24.1

(a): We are first told to evaluate the integral

$$A = \int_0^{\pi/2} \cos(x)\, dx = 1$$

Then we must evaluate

$$\frac{1}{A}\int_0^{\pi/2} x\cos(x)\, dx$$

for A=1; integrate by parts.

$$\ldots = \left|\sin(x)\, x\right|_0^{\pi/2} - \int_0^{\pi/2} \sin(x) = X_{com}$$

$$= \frac{\pi}{2} - \left|-\cos(x)\right|_0^{\pi/2}$$

$$= \pi/2 - 1$$

(b): First find the area between x and x^2 on [0,1]. I've done this in the past but may as well do it again.

$$A = \int_0^1 (x - x^2)\, dx$$

$$= \left|\frac{x^2}{2}\right|_0^1 - \left|\frac{x^3}{3}\right|_0^1$$

$$= \frac{1}{2} - \frac{1}{3} = \frac{1}{6}$$

Then evaluate:

$$X_{com} = 6\int_0^1 x^2 - x^3\, dx$$

$$6\left|\frac{x^3}{3}\right|_0^1 - 6\left|\frac{x^4}{4}\right|_0^1 = 2 - \frac{3}{2} = \frac{1}{2}$$