^{-t} dt$$

$$= \int_0^{\infty} e^{-st} \cdot t^4 dt$$

$$\text{put } st = u \quad \boxed{t = \frac{u}{s}} \quad t = 0 \quad u = 0$$

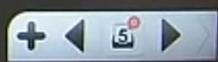
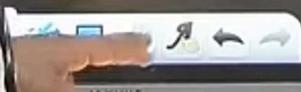
$$5 \cdot \frac{dt}{du} = 1 \quad t = \infty \quad u = \infty$$

$$s dt = du$$

$$dt = \frac{1}{s} du$$

$$= \int_0^{\infty} e^{-u} \left(\frac{u}{s}\right)^4 \frac{1}{s} du$$

11:13



$$\frac{du}{dt} = 1$$

$$t = \sigma$$

$$u = \sigma$$

11:15

$$dt = du$$

$$dt = \frac{1}{\sigma} du$$

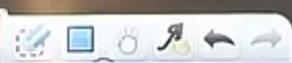
$$= \int_0^{\sigma} e^{-u} \left(\frac{u^4}{\sigma}\right) \frac{1}{\sigma} du$$

$$= \frac{1}{\sigma^5} \int_0^{\sigma} e^{-u} u^4 du$$

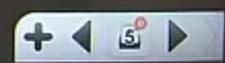
$$= \frac{1}{\sigma^5} \sqrt{u^5 + 1}$$

$$= \frac{1}{\sigma^5} \sqrt{\sigma^5} = \frac{1}{\sigma^5} \sigma^4 = \frac{24}{\sigma^5}$$

=



MAXHUB



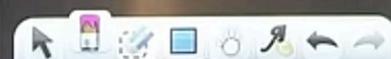
11:15

Type -IV

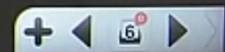
$$\text{put } a^x = e^t$$

$$\int_0^\infty \frac{x}{a^x} dx = \frac{1}{(\ln a)^{a+1}} \sqrt{a+1}$$

Evaluate: $\int_0^\infty \frac{x^7}{7^x} dx$



MAXHUB



11:17

Type -IV

$$\text{put } a^x = e^t$$

8 (R)

$$\frac{1}{(a)^{a+1}} \sqrt{a+1}$$

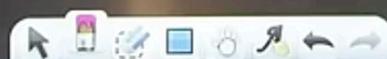
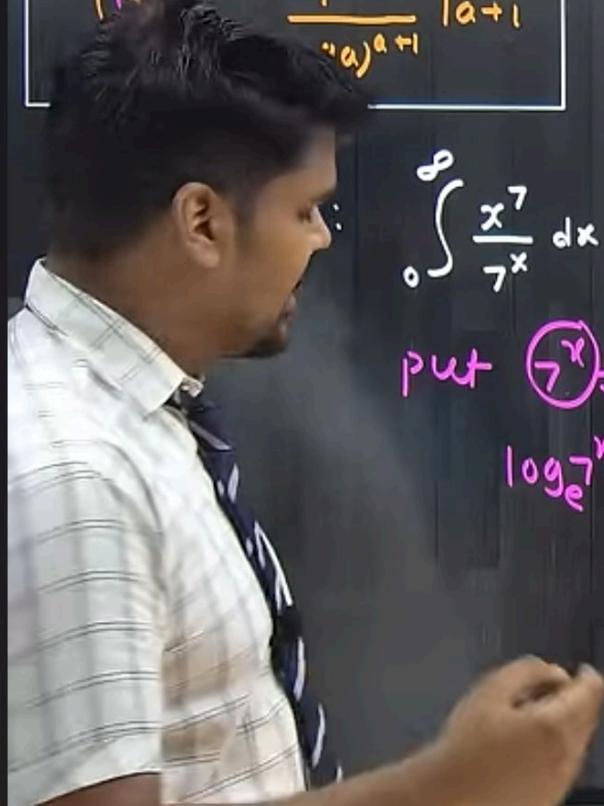
$$\int \frac{x^7}{7^x} dx$$

