$\begin{bmatrix} -1,1 \end{bmatrix}$ arctenh $x \in C$. Bsp: $F(x) = -\ln|\cos x| - -\frac{1}{2}\ln(\cos x)^2$ und du Ableiting 1st (nach Kettenregel) $\frac{T'(x) = -1}{2} \frac{1}{(\cos x)^2} \frac{(2\cos x)(-\sin x)}{\cos x} = \frac{\sin x}{\cos x}$ § 6.3 Parhelle Integration. Da dos Antegrahon du Umkehring von différenzeuren ist, liefert Jede Ableidingsregel dire for das Integrieren. OPorhelle Integration ist eine Unkehreng der Leibnizsichen produkregel und besagt für unbestimmte bzu das bestimmte integel o $(u \cdot v)' = u'v + u \cdot v'$ $=) \int uv' = uv - \int u'v + c$

Satz 6.2) (Partielle Integration) (Sotz 6.1.2) (39) Seien fig: [a, b] 312 zure stehg delementare Finktionen Dann got $\int f(x)g'(x)dx = f(x)g(x) - \int f(x)g(x)dx$ and $\int_{\alpha}^{\beta} f(x)g'(x)dx = f(x)g(x) \int_{\alpha}^{\beta} - \int_{\alpha}^{\beta} f(x)g(x)dx$ Bsp 6.22 $\int xe^{x} dx = xe^{x} \int 1e^{x} dx$ $= xe^{x} = e^{x}$ Durch Induktion über ne 72 20 folgert mon

Laraus des Resultat $\int x^n e^x dx = (-1)^n n! \frac{\int (-x)^k e^x}{k = 0} e^x$

Dertielle Integration eignet sich get dozu, Logorthmusterne zu climineren

Monchmal muss men dozu den Integrenden erst künstlich als Produkt schreiben

 $\int \log x \, dx = \int (\log x) (7) \, dx$

 $= (\log x) \times - \int \frac{1}{x} \cdot x \, dx = x \log x - x = c$

a Marchmal fishert wederholte parhelle
Integration auf den vispringlichen
Ausdrick zurick Mit Glock kann man
dann noch diesem auflösen

 $\int \sin^2 x \, dx = \int (\sin x) (\sin x) \, dx$

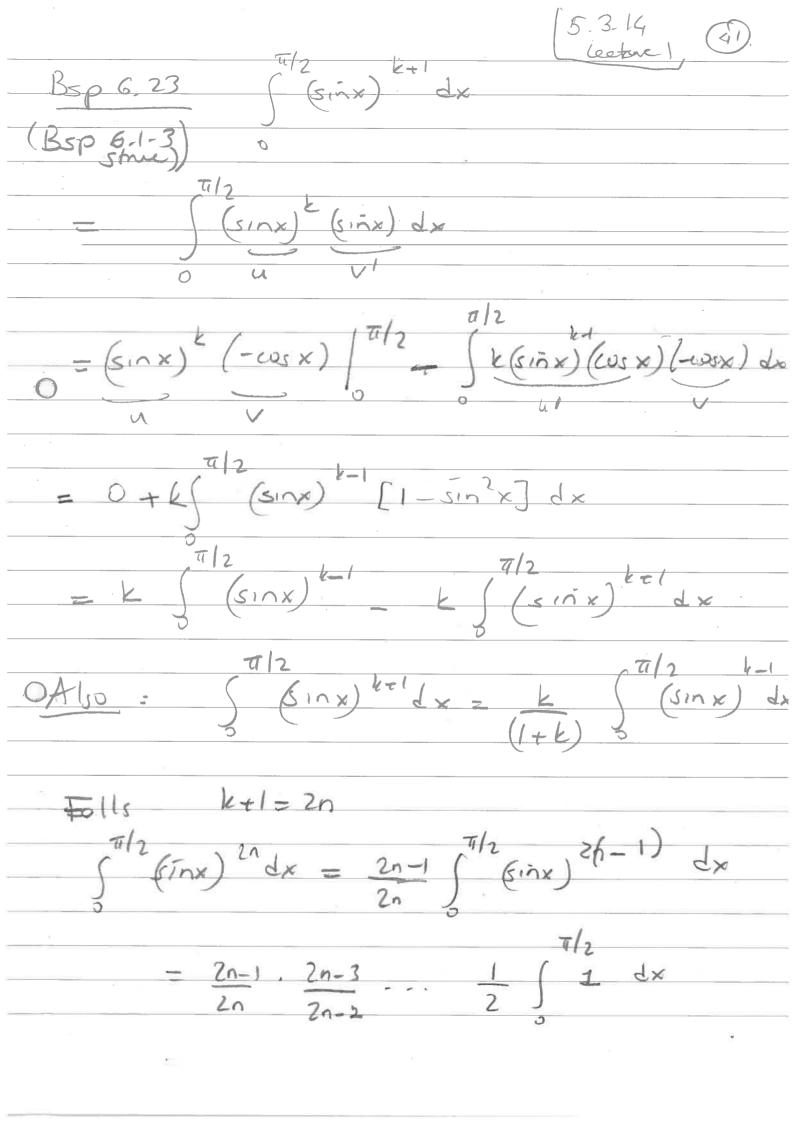
 $= - \sin x \cos x + \int \cos^2 x \, dx$

