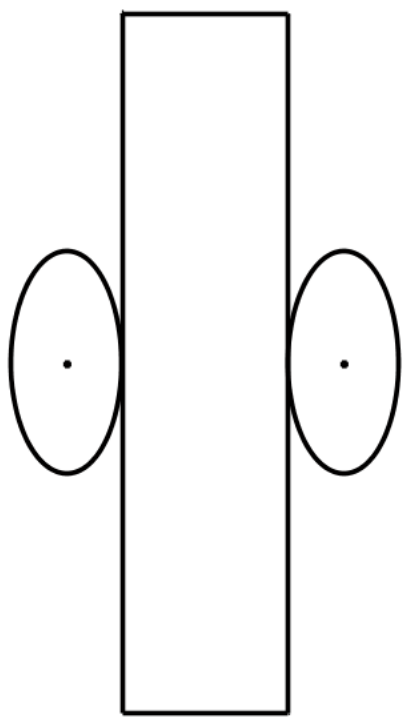


You are trying to design a can that maximizes the volume of a right cylinder a.k.a. can.

You are allowed 1800 square cm of sheet metal to create this can.

Things you need to commit to memory

SA = CH+2B = $2\cdot\pi\cdot r\cdot h+2\cdot\pi\cdot r^{2}$

SA = surface area of cylinder

C = circumference of a circle

r = radius of a circle

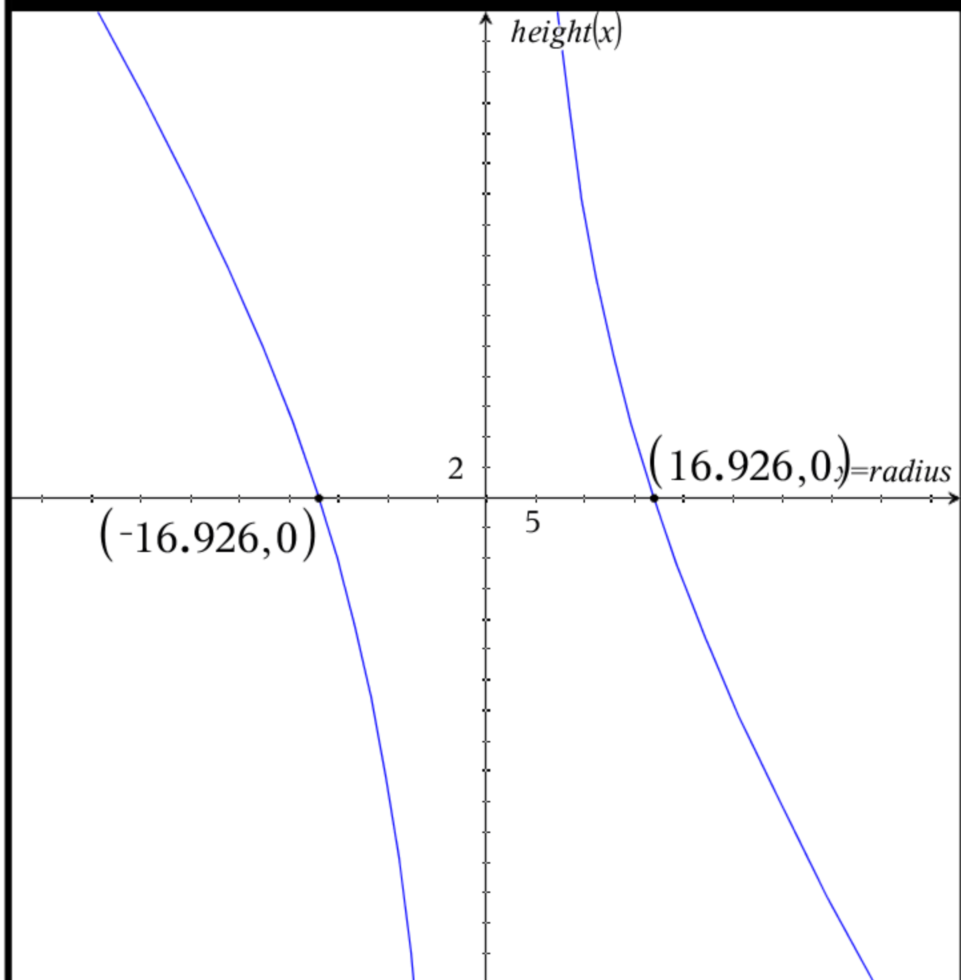
H = height of cylinder

B = Base =circle's area

V = BH = $2\cdot\pi\cdot r^{2}\cdot h$

V = volume of a cylinder

B, H, same as above



$$1800 = CH + 2B = 2\cdot\pi\cdot r\cdot h + 2\cdot\pi\cdot r^2$$

$$1800 = 2\cdot\pi\cdot x\cdot h + 2\cdot\pi\cdot x^2$$

$$1800 - 2\cdot\pi\cdot x^2 = 2\cdot\pi\cdot x\cdot h$$

$$h(x) = \frac{1800 - 2\pi\cdot x^2}{2\pi\cdot x} = \frac{1800}{2\pi\cdot x} - \frac{2\pi\cdot x^2}{2\pi\cdot x}$$