$$\text{put } 7^x = e^t$$

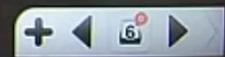
$$\log_7 x = t$$

$$\log_b a = p$$

$$a = b^p$$



MAXHUB



11:18

Type -IV

$$\text{put } a^x = e^t$$

$$\int \frac{1}{x(a+1)} dx$$

$$\int \frac{x^7}{7^x} dx$$

$$\text{put } 7^x = e^t$$

$$\log_7 e^t = t$$

$$t \log 7 = t$$

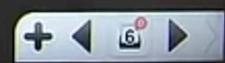
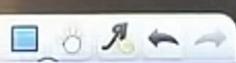
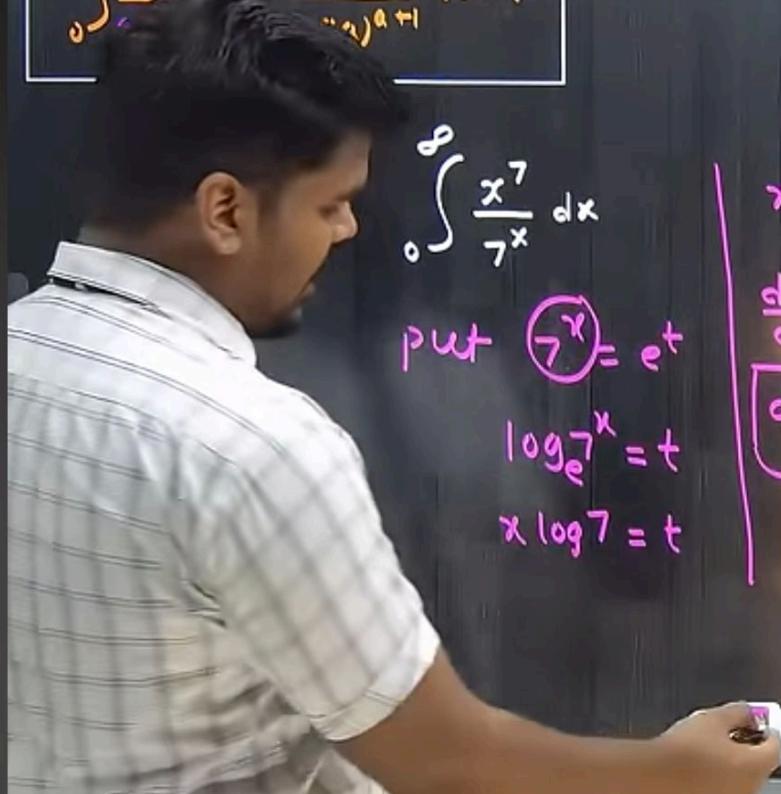
$$\log_b a = p$$

$$a = b^p$$

$$x = \frac{t}{\log 7}$$

$$\frac{dx}{dt} = \frac{1}{\log 7} \times 1$$

$$dx = \frac{1}{\log 7} dt$$



Type -IV

$$\text{put } a^x = e^t$$

$$\int \frac{x}{a^x} dx = \frac{1}{(\log a)^{a+1}} \sqrt{a+1}$$

Evaluate:

$$\int \frac{x^7}{7^x} dx$$

$$x = \frac{t}{\log 7}$$

$$\frac{dx}{dt} = \frac{1}{\log 7} \times 1$$

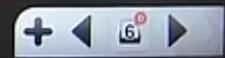
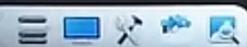
$$* dt$$

$$= 0$$

$$= \infty$$

$$\begin{aligned} & \int_0^\infty \frac{\left(\frac{t}{\log 7}\right)^7}{e^{-t}} \frac{1}{\log 7} dt \\ &= \int_0^\infty e^{-t} \frac{t^7}{(\log 7)^7} \times \frac{1}{(\log 7)} dt \\ &= \frac{1}{(\log 7)^8} \int_0^\infty e^{-t} \cdot \frac{t^7}{7^t} dt \\ &= \frac{1}{(\log 7)^8} \times \sqrt{7+1} \\ &= \frac{1}{(\log 7)^8} \times \sqrt{8} \end{aligned}$$

11:20



11:23

$$\int_0^{\infty} 4\sqrt{x} e^{-\sqrt{x}} dx$$

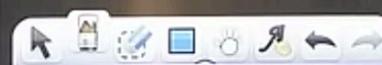
$$= \int_0^{\infty} x^{\frac{1}{4}} e^{-\sqrt{x}} dt$$

$$\sqrt{x} = t$$

$$x = t^2$$

$$\frac{dx}{dt} = 2t$$

$$dx = 2t \cdot dt$$



MAXHUB



11:24

$$\int_0^8 \sqrt[4]{x} e^{-\sqrt{x}} dx$$

$$= \int_0^8 -\frac{1}{2} e^{-t} dt$$

$$2t \\ = 2t \cdot dt$$

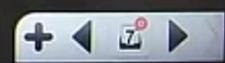
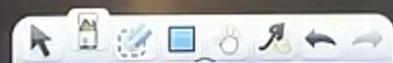
$$= \int_0^8 (t^2)^{\frac{1}{4}} \cdot e^{-t} \cdot 2t \cdot dt$$

