

$$\int x dx \quad (7) \sec^4 f$$

$$x \Rightarrow du dx = \sec x \Rightarrow dx = \frac{du}{\sec x} = \frac{du}{1 + \tan^2 x} \\ \int \sec^2 x \times \sec^2 x dx = \int \sec^2 x \sec^2 x dx = \int \sec^2 x \sec^4 x dx \\ x = \int (1 + u^2) du = u + \frac{1}{3} u^3 + C = \tan x + \frac{1}{3} \tan^3 x + C = \tan x + \frac{1}{3} \tan^3 x + C$$

$$\int x dx \quad (8) x \cos^2 \tan f$$

$$x \int \tan x \Rightarrow dx = du \sec^2 x \Rightarrow dx = \frac{du}{\sec^2 x} = \frac{du}{1 + \tan^2 x} \\ \int \tan x \cos^2 \tan x dx = \int \tan x \cos^2 \tan x dx = \int \tan x \cos^2 \tan x dx \\ x + C = \int u du = \frac{1}{2} u^2 + C = \frac{1}{2} \tan^2 x + C = \frac{1}{2} \tan^2 x + C$$

$$\int x dx \quad (9) \ln \sin f$$

$$u = \sin x \Rightarrow du = \cos x dx \\ \int \ln \sin x dx = \int \ln u du = u \ln u - \int \frac{1}{u} du = \sin x \ln \sin x - \cos x + C$$

$$\int x dx \quad (10) x^2 \cos \sin f$$

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

$$\int (2e^x - 2e^{-x})(e^x + e^{-x})^2 dx \quad (11) f$$

$$u = e^x + e^{-x} \Rightarrow du = e^x - e^{-x} dx \\ \int (2e^x - 2e^{-x})(e^x + e^{-x})^2 dx = \int 2(e^x - e^{-x})u^2 du = \frac{2}{3} u^3 + C = \frac{2}{3} (e^x + e^{-x})^3 + C$$

$$\int x(x+1)^{x+1} dx \quad (12) - f$$

$$u = x+1 \Rightarrow dx = du, x = u-1 \\ \int x(x+1)^{x+1} dx = \int (u-1)u^{u-1} du = \int (u-1)u^{u-1} du = \int (u-1)u^{u-1} du \\ = \frac{1}{2} u^2 - \frac{1}{3} u^3 + C = \frac{1}{2} (x+1)^2 - \frac{1}{3} (x+1)^3 + C = \frac{1}{2} (x+1)^2 - \frac{1}{3} (x+1)^3 + C$$

$$\int x(x+10)^3 dx \quad (13) f$$

$$u = x+10 \Rightarrow dx = du, x = u-10 \\ \int x(x+10)^3 dx = \int (u-10)u^3 du = \int (u^4 - 10u^3) du = \frac{1}{5} u^5 - 10 \frac{1}{4} u^4 + C \\ = \frac{1}{5} (x+10)^5 - \frac{10}{4} (x+10)^4 + C = \frac{1}{5} (x+10)^5 - \frac{5}{2} (x+10)^4 + C$$

$$\int x^2 dx \quad (14) x^2 \tan^7 \sec^2 f$$

$$x^2 dx = \int \sec^2 x \tan^7 x^2 \int \sec^2 x^2 \Rightarrow dx = 2 du \sec^2 x^2 \Rightarrow du dx = 12 \sec^2 u = \tan x^2 + C x^2 = 2 \int u^7 du = 14 u^8 + C = 14 \tan^8 x^2 u^7 \times 2 du \sec^2$$

$$(x dx (15 x \sec x + e \sin \sec^3 \int$$

$$x x e \sin x dx + \int \cos x) dx = \int \sec^2 x e \sin x + \cos x dx = \int (\sec^2 x \sec x + e \sin \sec^3 \int x dx + x dx = \int \sec^2 x \sec x + e \sin x \int \sec^3 x \Rightarrow dx = du \cos x \Rightarrow du dx = \cos dx u = \sin x + C x + e \sin x + e u + C = \tan x + \int e u du = \tan x = \tan x e u \times du \cos \int \cos$$

