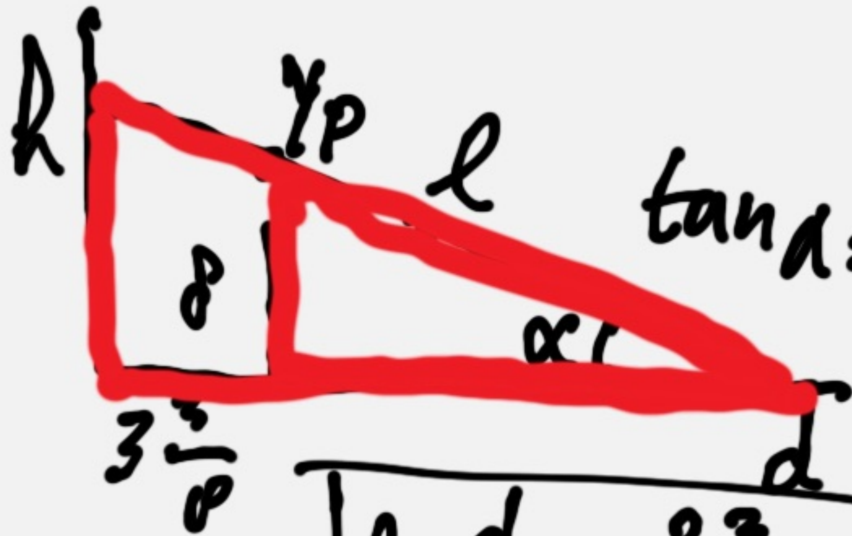

$$\tan\alpha = \frac{y_p}{d - 3\frac{3}{8}} = \frac{h}{d}$$

$$\boxed{y_p = h\,\frac{d - 3\frac{3}{8}}{d} \geq 8}$$

minimize $l = \sqrt{h^2 + d^2}$

subject to

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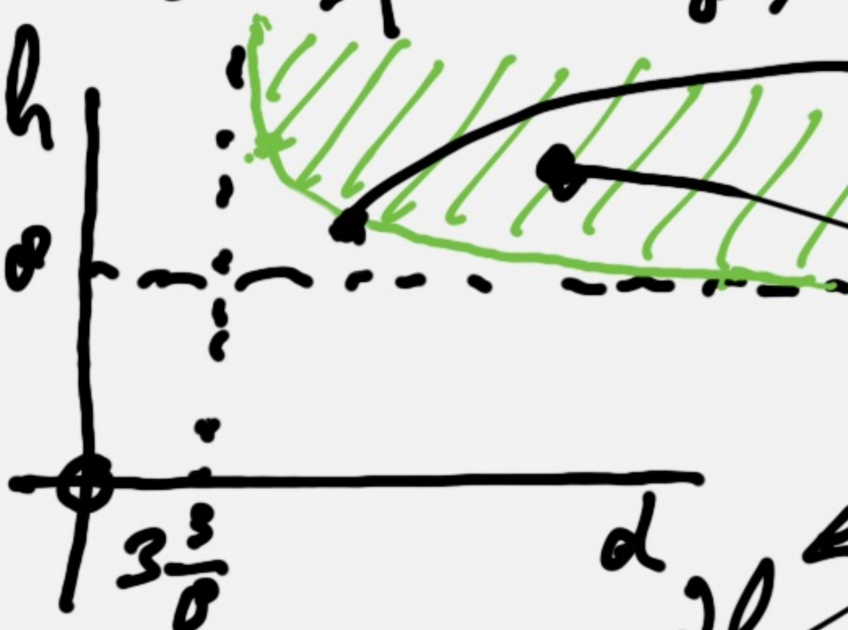
$$h \frac{d - 3\frac{3}{8}}{d} \geq 8$$ where equality?

$$h = 8d/(d - 3\tfrac{3}{8})$$

$d \to \infty$



on the boundary

interior minimum

$\frac{\partial l}{\partial h} = 0$ $\frac{\partial l}{\partial d} = 0$

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$$l = \sqrt{h^2 + d^2} = (h^2 + d^2)^{1/2}$$

$$\frac{\partial l}{\partial h} = \frac{1}{\cancel{2}}(h^2 + d^2)^{-1/2} * \cancel{2}h = 0$$

$$\frac{\partial l}{\partial d} = \frac{1}{\cancel{2}}(h^2 + d^2)^{-1/2} * \cancel{2}d = 0$$

$$\Longrightarrow h = d = 0 \qquad l = 0$$

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$f \qquad l = \sqrt{h^2+d^2}$

Zeroth constraint equation

$$\underbrace{h\left(d - 3\tfrac{3}{8}\right) - 8d}_{c} = 0$$

Form new function Lagrangian multiplier

$$F = f - \lambda c \quad \text{here:}$$

$$F = \sqrt{h^2+d^2} - \lambda\left(h\left[d - \tfrac{3}{8}\right] - 8d\right)$$

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$$F = \sqrt{h^2+d^2} - \lambda\left(h\left(d - 3\tfrac{3}{8}\right) - 8d\right)$$

$$\frac{\partial F}{\partial \lambda} = h\left(d - 3\tfrac{3}{8}\right) - 8d = 0$$

$$\frac{\partial F}{\partial h} = \frac{h}{\sqrt{h^2+d^2}} - \lambda\left(d - 3\tfrac{3}{8}\right) = 0$$

$$\frac{\partial F}{\partial d} = \frac{d}{\sqrt{h^2+d^2}} - \lambda(h-8) = 0$$

$\rightarrow$ Solve

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Approximation:

- need
- effort
- accuracy
- $\boxed{\text{insight}}$

} matched asymptotic expansions

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Taylor series $f(x)$

Select Base point $x = a$

e.g. $a = 0$ ($\Rightarrow$ Maclaurin)

Then for x close a

$$f(x) \simeq f(a) + f'(a)\frac{x-a}{1!} + f''(a)\frac{(x-a)^2}{2!} + f'''(a)\frac{(x-a)^3}{3!} + \cdots$$

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Example

Maclaurin series

$f(x) = \sin^2 x$

$f'(x) = 2\sin x \cos x$

$f'' = 2\cos x \cos x - 2\sin x \sin x$

$= 2 - 4\sin^2 x$

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