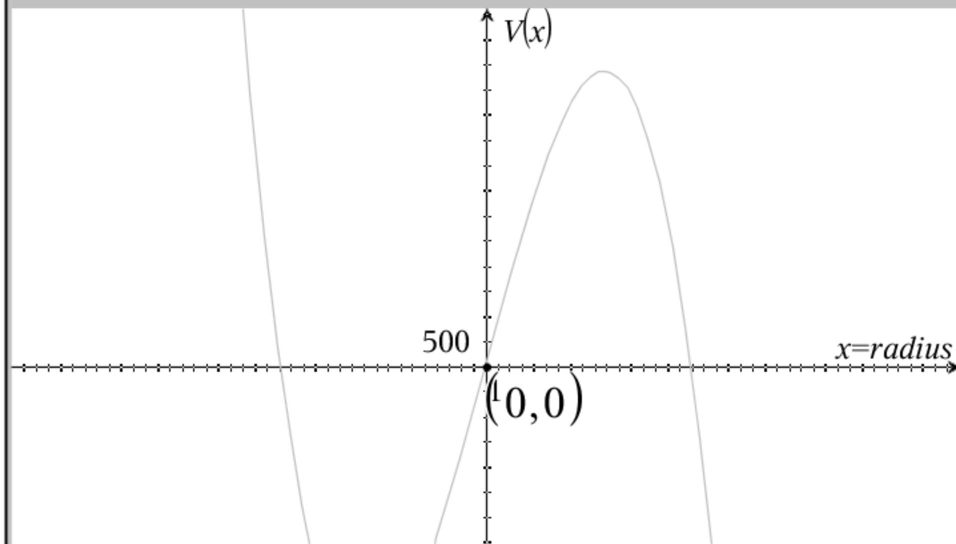
$$h(x) = \frac{900.}{\pi\cdot x} - x$$

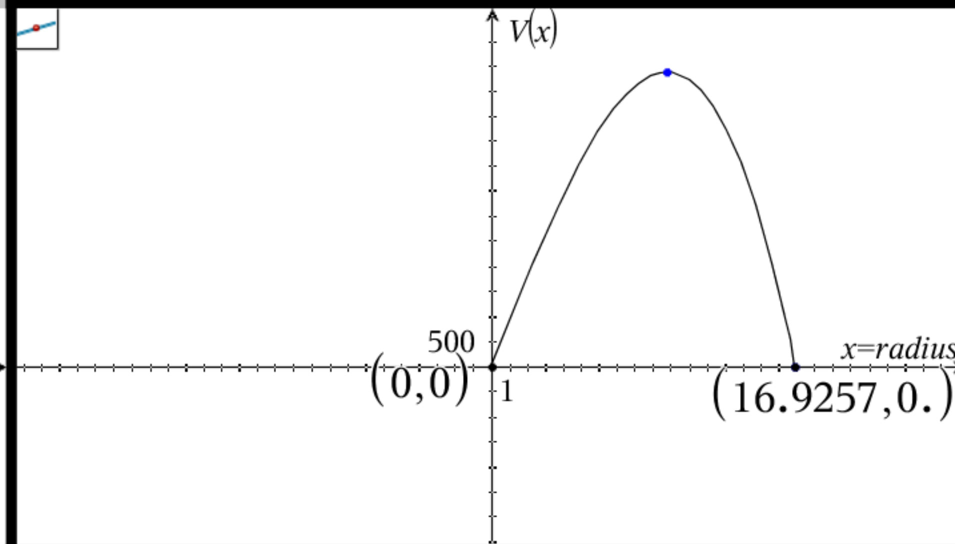
Feasibility of h

$$0 < h < \sqrt{\frac{900.}{\pi}} \qquad 0 < h < 16.926$$

Step 1: Let x = radius find h in terms of SA and x

Step 2: Determine where h is feasible a.k,a positive





Volume Function $= \pi \cdot r^2 \cdot h$

$$V(x) = \pi \cdot x^2 \cdot \left(\frac{900.}{\pi \cdot x} - x \right)$$

$$V(x) = 900.\ x - \pi \cdot x^3$$

$$V(x) = x\left(900. - \pi \cdot x^2 \right)$$

Feasible Volume function

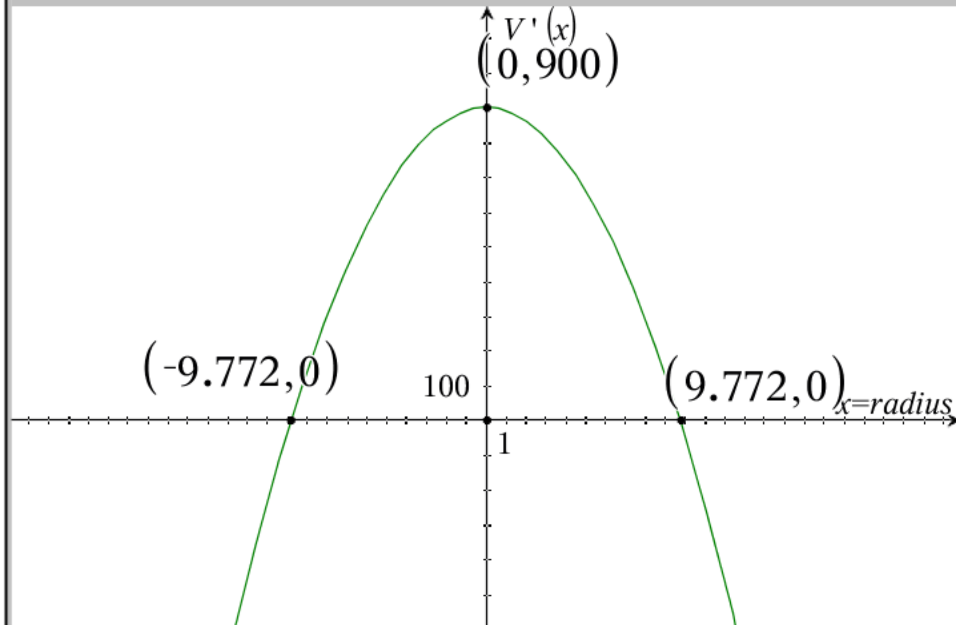
$V(x) = 900.\ x - \pi \cdot x^3$ for $0 < x < 16.926$