= -sinx cosx + (1-sin2x)dx

= - SINXWIX + X = (Sin 2xdx

 $= \sum 2 \int \sin^2 x \, dx = x - \sin x \cos x$

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



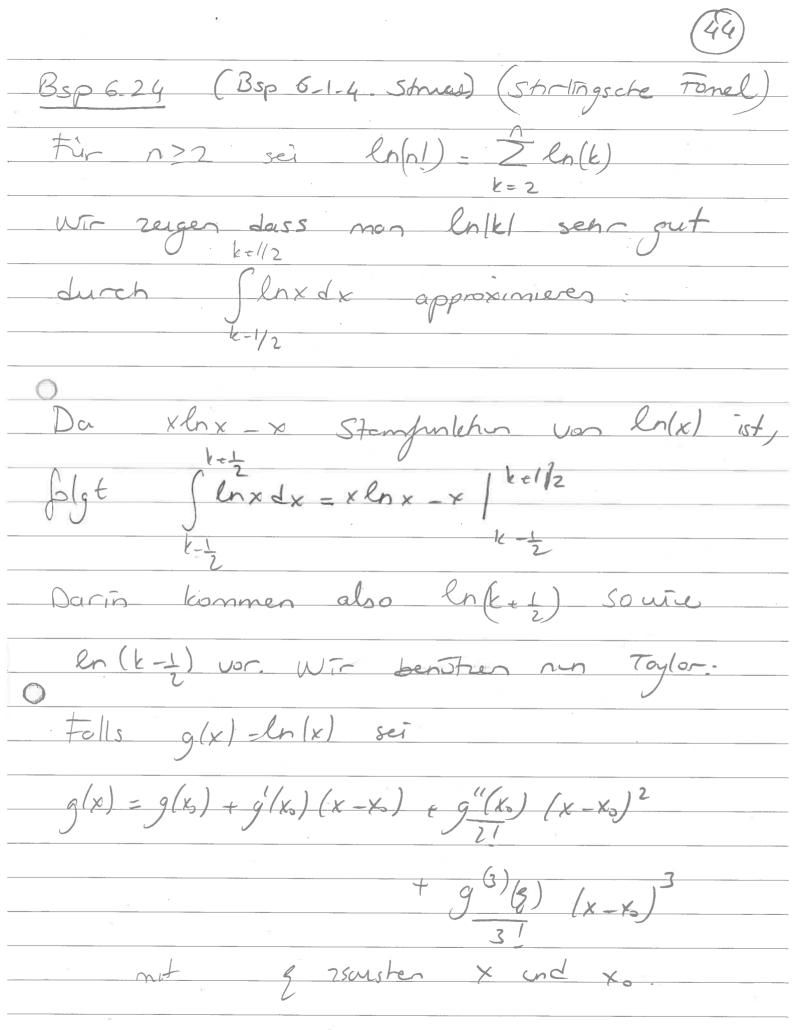
 $= \frac{(2n)(2n-1)(2n-2)...11}{((2n)(2n-2)...2]^2} \frac{1}{2}$ $\frac{-\left(2n\right)!}{\left(2^{n}n!\right)^{2}}\frac{\pi}{2}$ Andlog - $\int_{0}^{\pi/2} \left(\sin x \right)^{2n+1} dx = \left(\frac{2^{n}}{2^{n}} \right)^{2}$ $\left(\frac{2n+1}{2} \right)^{\frac{n}{2}}$ Beachte: der TI-tem bonnt in Zueiten Fall nicht vor Dies benotren wir wie folgt un ein Fone!" für TI aufrusteller. FUC 05 x 5 T/2 = (sinx) = (sinx) = (sinx) [1-sinx] >0

