

$$V = x^2 y$$

$$144 = x^2 y$$

$$y = \frac{144}{x^2}$$

W

$$SA = x^2 + 3xy$$

$$SA = x^2 + 3x \left(\frac{144}{x^2} \right)$$

$$SA = x^2 + \frac{432}{x}$$

$$\frac{dSA}{dx} = 2x - \frac{432}{x^2}$$

$$\frac{dSA}{dx} = 0$$

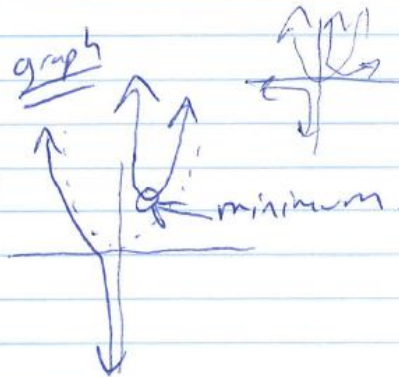
$$0 = 2x - \frac{432}{x^2}$$

$$2x = \frac{432}{x^2}$$

$$2x^3 = 432$$

$$x^3 = 216$$

$$x = 6$$

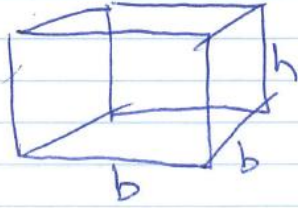


$$y = \frac{144}{6^2}$$

$$y = 4$$

$$6m \times 6m \times 4m$$

2.



$$\text{Cost} = 2b^2 + 4bh \quad (2)$$

$$120 = 3b^2 + 8bh$$

$$120 - 3b^2 = 8bh$$

$$h = \frac{120 - 3b^2}{8b}$$

$$V = b^2 h$$

$$V = b^2 \left(\frac{120 - 3b^2}{8b} \right)$$

$$V = \frac{120b - 3b^3}{8}$$

$$\frac{dV}{db} = \frac{1}{8} [120 - 9b^2]$$

$$0 = \frac{1}{8} (120 - 9b^2)$$

$$9b^2 = 120$$

$$b^2 = \frac{120}{9}$$

$$b^2 = \frac{40}{3}$$

$$b = \sqrt{\frac{40}{3}}$$

$$b = \frac{\sqrt{120}}{3}$$

$$b = \frac{2\sqrt{30}}{3}$$

$$h = \frac{120 - 3\left(\frac{2\sqrt{30}}{3}\right)^2}{8\left(\frac{2\sqrt{30}}{3}\right)}$$

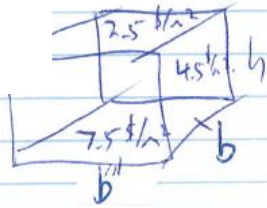
$$h = \frac{120 - \frac{120}{3}}{\frac{16\sqrt{30}}{3}}$$

$$h = \frac{80}{\frac{16\sqrt{30}}{3}}$$

$$h = 80 \left(\frac{3}{16\sqrt{30}} \right)$$

$$h = \frac{15}{\sqrt{30}} = \frac{15\sqrt{30}}{30} = \frac{\sqrt{30}}{2}$$

3.



$$V = 15 \text{ m}^3$$

$$V = b^2 h$$

$$15 = b^2 h$$

$$h = \frac{15}{b^2}$$

$$h = \frac{15}{\left(\frac{3}{\sqrt{2}}\right)^2}$$

$$\begin{aligned} &= \frac{15}{9} \cdot \frac{2}{(\sqrt{2})^2} \\ &= \frac{15 \sqrt{2}^2}{9} \\ &= 2.65 \text{ m.} \end{aligned}$$