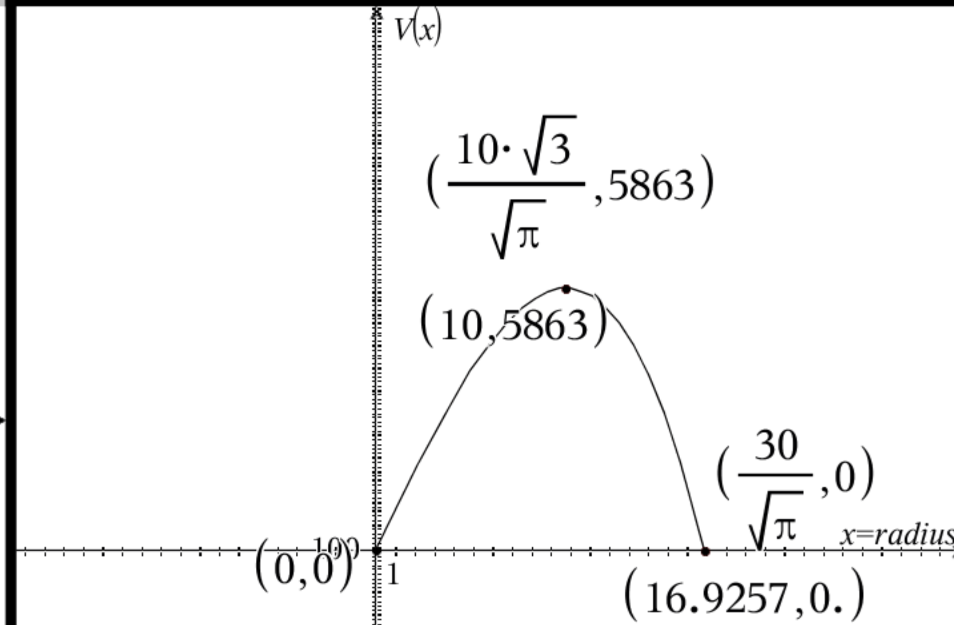
Feasible roots of Volume Function

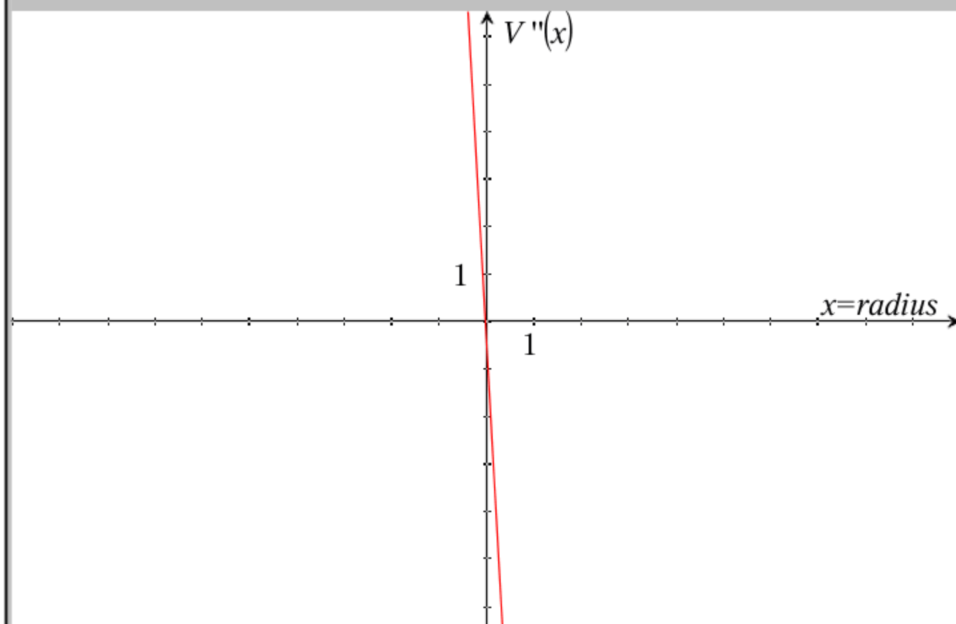
$x = 0$ or $x = \dfrac{30}{\sqrt{\pi}} \approx 16.926$