 $\Rightarrow (\sin x) \stackrel{k}{\leftarrow} \Rightarrow (\sin x) \stackrel{k+1}{\leftarrow} \stackrel{(k)}{\leftarrow} (k) \stackrel{(k)}{\leftarrow} (\cos x) \stackrel{(k)}{\leftarrow} (\cos$

 $\frac{2^{n-1}}{2^{n-1}} \leq \frac{2^{n-1}}{2^{n-1}} \cdot \frac{\pi}{2} \leq \frac{2^{n-1}}{2^{n-1}} \cdot \frac{\pi}{2}$ $\frac{2^{n-1}}{2^{n-1}} \cdot \frac{\pi}{2} \leq \frac{2^{n-1}}{2^{n-1}} \cdot \frac{\pi}{2}$ (221)3 $(2^{n},)^{2}, 2 \leq \pi \leq (2^{n},)^{4}$ $(2^{n+1})[2^{n}], 2^{n}$ $(2^{n})^{2}, 2^{n}$ $(2^{n})^{2}, 2^{n}$ $\frac{(2^{n}!)^{\frac{1}{2}}}{((2n)!)^{\frac{2}{2}}(2n\pi 1)} \leftarrow \frac{(2^{n}!)^{\frac{4}{2}}}{((2n)!)^{\frac{2}{2}}} = \frac{2}{2n}$ $= \lim_{n \to \infty} \frac{1}{n!} \left(\frac{2^n n!}{2^n n!} \right)^{\frac{1}{2}}$ Wallerche Fornel