$$(x dx (16 x^3) \cos^3 \sin + 1) \int$$

$$x dx = \int (1 + u^3) \cos^3 x^3) \cos^3 x \int (1 + \sin x \Rightarrow dx = du \cos x \Rightarrow du dx = \cos u = \sin x) du = \int (1 + u^3) (1 - u^2) du = \int (1 + u^3) (1 - \sin^2 x) = \int (1 + u^3) \cos^2 x du \cos) du = \int (1 + u^3) (1 - u^2) du = \int (1 - u^2 + u^3 - u^7) du = u - \frac{1}{3} u^3 + \frac{3}{4} u^4 - \frac{1}{8} u^8 + C x - \frac{1}{3} \sin^3 x + \frac{3}{4} \sin^4 x - \frac{1}{8} \sin^8 x + C = \sin$$

$$(x dx (17 x \sec^5 \sin \int$$

$$x \int \sin x \Rightarrow dx = du - \sin x \Rightarrow du dx = -\sin x dx u = \cos x \cos - 5 x dx = \int \sin x \sec^5 \sin \int x + x = - \int u - 5 du = 14 u - 4 + C = 14 \cos - 4 x u - 5 \times du - \sin x dx = \int \sin x \sec^5 n x + C C = 14 \sec^4$$

$$(x dx (18 x \cos^3 x + \tan \sin \int$$

$$x + s x (\sec x \sec x) dx = \int \tan x \sec^3 x + \tan x \sec^2 x dx = \int (\tan x \cos^3 x + \tan \sin \int x dx \cos^3 x + \tan x \int \sin x \sec x \Rightarrow dx = du \tan x \sec x \Rightarrow du dx = \tan x) dx u = \sec^2 x = \int (u + u^2) du = 12 u^2 + 13 u^3 + C = 12 \sec x \sec x (u + u^2) du \tan x \sec x = \int \tan x + C x + 13 \sec^3 2$$

أجد قيمة كلا من التكمالات الآتية:

$$(2 x dx (19 x^{1 - \cos 20\pi/4} \sin \int$$

$$|2 x^2 x| = |\sin^2 x = \sin^2 \cos^2 - 1$$

لكن الزاوية $2x$ تكون ضمن الربع الأول عندما $0 < 2x < \pi/4$

لذا فإن $2x > 0 \sin$ ويكون $2x > 0 \sin$

$$x \Rightarrow x dx u = \sin x \cos 2x dx = \int_0^{\pi/4} 2 \sin 2x \sin 2x dx = \int_0^{\pi/4} 2 \sin^2 x dx = \int_0^{\pi/4} 2(1 - \cos 2x) dx = 2x - \sin 2x \Big|_0^{\pi/4} = \left(\frac{\pi}{2} - 1\right) - (0 - 0) = \frac{\pi}{2} - 1$$

$$\int_0^{\pi/2} x^2 dx = \frac{1}{3} x^3 \Big|_0^{\pi/2} = \frac{1}{3} \left(\frac{\pi}{2}\right)^3 = \frac{\pi^3}{24}$$

$$x^2 dx = \int_0^{\pi/4} u = x^2 \Rightarrow du dx = 2x \Rightarrow dx = \frac{du}{2x} \quad x = \frac{\pi}{2} \Rightarrow u = \frac{\pi^2}{4} \quad x = 0 \Rightarrow u = 0$$

$$\int_0^{\pi/4} \pi^2 x \sin \pi^2 x dx = \int_0^{\pi^2/4} \frac{u}{2} du = \frac{1}{4} u^2 \Big|_0^{\pi^2/4} = \frac{1}{4} \left(\frac{\pi^2}{4}\right)^2 = \frac{\pi^4}{64}$$

$$\int_0^1 (1-x^3)^2 dx = \int_0^1 (1 - 2x^3 + x^6) dx = \left(x - \frac{1}{2}x^4 + \frac{1}{7}x^7\right) \Big|_0^1 = 1 - \frac{1}{2} + \frac{1}{7} = \frac{14}{14} - \frac{2}{14} + \frac{2}{14} = \frac{14}{14} = 1$$

$$u = 1 + x^2 \Rightarrow du dx = 2x \Rightarrow dx = \frac{du}{2x} \quad x^2 = u - 1 \quad x = 0 \Rightarrow u = 1 \quad x = 1 \Rightarrow u = 2$$