NOT *feasible* root *of Volume function*

$$x = \frac{^-30}{\sqrt{\pi}} \approx {}^-16.926$$







$\textit{Volume Function} = \pi\cdot r^2\cdot h$

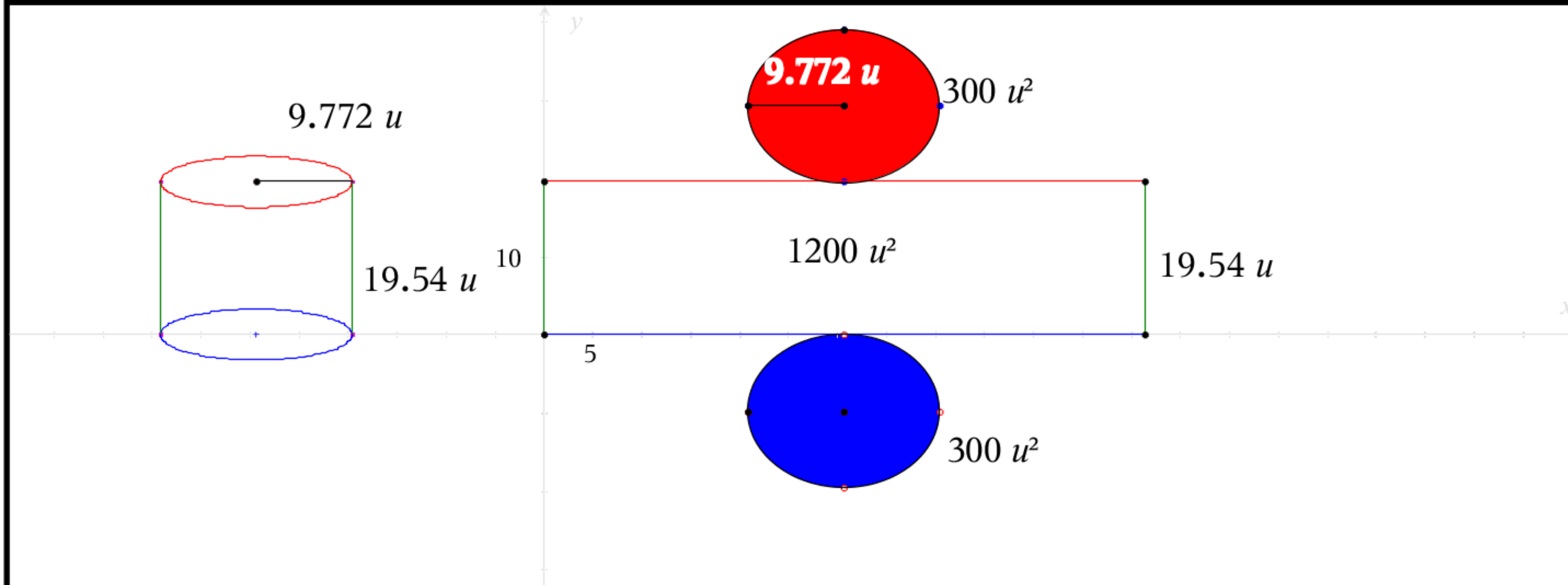