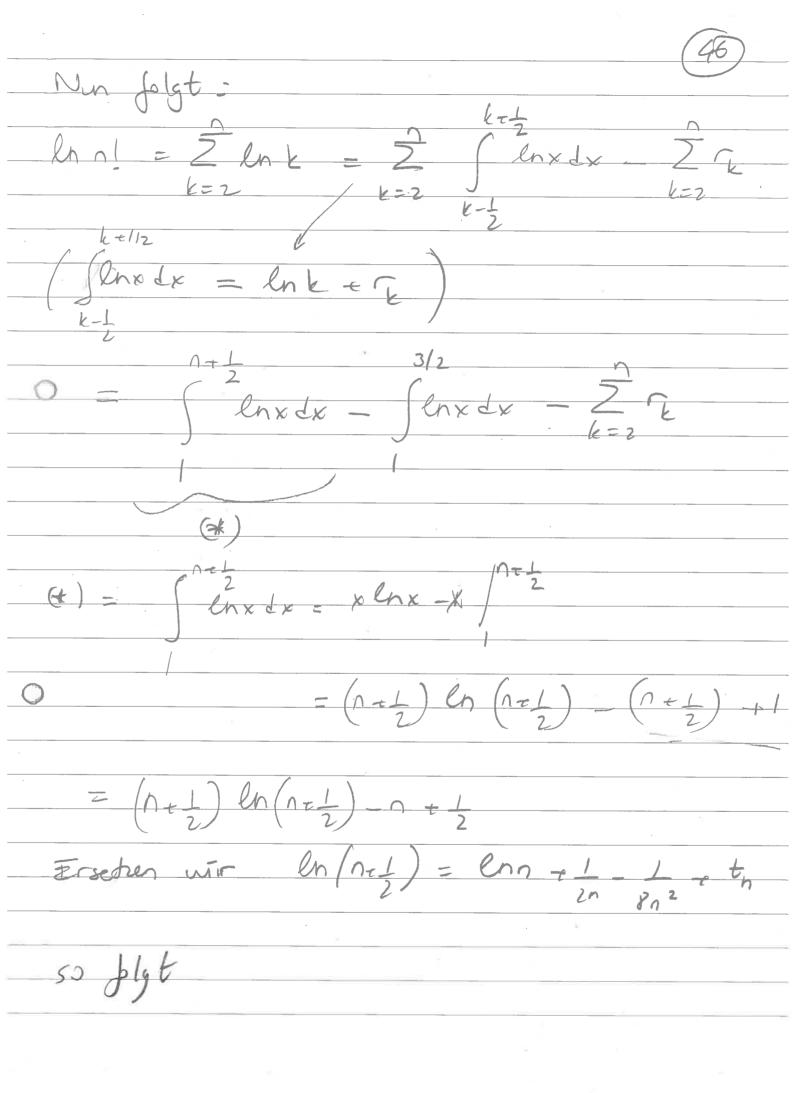
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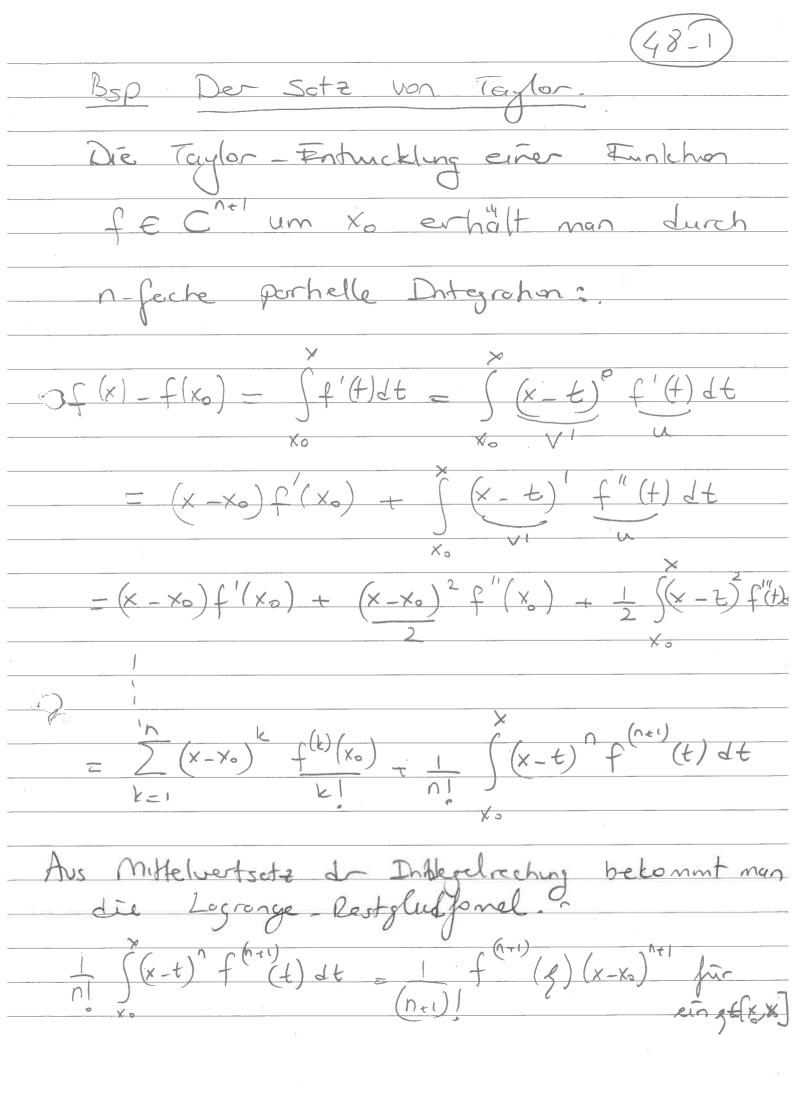


