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$x = t^{12}$

$$t^3+t+2 \overline{) \; t^8 \;}\; Q(t)$$

$$\int \frac{12 t^{11}\, dt}{t^6 + t^4 + 2t^3} = 12 \int \frac{t^8\, dt}{t^3+t+2}$$

$R(t)$

$$12 \int Q(t)\, dt + 12 \int \frac{R(t)\, dt}{(t+1)(t^2-t+2)}$$

$$\frac{A}{t+1} + \frac{Bt+C}{t^2-t+2}$$

$$\int \frac{t^2 + t^4}{(1+t^2)^3}\, dt$$

$$\frac{t^4+t^2-2t^2}{(1+t^2)^3}$$

$$\int \frac{t^2}{(1+t^2)^2}\, dt - 2\int \frac{t^2}{(1+t^2)^3}$$

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

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

$$\frac{1}{2\sqrt{x}}\, dx = \frac{-4t\, dt}{(1+t^2)^2}$$

$$\int \frac{-8t}{(1+t^2)^2}\, t\, \frac{(1-t^2)}{(1+t^2)}\, dt$$

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$$\int \frac{x-1}{(x+2)(x-1)^2} \frac{dx}{\sqrt[4]{\frac{x+2}{x-1}}} = -\frac{4}{3}\int \frac{t^3\,dt}{t^4\quad t} = -\frac{4}{3}\int \frac{dt}{t^2} = \frac{4}{3}\frac{1}{t} + C.$$

$$\frac{x+2}{x-1} = t^4 = 1 + \frac{3}{x-1}$$

$$4t^3\,dt = -\frac{3}{(x-1)^2}dx.$$

$$\int \cot^6 x \,\underline{x \operatorname{cosec}^2 x}\, dx - \int \cot^6 x\, dx.$$

$$\int \sqrt{1+\cot^2 2x}\, \operatorname{cosec}^2 2x\, dx$$

$$1-(1-\cos x)$$

$$\int \left(\frac{\cos 3x + 3\cos x}{4}\right)^2 dx$$

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$$\int \frac{\cos x \, dx}{\sin x \left(4\cos^2 x - 3\right)} = -\frac{1}{2}\int \frac{-2\cos x \, dx}{\sin^3 x\left(\frac{1}{\sin^2 x} - 4\right)}$$

$$= -\frac{1}{2} \ln\left|\frac{1}{\sin^2 x} - 4\right| + C$$

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

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

$$\int \frac{sx\,cx\, dx}{4sx\,cx + s^2x + 4c^2x}$$

$$\int \frac{\sin 2x\, dx}{1 + \frac{3}{2}(1+\cos 2x) + 2\sin 2x} \rightarrow \boxed{T-III}$$

$$\frac{1}{2}\int \frac{\cos x}{\cos x - \sin x}\, dx - \frac{1}{2}\int (\cos x + \sin x)\cos x\, dx$$

$$\int \frac{\sec^2 x \tan x\, dx}{(4\tan x + \tan^2 x + 4)(1+\tan^2 x)}$$

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

$$\frac{A}{t+2} + \frac{B}{(t+2)^2} + \frac{C(t+1)}{1+t^2}$$

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

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

$$K\int \frac{dt}{(1-t^4)t^2}$$

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

$$\int \frac{\sec^2 x\,dx}{(\tan^3 x-1)}$$

$$\frac{t^2-(t^2-1)}{t^3-1}$$

$$\int \frac{-2\tan^2 x\,\tan x\sec^2 x\,dx}{\sqrt{4\tan^2 x-1}} - 2\int \frac{(1+\tan^2 x)\tan x\sec^2 x\,dx}{\sqrt{4\tan^2 x-1}}$$

$$4\tan^2 x-1 = t^2$$

$\boxed{\text{AOD}}$

Decreasing Function in $[a, b]$

If $\quad x_1 > x_2$

$\Rightarrow \quad f(x_1) \leq f(x_2) \qquad \forall\, x_1, x_2 \in [a, b]$

then f is said to be decreasing function in $[a, b]$

If $f'(x)$ exist $\Rightarrow f'(x) \leq 0 \quad \forall\, x \in [a, b]$

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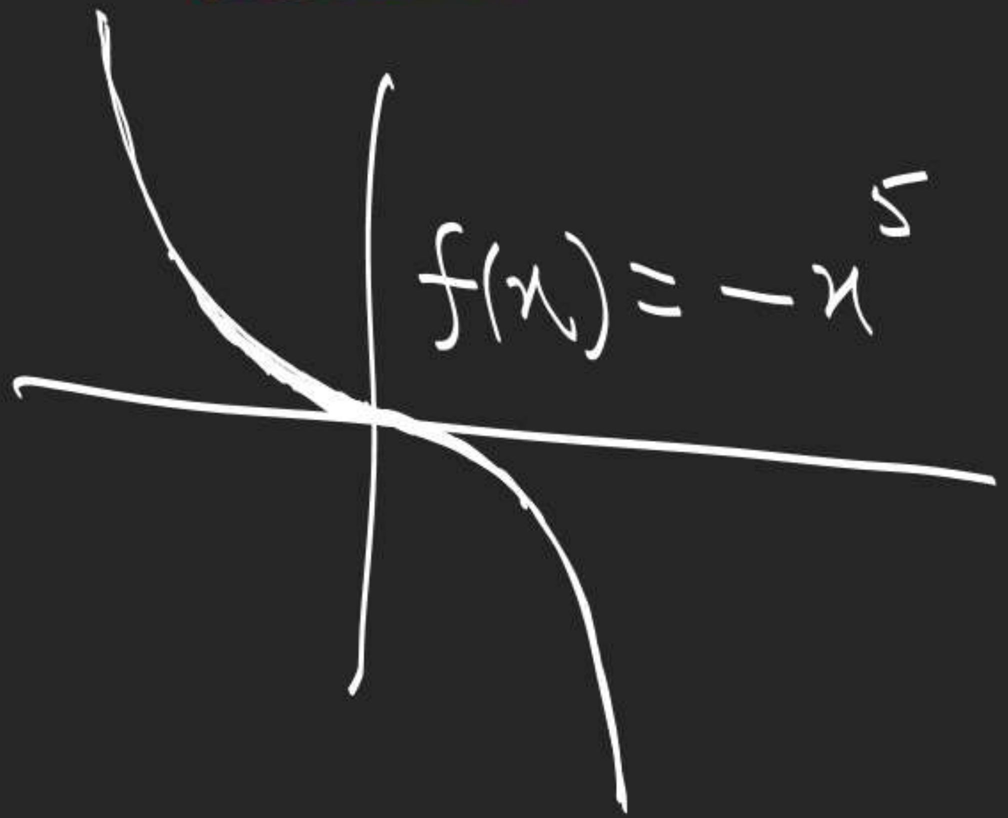
Strictly decreasing function in $[a,b]$

If $x_1 > x_2$

$\Rightarrow f(x_1) < f(x_2)$

then 'f' is strictly decreasing in $[a,b]$



If $f'(x)$ exists

$\Rightarrow f'(x) \leq 0 \ \forall x \in [a,b]$

where $f'(x) = 0$ holds at instants.

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Monotonic Function in $[a, b]$

If function is increasing in $[a, b]$
or
decreasing in $[a, b]$

Strictly monotonic in $[a, b]$

strictly increasing in $[a, b]$
or
strictly decreasing in $[a, b]$.

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Stationary Point

Points where $f'(x) = 0$ are called stationary points.

Critical Point

Points where $f'(x) = 0$ or does not exist is called critical point.

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$\int x^2 e^x \cos x \, dx$