$$\int_0^1 (1+x^2)^3 dx = \int_1^2 (u)^3 \frac{du}{2(u-1)} = \frac{1}{2} \int_1^2 \frac{u^3}{u-1} du = \frac{1}{2} \int_1^2 (u^2 + u + 1 + \frac{1}{u-1}) du$$

$$= \frac{1}{2} \left(\frac{1}{3}u^3 + \frac{1}{2}u^2 + u + \ln|u-1| \right) \Big|_1^2 = \frac{1}{2} \left(\frac{8}{3} + 2 + 2 + \ln 1 - \left(\frac{1}{3} + \frac{1}{2} + 1 + \ln 0 \right) \right)$$

$$\int_0^{\pi/3} x \tan 50\pi/3 \sec^2 x dx = \int_0^{\pi/3} x \sec^2 x dx$$

$$x \tan x = 0 \Rightarrow u = 0 \quad x = \pi/3 \Rightarrow u = 3 \quad \int_0^{\pi/3} \pi^3 \sec^2 x dx = \int_0^3 u \sec^2 x dx = \int_0^3 u \tan u du = \frac{1}{2} u^2 \tan u - \frac{1}{2} u^2 \Big|_0^3 = \frac{9}{2} \tan 3 - \frac{9}{2}$$

$$\int_0^2 (x-1)e^{(x-1)^2} dx = \int_0^2 (x-1)^2 dx = \frac{1}{3} (x-1)^3 \Big|_0^2 = \frac{1}{3} (1 - (-1)^3) = \frac{2}{3}$$

$$u = (x-1)^2 \Rightarrow du dx = 2(x-1) \Rightarrow dx = \frac{du}{2(x-1)} \quad x = 0 \Rightarrow u = 1 \quad x = 2 \Rightarrow u = 1$$

$$\int_0^2 (x-1)^2 dx = \int_1^1 \frac{u}{2} du = 0$$

$$\int_0^2 (x^2 + 1) dx = \left(\frac{1}{3}x^3 + x\right) \Big|_0^2 = \frac{8}{3} + 2 = \frac{14}{3}$$

$$u = 2 + x \Rightarrow du dx = 1 \Rightarrow dx = du \quad x = 3 \Rightarrow u = 5 \quad x = 4 \Rightarrow u = 6$$

$$\int_3^4 (2+x)^2 dx = \int_5^6 u^2 du = \frac{1}{3} u^3 \Big|_5^6 = \frac{1}{3} (216 - 125) = \frac{91}{3}$$

$$\int_0^1 10x(1+x^3)^2 dx = \int_0^1 10x^2(1+x^3)^2 dx = \frac{10}{3} \int_0^1 (1+x^3)^2 dx$$

$$u = 1 + x^3 \Rightarrow du dx = 3x^2 \Rightarrow dx = \frac{du}{3x^2} \quad x = 0 \Rightarrow u = 1 \quad x = 1 \Rightarrow u = 2$$

$$\int_0^1 10x(1+x^3)^2 dx = \int_1^2 \frac{10u^2}{3} du = \frac{10}{9} \left(\frac{1}{3} u^3 \right) \Big|_1^2 = \frac{10}{27} (8 - 1) = \frac{70}{27}$$

$$\int_0^{\pi/6} x \sin 0\pi/6 \cos x dx = \int_0^{\pi/6} x \cos x dx = \left(x \sin x + \cos x\right) \Big|_0^{\pi/6} = \left(\frac{\pi}{6} \sin \frac{\pi}{6} + \cos \frac{\pi}{6}\right) - (0 + 1) = \frac{\pi}{12} + \frac{\sqrt{3}}{2} - 1$$

$$x=0 \Rightarrow u=1 \quad x=\pi/6 \Rightarrow u=3/2 \quad \int_0^{\pi/6} 2 \cos x \Rightarrow dx = du - \sin x \Rightarrow du dx = -\sin u = \cos 2u$$