Auf X= x+1 2 auf gewendet ergibt. $\ln\left(x+\frac{1}{2}\right) = \ln k + \frac{1}{2k} + \frac{1}{8k^2} + \frac{1}{k}$ unbei $t_{k} = \frac{2}{5^{3}} \cdot \frac{1}{3!} \cdot \frac{1}{2!} \cdot \frac{1}{245^{3}}$ 0 [te] < 1 24 k³ se (k, k=1) $\ln \left(k - \frac{1}{2}\right) = \ln k - \frac{1}{2k} - \frac{1}{8k^2} + \frac{t'}{k}$ $\frac{|t|_{k}}{24} \stackrel{\text{def}}{=} \frac{1}{24} \stackrel{\text{def}}{=} \frac{3}{24} \stackrel{\text{d$ $-\left(\begin{pmatrix} k-1 \end{pmatrix}\begin{pmatrix} \ln k & -1 & 1 & 2k & 8k & 6k \end{pmatrix} - \left(k-\frac{1}{2}\right)\right]$ $= lnk - \frac{1}{8k^2} + \left(\frac{k-1}{2}\right) + \left(\frac{k-1}{2}\right) + \frac{k}{2}$ = $lnk + \Gamma_k$ wober $(\Gamma_k) \leq \frac{C}{k^2}$



 $(t) = (n-1)(nn-1) + (n-1)(2)(2n-8n^2 + tn) + \frac{1}{2}$ + 1₂ = (n-1) lnn -n + 1 + 1 + ntn - 1 + 1 tn - 16n2 = 2 tn ln(n!) = nlnn + 1 lnn - n + 9n wobei $a = \frac{1}{4n} + \left(\frac{n+1}{2}\right)\left(\frac{-1}{2n^2} + \frac{7}{2n}\right) + \frac{7}{k=2}$ $-\frac{3}{2n} + \frac{3}{2n}$ und [T] < C = 2 The homegret Set a == liman, b=ea und b=ea Also log n/ = (n+1) logn -n+an = 109 1 12 - 1 7

Pas asymptohische Verhalten un n!