$$C = 7.5b^2 + 2.5b^2 + 4bh(4.5)$$

$$C = 10b^2 + 18bh$$

$$C = 10b^2 + 18b \left(\frac{15}{b^2}\right)$$

$$C = 10b^2 + \frac{270}{b}$$

$$\frac{dC}{db} = 20b - \frac{270}{b^2}$$

$$0 = 20b - \frac{270}{b^2}$$

$$\frac{270}{b^2} = 20b$$

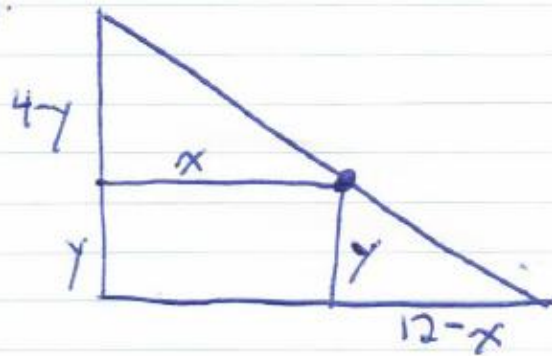
$$270 = 20b^3$$

$$\frac{27}{2} = b^3$$

$$b = \sqrt[3]{\frac{27}{2}}$$

$$b = \frac{3}{\sqrt{2}} \text{ m} = 2.38 \text{ m.}$$

4.



$$A = xy$$

$$A = (12 - 3y)y$$

$$A = 12y - 3y^2$$

$$\frac{dA}{dy} = 12 - 6y$$

$$\frac{dA}{dy} = 0 \rightarrow 12 - 6y = 0$$

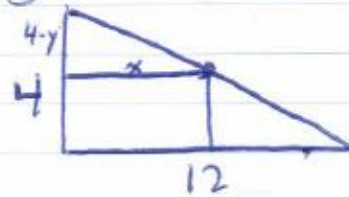
$$-6y = -12$$

$$y = 2$$

$$x = 12 - 3(2)$$

$$x = 6$$

using similar triangles



$$\frac{4}{12} = \frac{4-y}{x}$$

big Δ and
top Δ are
similar.

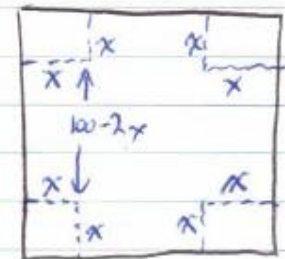
$$4x = 48 - 12y$$

$$x = 12 - 3y$$

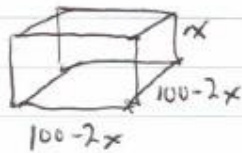
$$A = 6m(2m)$$

$$A = 12m^2$$

py 141 #3



100



Let x be side length of square to cut out

Hence once folded up, the base of the box will have side length of $100 - 2x$ and a height of x

$$V = x(100 - 2x)(100 - 2x)$$

$$V = x(4x^2 - 400x + 10000)$$

$$V = 4x^3 - 400x^2 + 10000x$$

$$\frac{dV}{dx} = 12x^2 - 800x + 10000$$

C.p. at $0 = 12x^2 - 800x + 10000$

$$0 = 3x^2 - 200x + 2500$$

$$x = 50$$

$$\text{or } x = \frac{50}{3}$$

(quad. formula!)

$$x \neq 50$$

$$100 - 2\left(\frac{50}{3}\right)$$

$$= \frac{200}{3}$$

$$\text{so box will be } \frac{200}{3} \times \frac{200}{3} \times \frac{50}{3}$$

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$$V = \pi r^2 h$$

$$180 = 4h + 2\pi r(2)$$

$$4h = 180 - 4\pi r$$

$$h = 45 - \pi r$$

$$V = \pi r^2 h$$

$$V = \pi r^2 (45 - \pi r)$$

$$V = 45\pi r^2 - \pi^2 r^3$$

$$\frac{dV}{dr} = 90\pi r - 3\pi^2 r^2$$

$$0 = 90\pi r - 3\pi^2 r^2$$

$$0 = 3\pi r (30 - \pi r)$$

$$r = 0 \text{ or } 30 - \pi r = 0$$

$$-\pi r = -30$$

$$r = \frac{30}{\pi}$$

$$C = 2\pi \left(\frac{30}{\pi}\right)$$

$$C = 60 \text{ cm}$$

$$h = 45 - \pi \left(\frac{30}{\pi}\right)$$

$$h = 15 \text{ cm}$$

∴ 60 cm (2 pieces)

and 4 that are 15 cm.