$V(x) = 900.\ x - \pi\cdot x^3$

Derivative *of Volume function*

$V'(x) = 900. - 3\pi\cdot x^2$

2nd Derivative *of Volume Function*'

$V''(x) = -6\pi\cdot x$

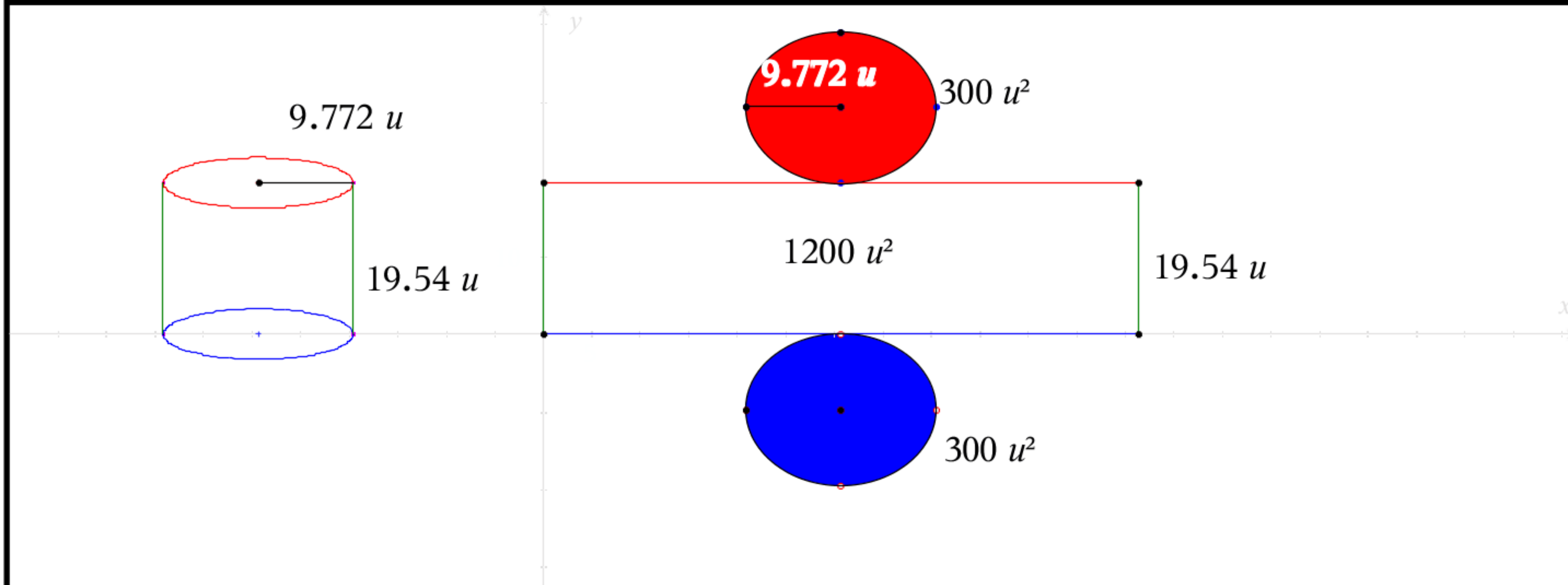


What we found!