$$= 2 \int_0^8 t^{\frac{1}{2}} \cdot e^{-t} \cdot t' dt$$

$$= 2 \int_0^8 e^{-t} \cdot t^{\frac{3}{2}} dt$$

$$= 2 \sqrt{\frac{3}{2} + 1}$$

$$\frac{1}{2} + 1 = \frac{3}{2}$$



11:26

$$\int_0^{\infty} \frac{dx}{3^{4x^2}}$$

$$3^{4x^2} = e^t$$

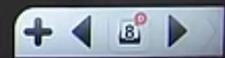
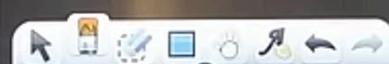
$$\log_e 3^{4x^2} = t$$

$$4x^2 \cdot \log 3 = t$$

$$x^2 = \frac{t}{4 \cdot \log 3}$$

$$x = \frac{\sqrt{t}}{2\sqrt{\log 3}}$$

$$\frac{dx}{dt} = \frac{1}{2\sqrt{t}} \frac{1}{2\sqrt{\log 3}}$$



11:28

$$\int_0^\infty \frac{dx}{3^{ex^2}}$$

$$dx = \frac{1}{4\sqrt{1093} \sqrt{t}} dt$$

 $t^{1/2}$

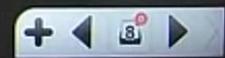
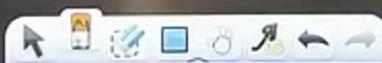
$$= \int_0^\infty \frac{1}{e^t} \cdot \frac{1}{4\sqrt{1093}} \times \frac{1}{\sqrt{t}} dt$$

$$= \frac{1}{4\sqrt{1093}} \int_0^\infty e^{-t} t^{-1/2} dt$$

$$= \frac{1}{4\sqrt{1093}} \sqrt{-\frac{1}{2} + 1}$$

$$= \frac{1}{4\sqrt{1093}} \times \sqrt{\frac{1}{2}}$$

$$\begin{aligned} &= \frac{t}{4\sqrt{1093}} \\ &= \frac{\sqrt{t}}{2\sqrt{1093}} \\ &= \frac{1}{4\sqrt{1093} \sqrt{2\sqrt{t}}} \end{aligned}$$



$$\int_0^{\infty} x^9 \cdot e^{-2x^2} dx$$

$$\text{put } 2x^2 = t$$

$$x^2 = \frac{t}{2}$$

$$x = \frac{\sqrt{t}}{\sqrt{2}}$$

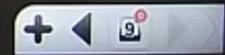
$$\frac{dx}{dt} = \frac{1}{\sqrt{2}} \times \frac{1}{2\sqrt{t}}$$

$$dx = \frac{1}{2\sqrt{2}\sqrt{t}} dt$$

$$\int_0^{\infty} \left(\frac{\sqrt{t}}{\sqrt{2}}\right)^9 e^{-t} \frac{1}{2\sqrt{2}\sqrt{t}} dt$$

$$= \frac{1}{(\sqrt{2})^9(2)}$$

$$= \frac{1}{(\sqrt{2})^9} \cdot e^{-t} \cdot t^{-1/2} dt$$



11:34

$$0 \int x^q e^{-2x^2} dx$$

put $x^2 = t$

$$\begin{aligned}& \int_0^\infty \left(\frac{\sqrt{t}}{\sqrt{2}}\right)^q e^{-t} \frac{1}{2\sqrt{2}\sqrt{t}} dt \\&= \frac{1}{(\sqrt{2})^q (2\sqrt{2})} \int_0^\infty (\sqrt{t})^q e^{-t} t^{-1/2} dt \\&= \frac{1}{16\sqrt{2} \times 2\sqrt{2}} \times \int_0^\infty t^{\frac{q}{2}} \cdot e^{-t} \cdot t^{-1/2} dt \\&= \frac{1}{64} \int_0^\infty e^{-t} \cdot t^{\frac{q}{2}-\frac{1}{2}} dt \\&= \frac{1}{64} \sqrt{\pi}\end{aligned}$$