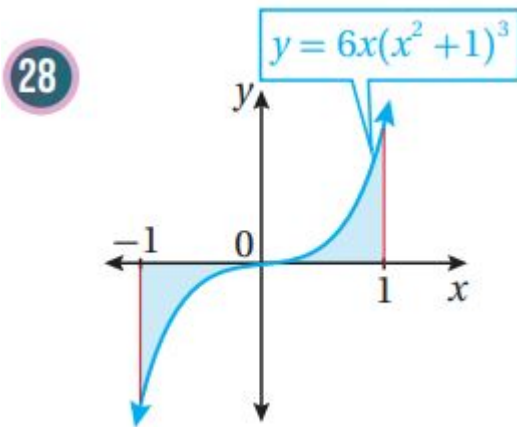
$$2 \int_{3/2}^2 \cos u du = -2 \ln |x| = -2 \ln |3/2| = -2 \ln 3/2 = -2(\ln 3 - \ln 2) \approx 0.256$$

$$\int_0^{\pi/2} x \cot x dx = \int_0^{\pi/2} x \frac{\cos x}{\sin x} dx = \int_0^{\pi/2} x \csc x dx$$

$$x=\pi/2 \Rightarrow u=0 \quad x=\pi/4 \Rightarrow u=1 \quad \int_{\pi/4}^{\pi/2} x \cot x dx = \int_0^1 (u + \pi/4) \cot(u + \pi/4) du$$

$$= \int_0^1 (u + \pi/4) \frac{\cos(u + \pi/4)}{\sin(u + \pi/4)} du = \int_0^1 (u + \pi/4) \csc(u + \pi/4) du$$

أجد مساحة المنطقة المظللة في كل من التمثيلات البيانية الآتية:



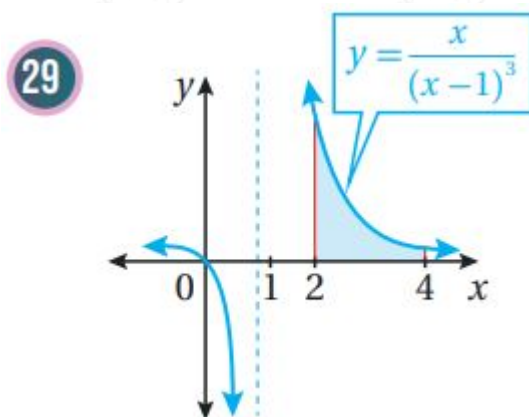
$$A = -\int_{-1}^0 6x(x^2+1)^3 dx + \int_0^1 6x(x^2+1)^3 dx$$

$$u = x^2 + 1 \Rightarrow du dx = 2x \Rightarrow dx = \frac{du}{2x}$$

$$x = -1 \Rightarrow u = 2 \quad x = 0 \Rightarrow u = 1 \quad x = 1 \Rightarrow u = 2$$

$$A = -\int_2^1 3u^3 \frac{du}{2x} + \int_1^2 3u^3 \frac{du}{2x} = -\int_2^1 \frac{3}{2} u^3 du + \int_1^2 \frac{3}{2} u^3 du$$

$$= \frac{3}{2} \left[\frac{u^4}{4} \right]_2^1 + \frac{3}{2} \left[\frac{u^4}{4} \right]_1^2 = \frac{3}{8} (1 - 16) + \frac{3}{8} (16 - 1) = \frac{3}{8} (-15) + \frac{3}{8} (15) = 0$$

