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Question 2

Implicit differentiation to find an equation of the tangent line to the curve $5x^2 + 10xy^2 + 5y = 20$ at point $(2, 2)$.

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$\therefore$ Tangent Line: $\boldsymbol{y = -\frac{12}{17}x + \frac{58}{17}}$

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$y \cos x = 1 + \sin(xy)$. Find $\frac{dy}{dx}$ by implicit differentiation.

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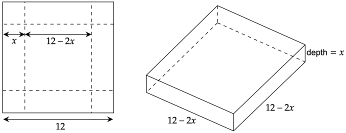
Question 5

An open box is to be made from cutting a square from each corner of a 12 in by 12 in piece of metal and then folding up the sides. What size square should be cut from each corner to produce a box of maximum volume?



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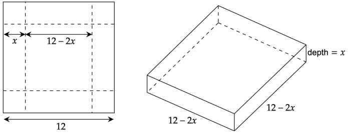

The volume is to be maximized,

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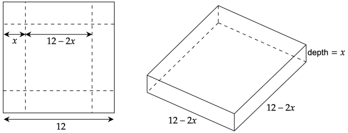

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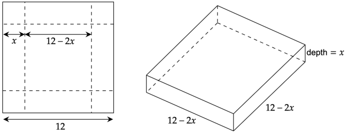

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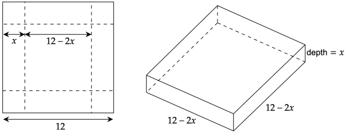

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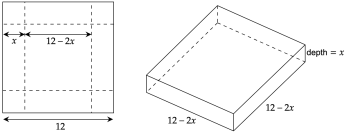

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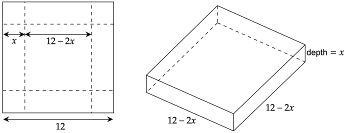

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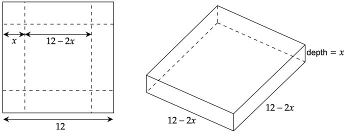

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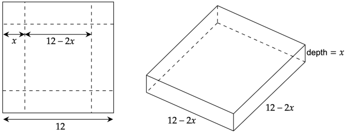

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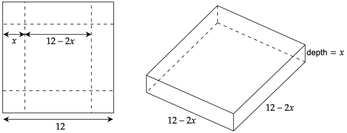

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When $x = 2$, $V(2) = 128$. When $x = 6$, $V(6) = 0$.

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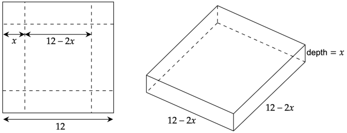

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Thus, when $x = 2$, the maximum volume is 128 in^3.

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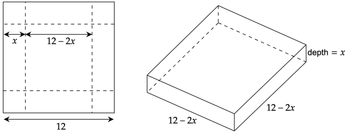

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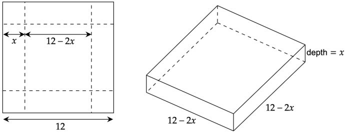

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When $x = 2$, $V''(2) < 0$ (Maximum Volume)

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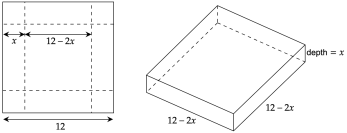

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$$\therefore x = 2, 6$$

When $x = 2$, $V(2) = 128$. When $x = 6$, $V(6) = 0$.

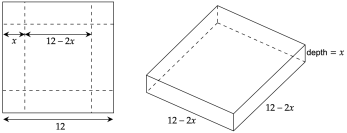
Thus, when $x = 2$, the maximum volume is 128 in^3. To prove that, using second derivation $V''(x) = 24x - 96$.

When $x = 2$, $V''(2) < 0$ (Maximum Volume)

When $x = 6$, $V''(6) > 0$ (Minimum Volume)

Question 5

An open box is to be made from cutting a square from each corner of a 12 in by 12 in piece of metal and then folding up the sides. What size square should be cut from each corner to produce a box of maximum volume?



The volume is to be maximized,

$$\begin{aligned} V &= lwh = x(12-2x)(12-2x) \\ &= 4x^3 - 48x^2 + 144x \end{aligned}$$

$$\begin{aligned} V(x) &= 4x^3 - 48x^2 + 144x \\ V'(x) &= 12x^2 - 96x + 144 \end{aligned}$$

The critical point can be calculate such that, $V'(x) = 0$.

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Thus, $\mathbf{x} = \mathbf{2}$.

Question 6

We are going to fence in a rectangular field. If we look at the field from above the cost of the vertical sides are RM 10/ft, the cost of the bottom is RM2/ft and the cost of the top is RM 7 /ft. If we have RM 700 determind the dimensions of the field that will maximize the enclosed area.

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Thus, the final dimension is,
$\mathbf{x} = \mathbf{\frac{350}{9}}, \mathbf{y} = \mathbf{\frac{35}{2}}$.