(1)

2.1.3. What is the minimum value of $f(x)$? For what values of x is this minimum value attained?

2.2. On the closed and bounded interval $[-6, 0]$.

2.2.1. What are the critical numbers inside this interval?

2.2.2. What is the maximum value of $f(x)$? For what values of x is this maximum value attained?

2.2.3. What is the minimum value of $f(x)$? For what values of x is this minimum value attained?

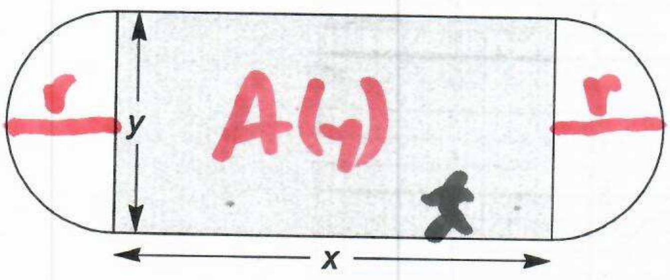
3. Let $g(x) = \frac{x^2+3x}{x^2+x+2} + 5$.

3.1. Show that $g'(x) = -2\,\frac{(x+1)(x-3)}{(x^2+x+2)^2}$.

3.2. For x-values in the interval $[0, 5]$, what is the maximum value of $g(x)$? For what values of x is this maximum attained?

3.3. For x-values in the interval $[0, 5]$, what is the minimum value of $g(x)$? For what values of x is this minimum attained?

4. A local high school is designing a new sports field. Its shape is rectangular with two semicircles at the opposite sides.



Constraint:

$P = 400\text{m}$

The field needs to have a 400 meter track around its perimeter. What are the dimensions x and y that make the area of the field as large as possible while maintaining the 400 meter perimeter?

$P = 2x + 2\pi r$

$= 2x + 2\pi\left(\frac{y}{2}\right) = 2x + \pi y = 400$

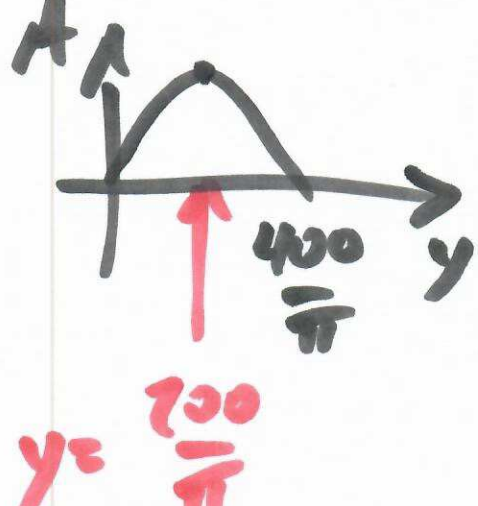
$$\therefore \quad x = 200 - \tfrac{\pi}{2} y$$

$$A = x \cdot y$$

want to maximize this!

$$= \left(200 - \tfrac{\pi}{2} y\right) \cdot y$$

$$= 200y - \tfrac{\pi}{2} y^2$$



Let's check that w/calculus:

$$A'(y) = 200 - \pi y = \underline{0}$$

demand this

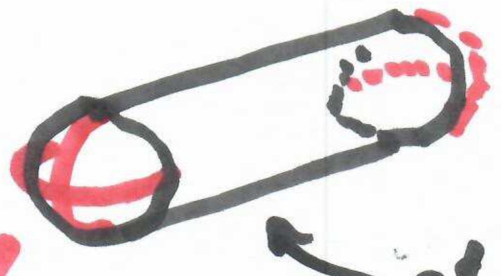
$$\boxed{y = \frac{200}{\pi}\,m} \approx 64\,m$$

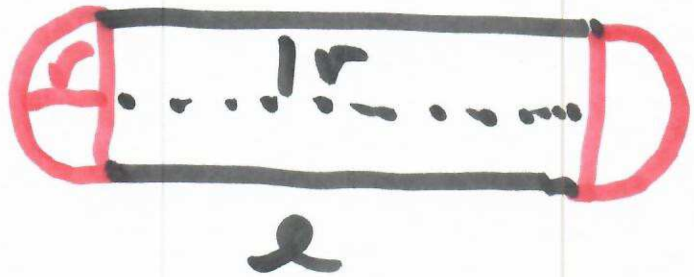
$$\therefore\ x = 200 - \frac{\pi}{2}\left(\frac{200}{\pi}\right)$$

$$= 200 - 100$$

$$\boxed{x = 100\ m}$$

AC 3.4.9 :





Minimize Total Cost.

$SA_s = 4\pi r^2$ $\quad$ $SA_c = 2\pi r \cdot l$

$V_s = \frac{4}{3}\pi r^3$ $\quad$ $V_c = \pi r^2 \cdot l$

Total volume $V = 1000$

$V = V_s + V_c$

(2)

$$V = \frac{4}{3}\pi r^3 + \pi r^2 l = 1000$$

$$\therefore \boxed{l = \frac{1000 - \frac{4}{3}\pi r^3}{\pi r^2}}$$

Total Cost $C(r) = C_s + C_c$

$$C(r) = 5^{\$} \cdot 4\pi r^2 + 2^{\$} \cdot 2\pi r\, l(r)$$

$$= 20\pi r^2 + \frac{4(1000 - \frac{4}{3}\pi r^3)}{r}$$

$$C(r) = 20\pi r^2 - \frac{16}{3}\pi r^2 + \frac{4000}{r}$$

$$= \frac{44}{3}\pi r^2 + \frac{4000}{r}$$

$$C'(r) = \frac{88}{3}\pi r - \frac{4000}{r^2} = \underbrace{0}_{\text{demand}}$$

$$\frac{88}{3}\pi r^3 = \overset{(3)}{4000}$$

$$\frac{11}{3}\pi r^3 = 500$$

$$\boxed{r_0 = \left(\frac{1500}{11\pi}\right)^{1/3}}$$

$$\boxed{r_0 \simeq 3.51 \text{ ft}}$$

Check: is $V(r_0) = 1000$?

What is $\ell(r_0)$?

Finally compute

$\underline{C(r_0)}$. (\$)