The dimensions of the can that maximize volume of a can with surface area= 1800

$$r = x = \sqrt{\frac{1800}{6\pi}} = \frac{10\cdot\sqrt{3}}{\sqrt{\pi}} \approx 9.772$$

$$h = \frac{1800}{2\cdot\pi}\cdot\frac{1}{\sqrt{\frac{1800}{6\pi}}} - \sqrt{\frac{1800}{6\pi}} = \frac{20\cdot\sqrt{3}}{\sqrt{\pi}} \approx 19.54$$



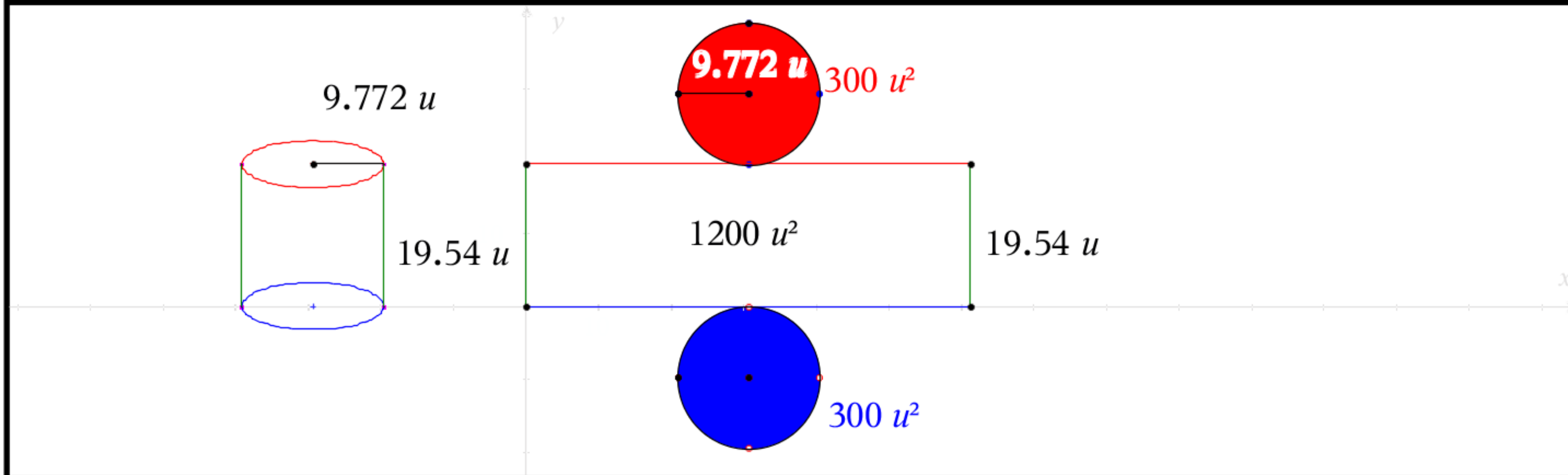
What we found!

The maximum volume of the can that maximize volume of a can with surface area of 1800

Exact *Volume*	*Approximate Volume*
$\frac{6000\cdot\sqrt{3}}{\sqrt{\pi}}$	5863.23

$$V=\pi\left(\frac{10\cdot\sqrt{3}}{\sqrt{\pi}}\right)^2\left(\frac{20\cdot\sqrt{3}}{\sqrt{\pi}}\right)$$

$$V= 300 \cdot \frac{20\cdot\sqrt{3}}{\sqrt{\pi}} \approx 5863.23$$



What we found! *The parts of the can that maximize volume of a can with surface area of* 1800

Base Area $=\pi\cdot\left(\frac{10\cdot\sqrt{3}}{\sqrt{\pi}}\right)^2 = 300 \approx 300.$

radius $= \frac{10\cdot\sqrt{3}}{\sqrt{\pi}} \approx 9.772$

Lateral Area $=2\pi\left(\frac{10\cdot\sqrt{3}}{\sqrt{\pi}}\right)\cdot\left(\frac{20\cdot\sqrt{3}}{\sqrt{\pi}}\right) = 1200 \approx 1200.$

height $= \frac{20\cdot\sqrt{3}}{\sqrt{\pi}} \approx 19.54$

total surface area $= LA + 2B = 1200 + 2(300) = 1800$