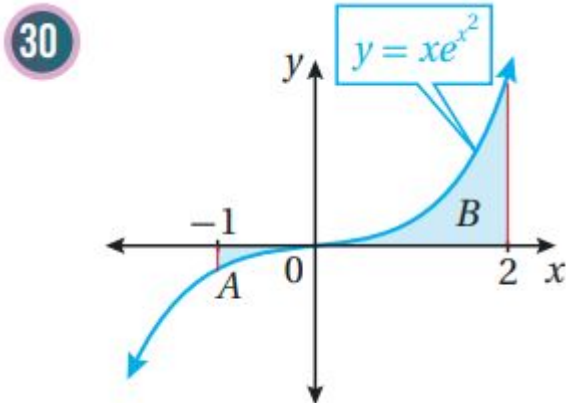


$$A = \int_2^4 \frac{x}{(x-1)^3} dx$$

$$u = x-1 \Rightarrow dx = du, \quad x = u+1$$

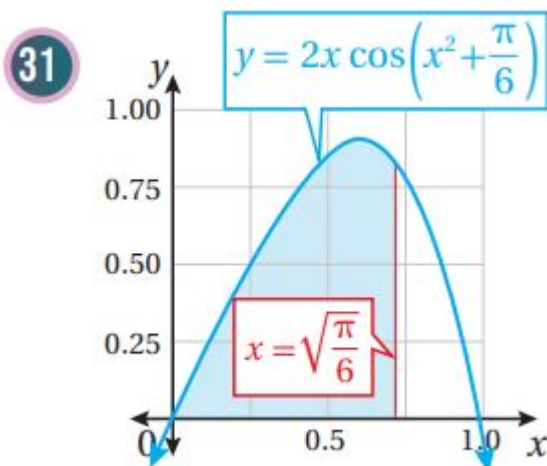
$$x=2 \Rightarrow u=1 \quad x=4 \Rightarrow u=3$$

$$A = \int_1^3 \frac{u+1}{u^3} du = \int_1^3 (u^{-2} + u^{-3}) du = \left[-u^{-1} - \frac{1}{2}u^{-2} \right]_1^3 = \left(-\frac{1}{3} - \frac{1}{18} \right) - \left(-1 - \frac{1}{2} \right) = -\frac{7}{18} + \frac{3}{2} = \frac{-7 + 27}{18} = \frac{20}{18} = \frac{10}{9}$$



$$u = x^2 \Rightarrow \frac{du}{dx} = 2x \Rightarrow dx = \frac{du}{2x} \Rightarrow \frac{dx}{x} = \frac{du}{2u} \Rightarrow \int \frac{dx}{x} = \frac{1}{2} \int \frac{du}{u} \Rightarrow \ln|x| = \frac{1}{2} \ln|u| \Rightarrow \ln|x| = \frac{1}{2} \ln|x^2| \Rightarrow \ln|x| = \ln|x|$$

$$A = \int_{-1}^0 x e^{x^2} dx + \int_0^2 x e^{x^2} dx = \int_{-1}^0 \frac{1}{2} e^u du + \int_0^2 \frac{1}{2} e^u du = \frac{1}{2} [e^u]_{-1}^0 + \frac{1}{2} [e^u]_0^2 = \frac{1}{2} (e^0 - e^{-1}) + \frac{1}{2} (e^2 - e^0) = \frac{1}{2} (1 - e^{-1} + e^2 - 1) = \frac{1}{2} (e^2 - e^{-1}) \approx 27.658$$



$$u = x^2 + \frac{\pi}{6} \Rightarrow \frac{du}{dx} = 2x \Rightarrow dx = \frac{du}{2x} \Rightarrow \frac{dx}{x} = \frac{du}{2u} \Rightarrow \int \frac{dx}{x} = \frac{1}{2} \int \frac{du}{u} \Rightarrow \ln|x| = \frac{1}{2} \ln|u| \Rightarrow \ln|x| = \frac{1}{2} \ln|x^2 + \frac{\pi}{6}|$$

$$A = \int_0^{\sqrt{\pi/6}} 2x \cos(x^2 + \frac{\pi}{6}) dx = \int_{\pi/6}^{\pi/6 + \pi/3} \cos u du = \sin u \Big|_{\pi/6}^{\pi/6 + \pi/3} = \sin(\frac{\pi}{6} + \frac{\pi}{3}) - \sin(\frac{\pi}{6}) = \sin(\frac{\pi}{2}) - \sin(\frac{\pi}{6}) = 1 - \frac{1}{2} = \frac{1}{2} \approx 0.5$$

في كل مما يأتي المشتقة الأولى للاقتران $(f(x), g(x))$ ، ونقطة يمر بها منحنى $y = f(x)$.
أستعمل المعلومات المعطاة لإيجاد قاعدة الاقتران $(f(x), g(x))$:

(32) $(f(x), g(x)) = (2x(4x^2 - 10)^2, (2, 10))$

$$f(x) = \int f'(x) dx = \int 2x(4x^2 - 10)^2 dx \quad u = 4x^2 - 10 \Rightarrow \frac{du}{dx} = 8x \Rightarrow dx = \frac{du}{8x}$$

$$f(x) = \int 2x u^2 \frac{du}{8x} = \frac{1}{4} \int u^2 du = \frac{1}{4} \cdot \frac{1}{3} u^3 + C = \frac{1}{12} (4x^2 - 10)^3 + C$$

$$f(2) = \frac{1}{12} (216) + C = 10 \Rightarrow C = -8 \Rightarrow f(x) = \frac{1}{12} (4x^2 - 10)^3 - 8$$

