1) $\int \frac{x^2}{x^2+4}\,dx = \int 1 - \frac{4}{x^2+4}\,dx$

$$\begin{array}{r|l} & \quad 1 \\ \hline x^2+4 & x^2 + 0 \\ & -(x^2+4) \\ \hline & \quad -4 \end{array}$$

$= x - \frac{4}{2}\arctan\frac{x}{2} + C$

2) $\int x \ln x \, dx$

$u = \ln x \qquad du = \frac{1}{x} dx$

$v = \frac{1}{2} x^2 \qquad dv = x \, dx$

$= \frac{1}{2} x^2 \ln x - \int \frac{1}{2} x \, dx$

$= \frac{1}{2} x^2 \ln x - \frac{1}{4} x^2 + C$

3) $\int e^x \cos(2x)\, dx$

$u = \cos(2x) \quad du = -2\sin 2x\, dx$

$v = e^x \quad dv = e^x dx$

$\int e^x \cos(2x) dx = e^x \cos(2x) + 2\int e^x \sin(2x) dx$

$u = \sin(2x) \quad du = 2\cos 2x\, dx$

$v = e^x \quad dv = e^x\, dx$

$\int e^x \cos 2x\, dx = e^x \cos 2x + 2e^x \sin 2x - 4\int e^x \cos 2x\, dx$

$5\int e^x \cos 2x\, dx = e^x \cos 2x + 2e^x \sin 2x$

$\int e^x \cos 2x\, dx = \frac{1}{5}e^x \cos 2x + \frac{2}{5}e^x \sin 2x + C$

4) $\int \frac{1-\sec x}{\cos x - 1}\,dx = \int \frac{1-\frac{1}{\cos x}}{\cos x - 1}\,dx$

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

$= \int \frac{1}{\cos x}\,dx = \int \sec x\,dx$

$= \ln|\sec x + \tan x| + C$

5) $\int \sec^2 t \sqrt{\tan t}\, dt$ $= \int u^{\frac{1}{2}} du$

$u = \tan t$

$du = \sec^2 t\, dt$

$= \frac{2}{3} u^{\frac{3}{2}} + C$

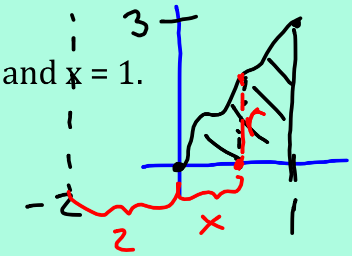
$= \frac{2}{3} \tan^{\frac{3}{2}} t + C$

6) $\int \cos^2(2x)\,dx$

$= \int \frac{1}{2}(1 + \cos 4x)\,dx$

$= \frac{1}{2}x + \frac{1}{8}\sin 4x + C$

A region is bounded by $y = 3x^{\frac{2}{3}}$, y = 0 and x = 1.



a) Find the area of the region

$$A = \int_0^1 3x^{\frac{2}{3}}\,dx$$

b) Find the volume of the solid formed by revolving the region about y = 3

$$V = \pi \int_0^1 \left[(3-0)^2 - \left(3 - 3x^{\frac{2}{3}}\right)^2\right] dx$$

c) Find the volume of the solid formed by revolving the region about x = -2

$$V = 2\pi \int_0^1 (x+2)\left(3x^{\frac{2}{3}}\right) dx$$

d) Find the volume of the region is the base of a solid whose cross sections are rectangles where the height is 5 times the length of the base ⊥ to x-axis

$5\left(3x^{\frac{2}{3}}\right)$

$3x^{2/3}$

$$V = \int_0^1 \left(3x^{\frac{2}{3}}\right)(5)\left(3x^{\frac{2}{3}}\right) dx$$

e) Find the length of the curved boundary (just write the setup, do not evaluate)

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

$$(y')^2 = 4x^{-\frac{2}{3}}$$

$$AL = \int_0^1 \sqrt{1 + 4x^{-\frac{2}{3}}}\,dx$$

f) Find the area of the surface of revolution if the region is revolved about the x-axis (just write the setup, do not evaluate)

$$SA = 2\pi \int_0^1 \underbrace{\left(3x^{\frac{2}{3}}\right)}_{\text{radius}} \underbrace{\sqrt{1 + 4x^{-\frac{2}{3}}}}_{AL}\,dx$$

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