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$$1) f(x) = \frac{3x^2 + x - 1}{x^2 - x + 1}$$

$$D(f) = \mathbb{R} \Rightarrow f'(x) = \frac{3 \cdot 2x + 1}{2x - 1}$$

$$f'(x) = \frac{(3 \cdot 2x + 1) \cdot (x^2 - x + 1) - (3x^2 + x - 1) \cdot (2x - 1)}{(x^2 - x + 1)^2}$$

$$f'(x) = \frac{6x^2 - 5x^2 + 5x + 1 - 6x^2 + x^2 + 3x - 1}{(x^2 - x + 1)^2}$$

$$f'(x) = \frac{-4x^2 + 8x}{(x^2 - x + 1)^2}$$

Denom

$$D(f') \cap \mathbb{R} \text{ logo } f'(x) = 0$$

$$\therefore \frac{-4x^2 + 8x}{(x^2 - x + 1)^2} \Rightarrow -4x^2 + 8x = 0 \cdot (x^2 - x + 1)^2$$
$$-4x^2 + 8x = 0 \quad | (-4)$$
$$x^2 - 2x = 0$$

movendo para $(-1)^2$:

$$\text{I) } x^2 - 2x + (-1)^2 = (-1)^2 + 0$$

$$x^2 - 2x + (-1)^2 = 1$$

$$(x - 1)^2 = 1$$

$$\sqrt{(x - 1)^2} = \pm \sqrt{1}$$

$$x - 1 = \pm 1$$

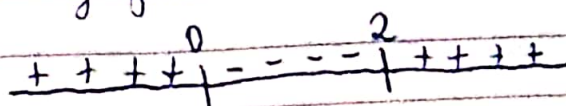
$$x = 2 \text{ (ponto m\u00e1x)}$$

$$\text{II) } x^2 - 1 = -\sqrt{1}$$

$$x^2 - 1 = -1$$

$$x^2 = 0 \text{ (ponto m\u00ednima)}$$

* graficamente:



(2) ^(I) $V = 2000\pi \text{ dm}^3$

$$V(n, h) = \pi n^2 \cdot h \Rightarrow \pi n^2 \cdot h = 2000\pi$$

$$h = \frac{2000}{n^2} \Rightarrow h = \frac{2000}{10^2} \Rightarrow \boxed{h = 20 \text{ dm}}$$

(I) $A(n, h) = 2\pi n^2 + 2\pi n \cdot h$

$$A(n, h) = 2\pi (n^2 + n \cdot h)$$

$$A(n, h) = 2\pi \left(n^2 + n \cdot \frac{2000}{n^2} \right)$$

$$A(n) = 2\pi \cdot \left(n^2 + \frac{2000}{n} \right)$$

$$\therefore \boxed{A(n) = 2\pi \cdot \left(\frac{n^3 + 2000}{n} \right)}$$

(III) $A'(n) = 2\pi \cdot \left(\frac{3n^2 \cdot n - (n^3 + 2000) \cdot 1}{n^2} \right)$

$$A'(n) = 2\pi \cdot \left(\frac{3n^3 - n^3 - 2000}{n^2} \right)$$

$$A'(n) = 2\pi \cdot \left(\frac{2n^3 - 2000}{n^2} \right) \therefore A'(n) = 0$$

$$\therefore 2n^3 - 2000 = 0 \Rightarrow n^3 = 1000 \Rightarrow \boxed{n = 10 \text{ dm}}$$

(IV) Mínimo:

$$A_{\min} = A(n) = 2\pi \cdot \left(\frac{10^3 + 2000}{10} \right)$$

$$\therefore A_{\min} = 2\pi \cdot \left(\frac{1000 + 2000}{10} \right) \Rightarrow \boxed{A_{\min} = 600\pi \text{ dm}^2}$$