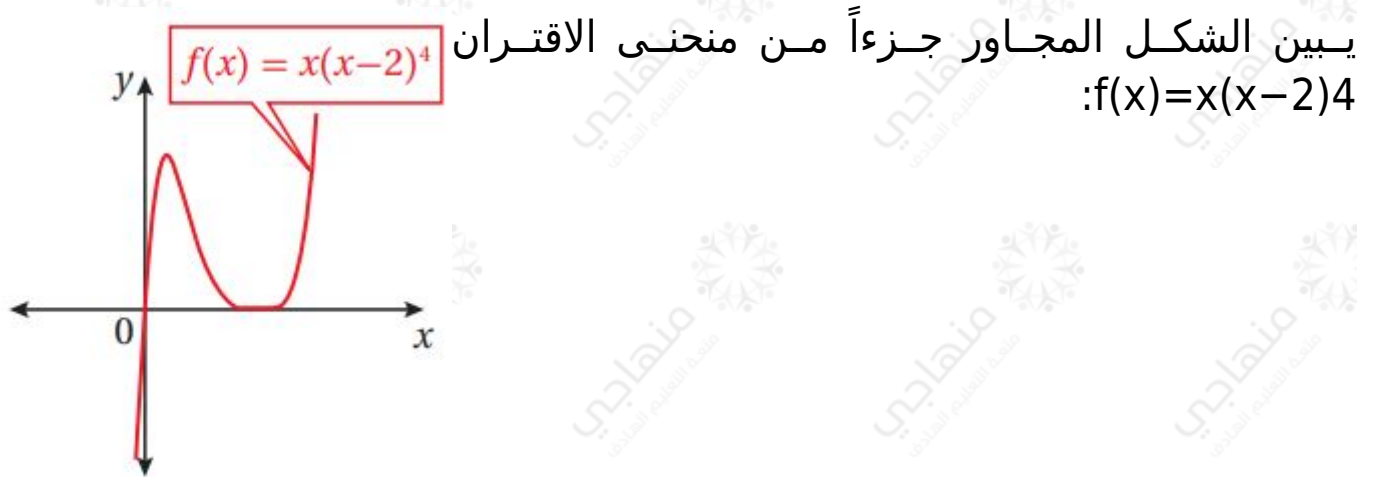
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$$(f'(x) = x^2 e^{-0.2x^3}; (0, 32)) \quad (33)$$

$$f(x) = \int f'(x) dx = \int x^2 e^{-0.2x^3} dx \quad u = -0.2x^3 \Rightarrow du/dx = -0.6x^2 \Rightarrow dx = du / -0.6x^2$$

$$x^2 f(x) = \int x^2 e^u du / -0.6x^2 = -1/0.6 \int e^u du = -5/3 e^u + C \Rightarrow f(x) = -5/3 e^{-0.2x^3} + C$$

$$+ C f(0) = -5/3 + C 32 = -5/3 + C \Rightarrow C = 196 \Rightarrow f(x) = -5/3 e^{-0.2x^3} + 196$$



(34) أجد إحداثي نقطة تماس الاقتران مع المحور x

نجد أصفار الاقتران بحل المعادلة $f(x) = 0$

$$x(x-2)^4 = 0 \Rightarrow x = 0, x = 2$$

نقطة التقاطع $(0, 0)$, فتكون نقطة التماس $(2, 0)$

ويمكن التحقق بحساب $f'(2)$:

$$f'(x) = (x-2)^4 + 4x(x-2)^3 \quad f'(2) = (2-2)^4 + 4(2)(2-2)^3 = 0$$

(35) أجد مساحة المنطقة المحصورة بين منحنى الاقتران $f(x)$ والمحور x

$$A = \int_0^2 x(x-2)^4 dx \quad u = x-2 \Rightarrow dx = du, x = u+2 \quad x=0 \Rightarrow u = -2 \quad x=2 \Rightarrow u = 0$$

$$A = \int_{-2}^0 (u+2)u^4 du = \int_{-2}^0 (u^5 + 2u^4) du = (1/6 u^6 + 2/5 u^5) \Big|_{-2}^0$$

$$= 0 - (1/6 (-2)^6 + 2/5 (-2)^5) = 32/15$$

(36) يتحرك جسيم في مسار مستقيم، وتعطى سرعته المتجهة بالاقتران:

