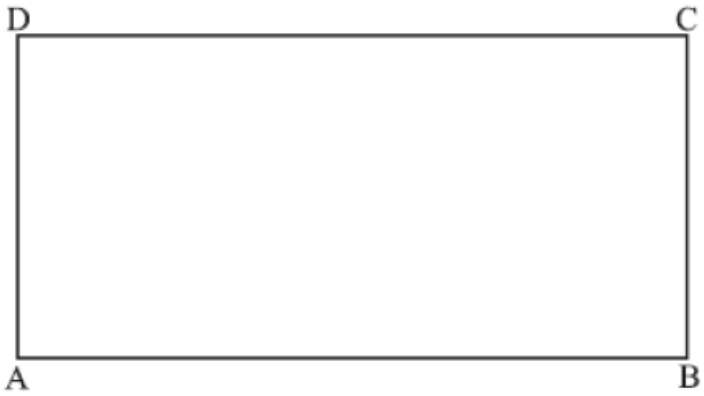
Optimization

Max Or Min
Volume Or Area
First derivative = 0

1. A farmer wants to make a fencing with total length 40 m. The length of AB is x m and CB is y m.



(a) Write an equation to show the above information.
(b) Express Area (A) in terms of x.
(c) Find the maximum area of the enclosure.

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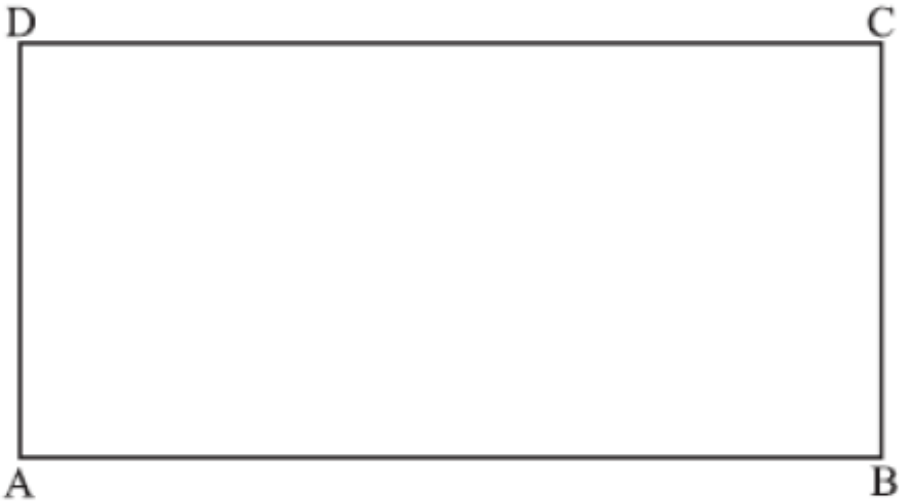
2. A farmer wants to make a fencing with total length 100 m. The length of AB is x m and CB is y m.



(a) Write an equation to show the above information.
(b) Express Area (A) in terms of x.
(c) Find the maximum area of the enclosure.

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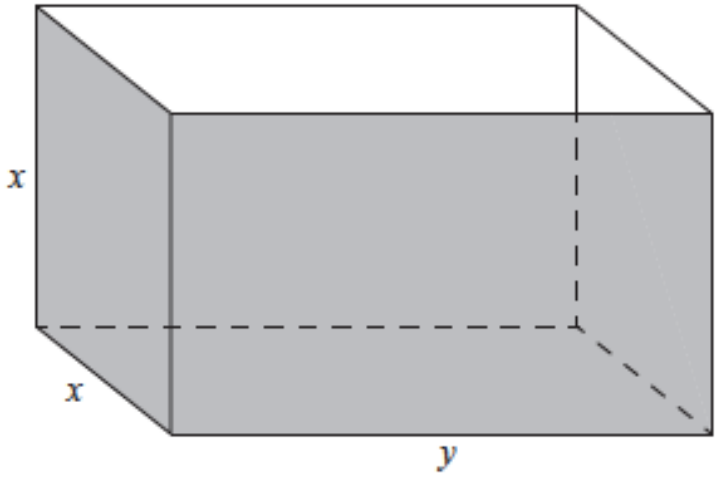
Exercise

1. Fred makes an open metal container in the shape of cuboid, as shown in the following diagram.



The container has height x m, width x m and length y m. The volume is 36 m^3.
Let A(x) be the outside surface area of the container.

(a) Show that A(x) = $\frac{108}{x} + 2x^2$.

(b) Find $A'(x)$.

(c) Given that the outside surface area is a minimum, find the height of the container.

(d) Fred paints the outside of the container. A tin of paint covers a surface area of $10m^2$ and cost \$20. Find the total cost of the tins needed to paint the container.

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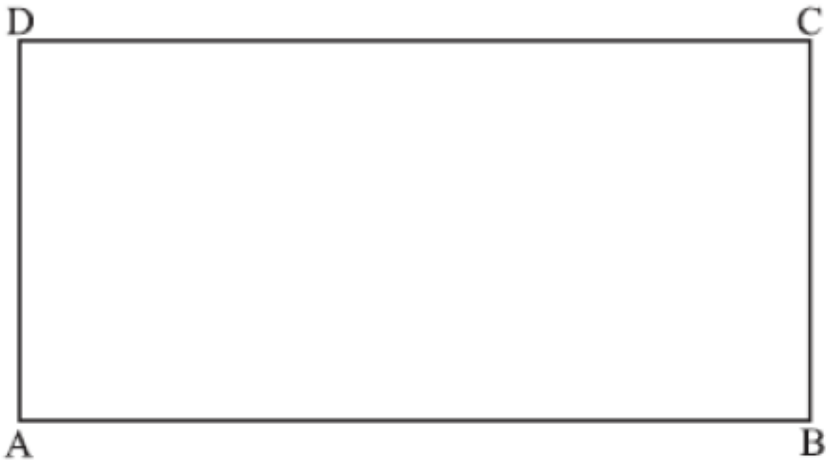
2. A farmer wishes to create a rectangular enclosure, ABCD, of area 525 m^2, as shown below.



The fencing used for side AB costs $11 per metre. The fencing for the other three sides costs $3 per metre. The farmer creates an enclosure so that the cost is minimum. Find this minimum cost.

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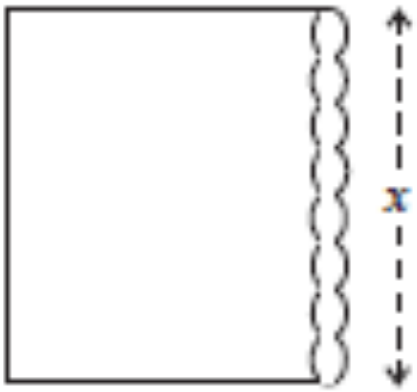
3. A farmer has a rectangular enclosure with a straight hedge running down one side. The area of the enclosures 162 m^2. He encloses this area using x metres of the hedge on one side as shown on the diagram below.



(a) If he uses y metres of fencing to complete the enclosure, show that $y = x + \frac{324}{x}$.

The farmer wishes to use the least amount of fencing

(b) Find $\frac{dy}{dx}$.

(c) Find the value of x which makes y a minimum.

(d) Calculate this minimum value of y.

(e) Using $y = x + \frac{324}{x}$ find the values of a and b in the following table.

x	6	9	12	18	24	27	36
y	60	45	39	a	37.5	b	45

(f) Write down the values of x for which y increases.

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