**1.** Find the area of the region enclosed by the line $y = 4x$ and the curve $y = x^3 + 3x^2$.

Intersection points:

$4x = x^3 + 3x^2$

$0 = x^3 + 3x^2 - 4x$

$0 = x(x^2 + 3x - 4)$

$0 = x(x+4)(x-1)$

$x = 0 \quad x = -4 \quad x = 1$

$$\int_{-4}^{0} \left[(x^3 + 3x^2) - 4x\right] dx$$

$$= \left[\frac{x^4}{4} + x^3 - 2x^2\right]_{-4}^{0}$$

$$= 0 - \left(\frac{256}{4} - 64 - 32\right) = 32$$

$$\int_0^1 \left[4x - (x^3 + 3x^2)\right] dx$$

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

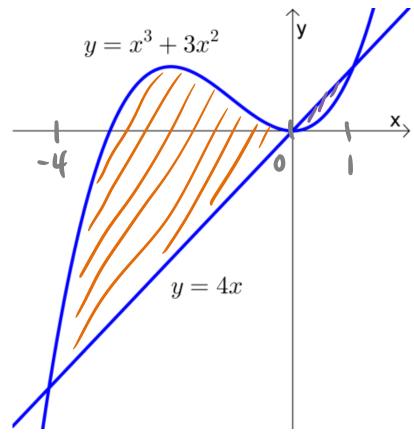
$$= \left(2 - \frac{1}{4} - 1\right) - 0$$

$$= \frac{3}{4}$$

Total area

$$= 32 + \frac{3}{4}$$

$$= \boxed{32\tfrac{3}{4}} \ (32.75)$$




**2.** Find the area of the region enclosed by the curves $x - y^2 = 0$ and $x + 2y^2 = 3$. (Hint: Integrate in $y$ direction.)

$x = y^2 \qquad x = -2y^2 + 3$

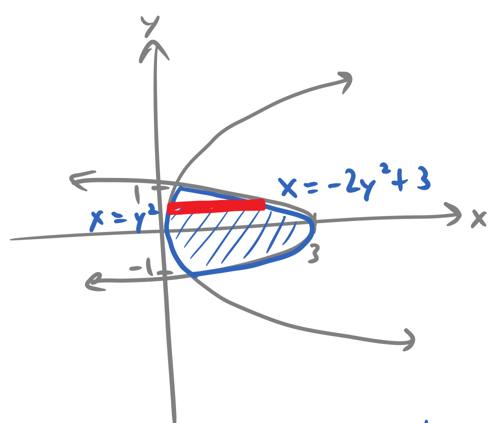
Intersection points:

$y^2 = -2y^2 + 3$

$3y^2 = 3$

$y^2 = 1$

$y = \pm 1$




$$\text{Area} = \int_{-1}^{1} \left[(-2y^2 + 3) - (y^2)\right] dy$$

$$= \int_{-1}^{1} (-3y^2 + 3)\, dy$$

$$= 2\int_0^1 (-3y^2 + 3)\, dy$$

$$= 2\left[-y^3 + 3y\right]_0^1$$

$$= 2(-1 + 3)$$

$$= \boxed{4}$$