$\omega t \cos 2v(t) = \sin$ حيث t الزمن بالثواني، و v سرعته المتجهة بالمتري لكل ثانية،

و b ثابت، إذا انطلق الجسم من نقطة الأصل، فأجد موقعه بعد t ثانية.

$$wts(t) = wt \Rightarrow dt = du - w \sin wt \Rightarrow dudx = -w \sin wt dt u = \cos wt \cos 2s(t) = \int \sin wt + C wt = -1/w \int u^2 du = -1/3 w u^3 + C \Rightarrow s(t) = -1/30 \cos 3wt u^2 du - w \sin \int \sin$$

لكن $s(0) = 0$ لأن الجسم انطلق من نقطة الأصل.

$$wt + 13ws(0) = -13w + C0 = -13w + C \Rightarrow C = 13w \Rightarrow s(t) = -13w \cos 3$$



(37) طب: يمثل الاقتران $C(t)$ تركيز دواء في الدم بعد t دقيقة من حقنه في جسم مريض، حيث C مقيسة بالمليغرام لكل سنتيمتر مكعب (mg/cm^3)، إذا كان تركيز الدواء لحظة حقنه في جسم المريض $0.5 mg/cm^3$ ، وأخذ يتغير بمعدل $C'(t) = -0.01e^{-0.01t}(1+e^{-0.01t})^2$ ، فأجد $C(t)$.

$$C(t) = \int C'(t) dt = \int -0.01e^{-0.01t}(1+e^{-0.01t})^2 dt u = 1+e^{-0.01t} \Rightarrow du/dt = -0.01e^{-0.01t} \Rightarrow dt = du - 0.01e^{-0.01t} C(t) = \int -0.01e^{-0.01t} u^2 \times du - 0.01e^{-0.01t} = \int u - 2du = -u - 1 + K$$

استعمل الرمز K لثابت التكامل بدل C المعتاد لتمييز ثابت التكامل عن رمز الاقتران C :

$$C(t) = -(1+e^{-0.01t}) - 1 + K C(0) = -(2) - 1 + K12 = -12 \Rightarrow K = 1 \Rightarrow C(t) = -(1+e^{-0.01t}) - 1 + 1 C(t) = -11 + e^{-0.01t} + 1$$

(38) أجد قيمة $\int 4e^{4x} x e^{-2x} dx$ $3 \ln \ln$ ، ثم اكتب الإجابة بالصيغة الآتية: $dab + c \ln$ ، حيث a, b, c, d ثوابت صحيحة.

$$3 - 2 = 3 - 2 = 1 x = |3 \Rightarrow u = e \ln u = e x - 2 \Rightarrow du/dx = e x \Rightarrow dx = du e x e x = u + 2 x = \ln 4e^{4x} x e^{-2x} = \int 1/2 e^{4x} u du e x = \int 1/2 e^{3x} u d 3 \ln 4 - 2 = 4 - 2 = 2 \int \ln 4 \Rightarrow u = e \ln u = \int 1/2 (u+2)^3 u du = \int 1/2 (u^3 + 6u^2 + 12u + 8) u du = \int 1/2 (u^4 + 6u^3 + 12u^2 + 8u) du |u| |1/2 = (1/5 u^5 + 3/2 u^4 + 2u^3 + 4u^2)$$

(39) إذا كان: $xf'(x) = \tan$ ، وكان: $f(3) = 5$ ، فأثبت أن $\ln | \cos x | + 5/3 \cos | \cos f(x) = \ln$.

$$3 | + C 5 = - \ln | \cos x | + C f(3) = - \ln | \cos x dx = - \ln x \cos x dx = - \int - \sin f(x) = \int \tan$$

$$x|+53\cos|\cos3|=\ln|\cos x|+5+\ln|\cos 3|f(x)=-\ln|\cos 3|+C\Rightarrow C=5+\ln|\cos$$