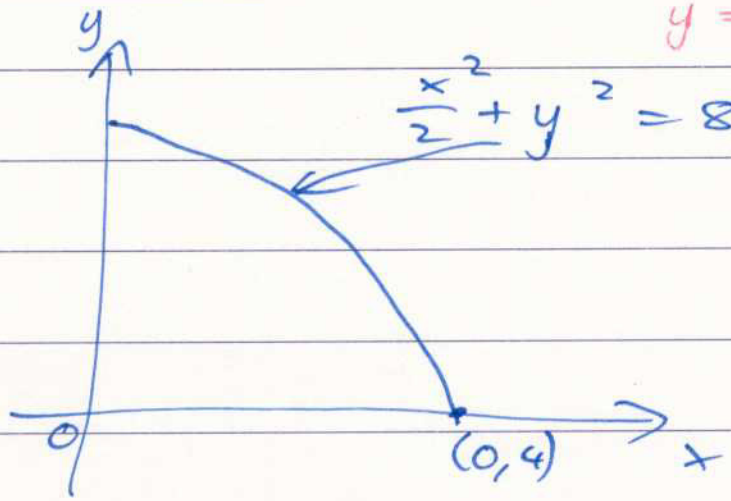
BOARD OF STUDIES
NEW SOUTH WALES

Question 7:

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

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

(a)



at $y = 0$ for x-intercept

$\frac{x^2}{2} + 0 = 8$

$x^2 = 16$

$x = \pm 4$

but it is positive

$\therefore x = 4$

$$V = \pi \int_0^4 \left(\sqrt{8 - \frac{x^2}{2}}\right)^2 dx$$

$$V = \pi \int_0^4 8 - \frac{x^2}{2}\, dx$$

$$V = \pi \left[8x - \frac{x^3}{3} \right]_0^4$$

$$V = \pi \left[\left(32 - \frac{4^3}{3}\right) - (0 - 0) \right]$$

$$V = \pi \left(32 - \frac{64}{3}\right)$$

$$V = \frac{32\pi}{3} \text{ Units}^3$$

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(b) $P(E) = 0.75$

(i) $P(\text{second time connection}) = 0.25 \times 0.75$
$= 0.1875$

(ii) $P(\text{Not connected after attempt 3}) = 0.25 \times 0.25 \times 0.$
$= 0.015625$

(c) $x = \frac{t-2}{t+2}$ t is in seconds

(i) at $t = 0$

$x = \frac{0-2}{0+2}$

$x = -1$ m

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

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

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

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

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

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$V = \frac{dx}{dt}$ $x = 1 - 4(t+2)^{-1}$

$V = 4(t+2)^{-2} \cdot 1$

$V = \frac{4}{(t+2)^2}$

$V = 4(t+2)^{-2}$

$a = \frac{dV}{dt} = -8(t+2)^{-3}$

$= -\frac{8}{(t+2)^3}$

(ii) at $V = 0$

$0 = \frac{4}{(t+2)^2}$

No solution for t

The particle is never at rest because when you substitute that velocity = 0 no time comes up.

(iv) The limiting velocity is 1 m/s

Because at time = 0 the velocity is 1 m/s if we sub in $t = 1$ we get $V = \frac{4}{9}$, if we sub in $t = 2$ $V = \frac{4}{16}$ and so, on.

So as time increases velocity decreases.