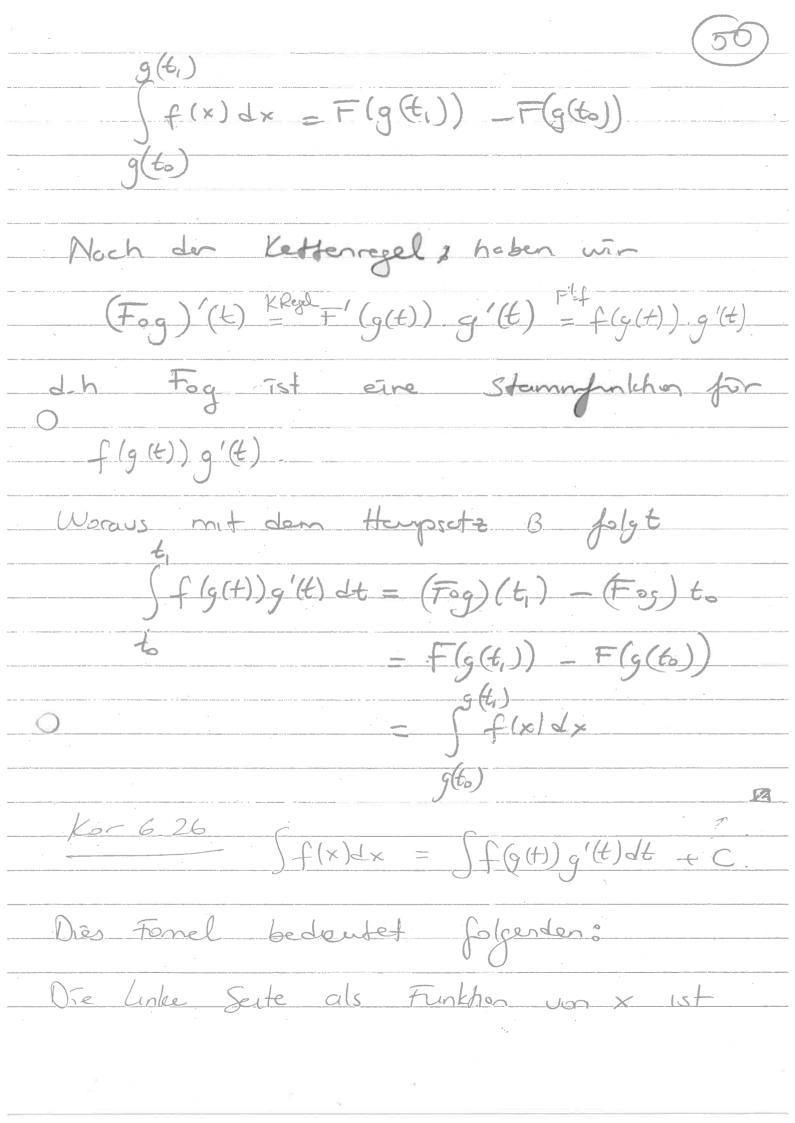
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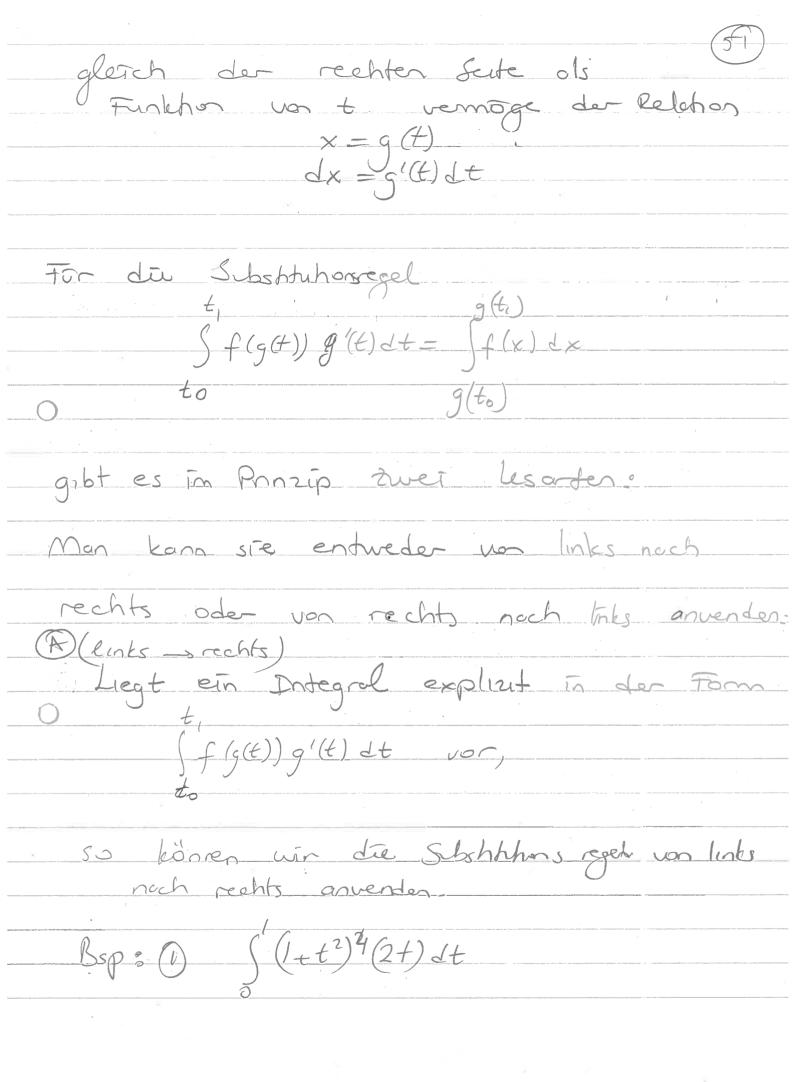
Benefit Set F: [a, b] - IR evice