11:35

MAXHUB

+ ← → 9⁰

ACADEMY

18:58

$$\int_0^{\frac{\pi}{2}} \frac{d\theta}{\sqrt{1 - \frac{1}{2}\sin^2\theta}}$$

put $\cos^2\theta = t$

$$\cos^2\theta = t^{\frac{1}{2}}$$

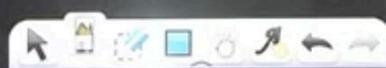
$$\cos\theta = t^{\frac{1}{4}}$$

$$\theta = \cos^{-1}(t^{\frac{1}{4}})$$

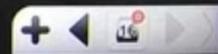
$$\frac{d\theta}{dt} = \frac{-1}{\sqrt{1 - (t^{\frac{1}{4}})^2}} \times \frac{1}{4} t^{-\frac{3}{4}}$$

$$d\theta = \frac{-1}{\sqrt{1 - t}} \frac{1}{4} t^{-\frac{3}{4}}$$

$$\begin{aligned}\sin^2\theta &= 1 - \cos^2\theta \\ \sin^2\theta &= 1 - t\end{aligned}$$



MAXHUB



19:00

$$\int_0^{\frac{\pi}{2}} \frac{d\theta}{\sqrt{1 - \frac{1}{2} \sin^2 \theta}}$$

$$\cos^2 \theta = \frac{1}{t} \quad \cos^2 \theta = t^{\frac{1}{2}}$$

$$\cos \theta = t^{\frac{1}{4}}$$

$$\theta = \cos^{-1}(t^{\frac{1}{4}})$$

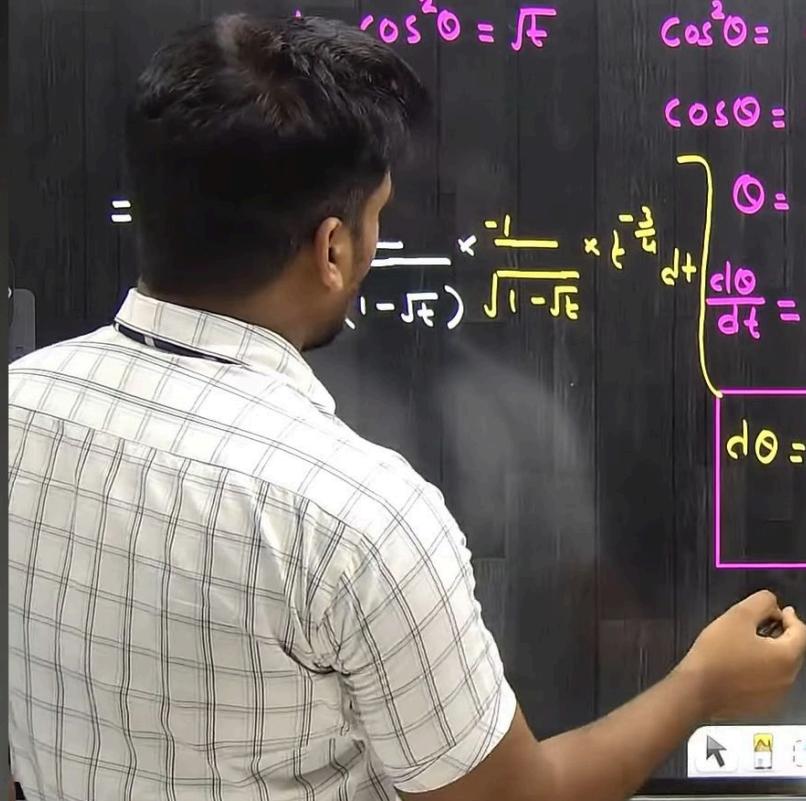
$$\frac{d\theta}{dt} = \frac{-1}{\sqrt{1 - (t^{\frac{1}{4}})^2}} \times \frac{1}{4} t^{-\frac{3}{4}}$$

$$d\theta = \frac{-1}{\sqrt{1 - \frac{1}{t}}} \frac{1}{4} t^{-\frac{3}{4}} dt$$

$$\begin{aligned}\sin^2 \theta &= 1 - \cos^2 \theta \\ \sin^2 \theta &= 1 - \frac{1}{t}\end{aligned}$$

