$x^3 - 9x = 0$

$x(x-3)(x+3) = 0$

$x = 0, 3, -3$

So $P(-3,0)$ $Q(0,6)$ $R(3,12)$

b) Area enclosed by 2 curves

$$= \int_{-3}^{0} x^3 - 7x + 6 - (2x+6)dx + \int_{0}^{3} 2x + 6 - (x^3 - 7x + 6)dx$$

$$= \int_{-3}^{0} x^3 - 9x\, dx + \int_{0}^{3} 9x - x^3 dx = \frac{81}{4} + \frac{81}{4} = \frac{81}{2}$$

4.

a) $4e^{-x} = e^x - 3$

$4 = e^{2x} - 3e^x$ and hence result.

b) *Let* $u = e^x$ $u^2 - 3u - 4 = 0$

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

$u = 4, -1$

$e^x = 4$ *or* $e^x = -1$ (no solution)

$x = ln4$

c) Area=$\int_0^{ln4} 4e^{-x} - (e^x - 3)dx = [-4e^{-x} - e^x + 3x]_0^{ln4}$

$= -4e^{-ln4} - e^{ln4} + 3ln4 - (-4e^0 - e^0)$

$= -4 \times \frac{1}{4} - 4 + 3ln4 + 5 = 3ln4$

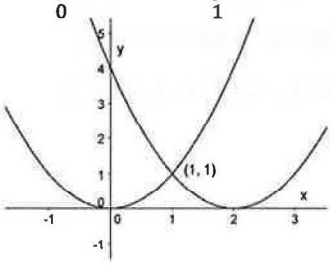
5. $V = \pi \int_0^1 x^2\, dy = \pi \int_0^1 e^{2y}\, dy$

$= \frac{\pi}{2}[e^{2y}]_0^1 = \frac{\pi}{2}(e^2 - 1)$

6. We have to find the sum of two volumes

$V = \pi \int_0^1 y^2\, dx + \pi \int_1^2 y^2\, dx$

$$= \pi \int_0^1 x^4\, dx + \pi \int_1^2 (x-2)^4\, dx = \frac{2\pi}{5}$$



7.

a) $V = \pi \int_{-2}^{2} (8 - x^2)^2 - x^4 dx = 170\frac{2}{3}$

b) $V = \pi \int_0^4 y\, dy + \pi \int_4^8 8 - y\, dy = 16$