Stemmynkhon for f. Dann gitt

(Noch Hapsotz B)

.





Setzt mon nomlich
$$f(x) = x^{\frac{1}{4}}$$
 $x = g(t) = 1 + t^{2}$
 $dx = g'(t) dt = 2t dt$

So fold

$$\int (1+t^{2})^{\frac{1}{4}}(2t)dt = \int f(g(t))g'(t)dt$$

$$\int g(t) dt = \int x^{\frac{1}{4}}dx = \int x^{\frac{1}{4}}dx = \int x^{\frac{1}{4}}dx$$

$$\int g(t) dt = \int x^{\frac{1}{4}}dx = \int x^{\frac{1}{4}}dx = \int x^{\frac{1}{4}}dx$$

$$\int x^{\frac{1}{4}}dx = \int x^{\frac{1}{4}}dx$$

(B) (rechts - slinks)

Ein integral liegt der Gestalt

(f(x)dx) mit genussen Grenzen

d, BEIR von,

das schwer zu berechnen scheint,

O versicht man dann mittels geeigneter

Subshhan x=g(+), dieses Integral

un suformulières 1.50 dars de Shohhansregel

anuendor ist, unber $g(t_0) = \alpha$ and $g(t_1) = B$

gelter miss

Bsp8260 (Tri-x2'dx)

Also f(x)= \(\int \) - \(\pi \) - \(\pi \) \(\pi

x = g(t) = sin t, $t \in Co, \pi/2$], dx = cost dt

1st glann g(0)=0, $g(\frac{\pi}{2})=1$

 $\int \sqrt{1-x^2} dx = \int f(x) dx$ $= \int f(g(x)) dx$ $= \int f(g(x)) g'(x) dx$ $= \int f(g(x)) g'(x) dx$ $= \int \sqrt{1-sin^2t^2} \cos t \, dt$ $= \int \cos^2 t \, dt \qquad \left(\cos^2 t = 1 + \cos 2t \right)$ $= \int_{2}^{1} (1 + \cos 2t) dt = \int_{2}^{1} (t + \sin 2t) dt$ $=\frac{1}{2!}\left(t+sintcost\right) = \pi/4$ $\frac{8sp(2)}{2x-3} = \frac{x}{2x-3} = \frac{1}{2}(2x-3)^{-1/2}$ $\frac{2x-3}{2} = \frac{1}{2}(2x-3)^{-1/2} =$ $= \int \left(\frac{u^2 + 3}{2}\right) dx$ $= \int_{2}^{2} \int_{2}^{2} \left(4^{2} + 3\right) dn$ $=\frac{1}{2}\left(\frac{u^{3}+3u}{3}+3u\right)=\frac{1}{2}\left(\frac{u^{2}+3}{3}+3\right)=\frac{1}{2}\left(\frac{2x-3}{3}+3\right)+C.$ = PX-3 (x +1) + C -