7) $\frac{x^2}{2}+y^2=8$

$\pi\int_0^4\left(\frac{x^2}{2}+y^2-8\;dx\right)^2$

$\left(\frac{x^2}{2}+y^2-8\right)\left(\frac{x^2}{2}+y^2-8\right)$

$\left(\frac{x^2}{2}\right)^2+2y^2\frac{x^2}{2}-\frac{16x^2}{2}+y^4-16y^2+64$

$\pi\times\int_0^4\left(\frac{x^4}{2}+2y^2\left(\frac{x^2}{2}\right)-\frac{16x^2}{2}+y^4-16y^2+64\right)dx$

$\pi\times\left[\frac{\left(\frac{x^2}{2}\right)}{2}+\frac{\left(2y^2\left(\frac{x^2}{2}\right)\right)^2}{2}-\frac{\left(\frac{16x^2}{2}\right)}{2}+\frac{y^5}{5}-\frac{16y^3}{3}+\frac{64^2}{2}\right]_0^4$

∴ Volume =

7) a) $\frac{x^2}{2}+y^2=8$

$\frac{x^2}{2}-8=-y$

$y=-\frac{x^2}{2}+8$

Volume $=\pi\times\int_0^4\left(-\frac{x^2}{2}+8\right)^2dx$

$=\pi\times\left[\left(-\frac{x^2}{2}\right)^2+\frac{-8x^2}{2}+\frac{-8x^2}{2}+64\right]_0^4$

$=\pi\times\left[\frac{\left(-\frac{x^2}{2}\right)^3}{3}+\frac{\left(-\frac{16x^2}{2}\right)^2}{2}+\frac{64^2}{2}\right]_0^4$

∴ volume = 69.75 units^2

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b) i) $= 0.75 \times 0.75$

$= 0.5625 \ \left(\frac{9}{16}\right)$

ii) $= 0.25 \times 0.25 \times 0.25$

$= 0.015625 \ \left(\frac{1}{64}\right)$

c) i) $= \frac{-2}{2}$

$= -1$

ii) let $t = 9$

$x = \frac{9-2}{9+2}$

$= \frac{7}{11}$

$x = 1 - \frac{4}{9+2}$

$= 1 - \frac{4}{11}$

$= \frac{7}{11}$

$x(t+2) = 1-4$

$t+2 = \frac{1-4}{x}$

$t = \frac{-3}{x} - 2$

iii) no, the particle is gradually accelerating as 't' increases.

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iv) limiting sum of a geometric series $= \frac{a}{1-r}$

$\therefore$ limiting velocity $= \frac{-1}{1-3}$

$= \frac{1}{2}$

$\therefore$ the limiting velocity $= \frac{1}{2}$ as $t \to \infty$