$$\theta = 0 \quad t = 1$$

$$\theta = \frac{\pi}{2} \quad t = 0$$



$$\sin \theta = 1 - \cos \theta$$

19.01

$$\sin^2 \theta = 1 - \sqrt{t}$$

$$\theta = 0 \quad t =$$

$$\theta = \frac{\pi}{2} \quad t =$$

put $\cos^2 \theta = \sqrt{t}$

$$\cos \theta = t^{\frac{1}{2}}$$

$$\cos \theta = t^{\frac{1}{4}}$$

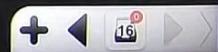
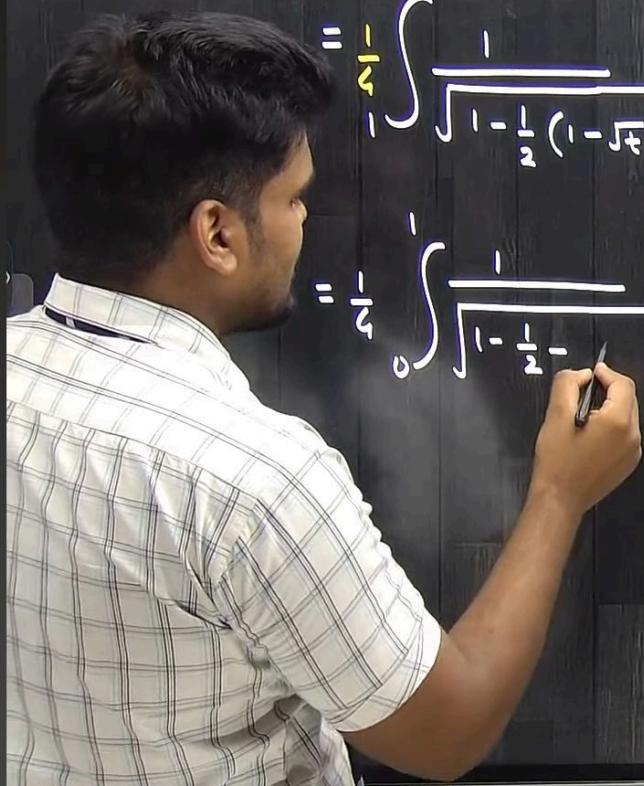
$$\theta = \cos^{-1}(t^{\frac{1}{4}})$$

$$\frac{d\theta}{dt} = \frac{-1}{\sqrt{1-(t^{\frac{1}{4}})^2}} \times \frac{1}{4} t^{-\frac{3}{4}}$$

$$d\theta = \frac{-1}{\sqrt{1-\sqrt{t}}} \frac{1}{4} t^{-\frac{3}{4}} dt$$

$$= \frac{1}{4} \int_1^0 \frac{1}{\sqrt{1-\frac{1}{2}(1-\sqrt{t})}} \times \frac{-1}{\sqrt{1-\sqrt{t}}} \times t^{-\frac{3}{4}} dt$$

$$= \frac{1}{4} \int_0^1 \frac{1}{\sqrt{1-\frac{1}{2}t}} dt$$



$$0 < \int^1_{\frac{1}{2}} \frac{1}{2t + \frac{\sqrt{5}}{2}} \sqrt{1-t} dt$$

$$\sqrt{1-t}$$

19:03

$$= \frac{1}{4} \int_0^1 \frac{1}{\sqrt{\frac{1}{2} + \frac{1}{2}\sqrt{t}}} \times \frac{1}{\sqrt{1-t}} t^{-\frac{3}{2}} dt$$

$$= \frac{1}{4} \int_0^1 \frac{1}{\sqrt{\frac{1}{2}(1-t)}} \times \frac{1}{\sqrt{1-t}} t^{-\frac{3}{2}} dt$$

$$\frac{1}{4} \times \int_0^1 \frac{1}{\sqrt{\frac{1}{2}}} \frac{1}{\sqrt{1-t}}$$



$$\begin{aligned}&= \frac{\sqrt{2}}{4} \int_0^{\infty} \frac{1}{\sqrt{(1+\sqrt{t})(1-\sqrt{t})}} t^{-3/4} dt \\&= \frac{\sqrt{2}}{4} \times \int_0^{\infty} \frac{1}{\sqrt{1-t}} t^{-3/4} dt \\&= \frac{\sqrt{2}}{4} \times \int_0^{\infty} \frac{1}{\sqrt{1-t}} t^{-3/4} dt\end{aligned}$$

A man in a white plaid shirt is standing at a blackboard, writing mathematical equations. He is facing away from the camera. The blackboard has several equations written on it, primarily in green chalk. The equations involve integrals and square roots. The blackboard also features a navigation bar with icons for back, forward, and other functions, and a small logo in the bottom right corner.

19:05

$$\begin{aligned}&= \frac{\sqrt{2}}{\zeta} \times \int_0^1 \frac{1}{\sqrt{t^2 - (\sqrt{\zeta})^2}} t^{-\frac{3}{\zeta}} dt \\&= \frac{\sqrt{2}}{\zeta} \times \int_0^1 \frac{1}{\sqrt{1-t}} t^{-\frac{3}{\zeta}} dt \\&= \frac{\sqrt{2}}{\zeta} \int_0^1 t^{-\frac{3}{\zeta}} (1-t)^{-\frac{1}{2}} dt \\&= \frac{\sqrt{2}}{\zeta} \times \beta\left(-\frac{3}{\zeta} + 1, -\frac{1}{2} + 1\right)\end{aligned}$$

