2.15 s

$$\lim_{x\to 0} \frac{\cos(x)-1}{(\arcsin(x))^2} \qquad \frac{0}{0} \text{ form}$$

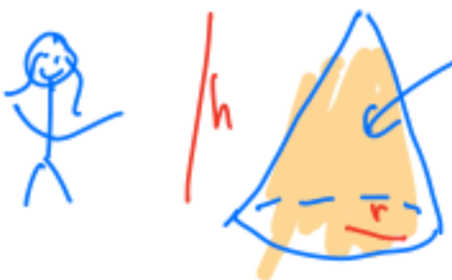
$$\underset{l'H}{=} \lim_{x\to 0} \frac{-\sin(x)}{2\arcsin(x)\cdot\frac{1}{\sqrt{1-x^2}}}$$

$$= \lim_{x\to 0} \frac{-\sin(x)\sqrt{1-x^2}}{2\arcsin(x)} \qquad \frac{0}{0} \text{ form}$$

$$\underset{l'H}{=} \lim_{x\to 0} \frac{-\cos(x)\sqrt{1-x^2} - \sin(x)\frac{1}{2}(1-x^2)^{-1/2}\cdot(-2x)}{2\frac{1}{\sqrt{1-x^2}}}$$

$$= \frac{-1}{2}.$$

Ex Olivia has decided to design a confetti container in the shape of a cone. She must design it to hold 300 cubic in of confetti. How should she design the container so that it uses the least amount of surface material — plutonium?

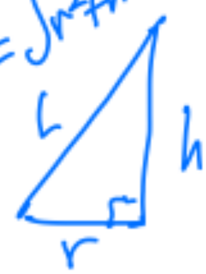


$300\ in^3 = V = \frac{1}{3}\pi r^2 h$

Function: Surface Area

$A = \pi r^2 +$ 

$L = \sqrt{r^2+h^2}$



surface area (upper part)

slice

cut 

→ flatten 

portion of a circle.

whole circumference

$2\pi L$

circumference of bottom circle

$2\pi r$

 $= (\pi L^{2})\left(\frac{\cancel{2\pi} r}{\cancel{2\pi} \cancel{L}}\right) = \pi L r = \pi r\sqrt{r^2+h^2}$

portion of disk of radius L

$\Rightarrow A = \pi r^2 + \pi r\sqrt{r^2+h^2}$

(also $V = 300\,\text{in}^3 = \frac{1}{3}\pi r^2 h$

$\Rightarrow h = \dfrac{300}{\frac{1}{3}\pi r^2} = \dfrac{900}{\pi r^2}$)

$$\boxed{\Rightarrow A(r) = \pi r^2 + \pi r\sqrt{r^2 + \frac{900^2}{\pi^2 r^4}} \quad \text{minimize} \quad \text{interval: } 0 < r < \infty.}$$

math.

Solution: $A'(r) = 2\pi r + \pi\sqrt{r^2 + \frac{900^2}{\pi^2 r^4}}$
$+ \pi r \frac{1}{2}\left(r^2 + \frac{900^2}{\pi^2 r^4}\right)^{-1/2} \cdot \left(2r - \frac{4\cdot 900^2}{\pi^2 r^5}\right)$

$= 0$

Type some Sage code below and press Evaluate:

```
f(r)=pi*r^2+pi*r*sqrt(r^2+900^2/pi^2/r^4)
show(f(r))
fp(r)=diff(f(r),r)
show(fp(r))
def fpn(x):
    return subs(fp(r),x)

show((fp(r)).find_root(0.2,200,r))
```

Evaluate

$\pi r^2 + \pi\sqrt{r^2 + \frac{810000}{\pi^2 r^4}}\,r$

$\dfrac{\pi\left(r - \frac{1620000}{\pi^2 r^5}\right) r}{\sqrt{r^2 + \frac{810000}{\pi^2 r^4}}} + 2\pi r + \pi\sqrt{r^2 + \frac{810000}{\pi^2 r^4}}$

4.661394732664658

$r = 4.66$ in
is only crit pt.

$A'(r)$ | − − 0 + + +

0 … 4.66 … ∞

$r = 4.66$ in is global min.

$$h = \frac{900}{\pi r^2} = \cancel{11.42} \; 13.2 \text{ in}$$

best design.