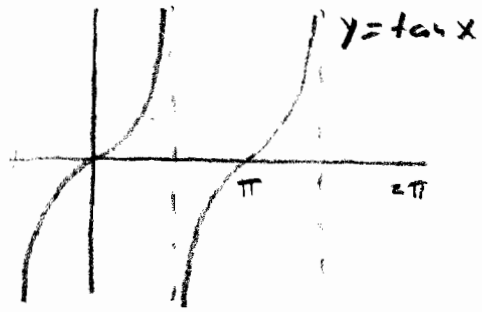
3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

20)



Find point on $y = \tan x$ closest to $(1,1)$

$$d = \sqrt{(x-1)^2 + (y-1)^2}$$

$$y = \tan x$$

$$\therefore d(x) = \sqrt{(x-1)^2 + (\tan x - 1)^2}$$

$$f(x) = d(x)^2 = (x-1)^2 + (\tan x - 1)^2$$

$$f'(x) = 2(x-1) + 2(\tan x - 1)\sec^2 x = 0$$

Graphing $f'(x)$ over $-\frac{\pi}{2}, \frac{\pi}{2}$, gives us $f'(x) = 0$ at $x \approx .82$

If $x = .82$, $y = \tan x = \tan .82 \approx 1.07$.

$\therefore$ The point on $y = \tan x$ that is closest to the point $(1,1)$ is $(.82, 1.07)$.

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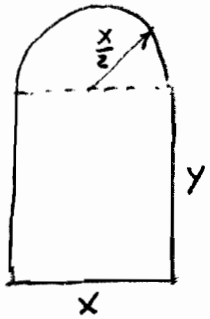
COMET

30)



Perimeter is 30 ft.
Find dimensions that maximize surface area of the window.

$$A = x \cdot y + \frac{\pi r^2}{2} \quad \text{but } r = \frac{x}{2} \qquad \frac{\pi}{2} \cdot \frac{x^2}{2}$$

$$= x \cdot y + \frac{\pi x^2}{8}$$

$$\text{Perimeter} = x + 2y + \tfrac{1}{2}(2\pi r) \quad \text{with } r = \frac{x}{2}$$

$$= x + 2y + \frac{\pi x}{2}$$

Perimeter is 30 ft so

$$x + 2y + \frac{\pi x}{2} = 30$$

$$2y = 30 - x\left(1 + \frac{\pi}{2}\right)$$

$$y = 15 - \frac{x}{4}(2 + \pi)$$

$$A(x) = 15x - \frac{x^2}{2} - \frac{\pi x^2}{4} + \frac{\pi x^2}{8}$$

$$= 15x - \left(\frac{1}{2} + \frac{\pi}{8}\right)x^2$$

$$A'(x) = 15 - \left(1 + \frac{\pi}{4}\right)x$$

$$A'(x) = 0 \qquad \left(\frac{4+\pi}{4}\right)x = 15$$

$$x = \frac{15 \cdot 4}{4 + \pi} = \frac{60}{4+\pi}$$

$$y = 15 - \frac{60}{16+4\pi}(2+\pi) = \frac{240 + 60\pi}{16+4\pi} - \frac{120 + 60\pi}{16+4\pi}$$

$$= \frac{120}{16+4\pi} = \frac{30}{4+\pi}$$

$$\boxed{x = \frac{60}{4+\pi} \quad y = \frac{30}{4+\pi}}$$

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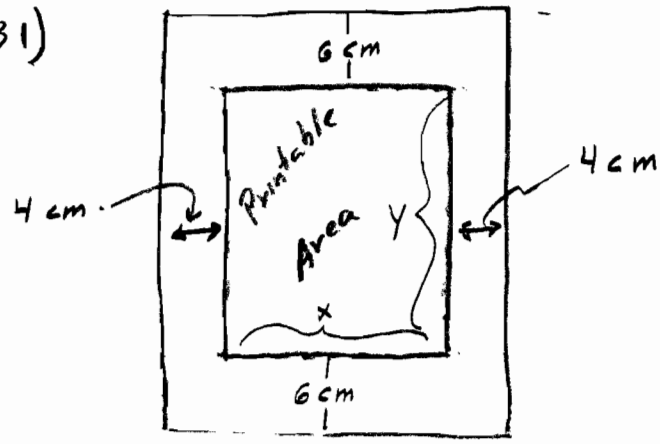
COMET

31)



Printable area = 384 cm²

Find the dimensions of the poster with the smallest area.

$A = (x+8)(y+12)$

Printable $= 384\text{ cm}^2 = x \cdot y$

$\therefore\ y = \dfrac{384}{x}$

$A(x) = (x+8)\left(\dfrac{384}{x} + 12\right)$

$= \dfrac{384x}{x} + \dfrac{8 \cdot 384}{x} + 12x + 96$

$A(x) = 12x + \dfrac{3072}{x} + 480$

$A'(x) = 12 - \dfrac{3072}{x^2}$

$A'(x) = 0 \rightarrow \dfrac{3072}{x^2} = 12$

$12x^2 = 3072$

$x^2 = 256$

$x = 16 \qquad y = \dfrac{384}{16} = 24$

$\therefore$ $\boxed{\text{Dimensions of poster are } 24\text{cm} \times 36\text{cm}}$

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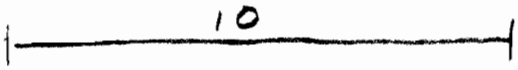
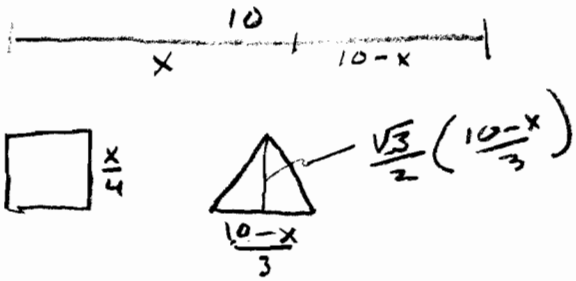
COMET

33) 

Cut in two and make a square + equilateral Δ.



$$\text{Area} = \square + \Delta$$

$$= \left(\frac{x}{4}\right)^2 + \frac{1}{2}\left(\frac{10-x}{3}\right)\left(\frac{\sqrt{3}}{2}\left(\frac{10-x}{3}\right)\right)$$

$$A(x) = \frac{x^2}{16} + \frac{\sqrt{3}(10-x)^2}{36} \qquad (0 \le x \le 10)$$

$$A'(x) = \frac{x}{8} - \frac{\sqrt{3}(10-x)}{18}$$

$$= \frac{18x - (80\sqrt{3} - 8\sqrt{3}x)}{8 \cdot 18}$$

$$A'(x) = 0 \Rightarrow \quad 18x - 80\sqrt{3} + 8\sqrt{3}\,x = 0$$

$$(18 + 8\sqrt{3})x = 80\sqrt{3}$$

$$x = \frac{80\sqrt{3}}{18 + 8\sqrt{3}} = \frac{40\sqrt{3}}{9 + 4\sqrt{3}} \approx 4.35$$

Evaluate end points + critical number

$$\left.\begin{aligned} A(0) &= \left(\frac{\sqrt{3}}{36}\right)100 \approx 4.81\,\text{cm}^2 \\ A\left(\frac{40\sqrt{3}}{9+4\sqrt{3}}\right) &\approx 2.72\,\text{cm}^2 \\ A(10) &= \frac{100}{16} = 6.25\,\text{cm}^2 \end{aligned}\right\} \therefore$$

$$\boxed{\begin{array}{l} \text{Max at } x = 10\text{cm} \\ \text{min at } x \approx 4.35\text{cm} \end{array}}$$

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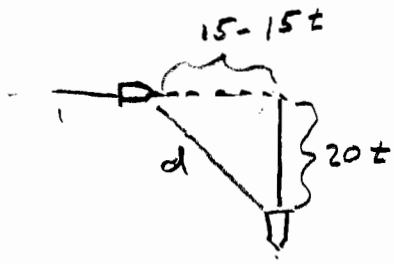
44)

time = 0



time: t

$$d^2 = (15-15t)^2 + (20t)^2$$

$$= 225 - 450t + 225t^2 + 400t^2$$

$$d^2 = 625t^2 - 450t + 225$$

$$(d^2)' = 1250t - 450$$

$$(d^2)' = 0 \qquad 1250t = 450$$

$$t = \frac{450}{1250} = \frac{9}{25} \text{ hrs}$$

$\therefore$ since $(d^2)'' > 0 \rightarrow$ concave up,

$t = \frac{9}{25}$ hrs is a minimum

$t = \frac{9}{25}$ hrs $= 21.6$ mins $= 21$ min 36 sec

$\boxed{\therefore \text{ Boats closest together at } 2:21:36}$