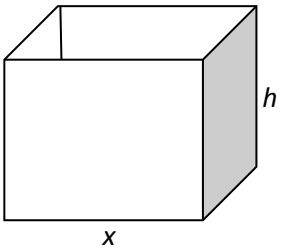
NR2 I can solve optimization problems in context using differentiation.

1. A plastic box with a square base and an open top is being designed. It must have a volume of 108 cm^3 .

The length of the base is ***x*** cm and the height is *h* cm.



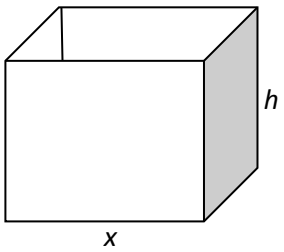
(a) Show that the total surface area *A* is given by

$$A(x) = x^2 + \frac{432}{x}$$

(b) Find the dimensions of the tray using the least amount of plastic

2. An open tank is to be designed in the shape of a cuboid with a square base. It must have a surface area of 100 cm^2 .

The length of the base is ***x*** cm.



(a) Show that the volume *V* is given by

$$A(x) = \frac{x}{4(100-x^2)}$$

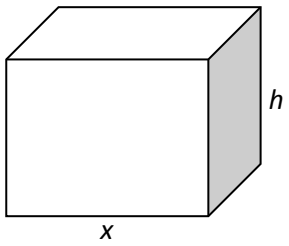
(b) Find the length of the base which gives the tank a maximum volume.

3. The height *h* m of a ball thrown upwards is given by the formula $h(x) = 20t - 5t^2$ where *t* is the time in seconds from when the ball is thrown.

(a) When does the ball reach its maximum height?

(b) Calculate the maximum height of the ball.

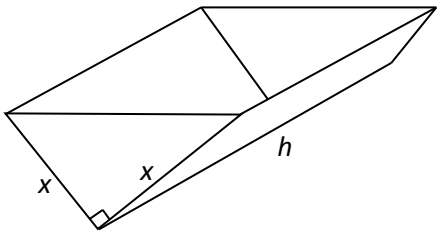
4. A Cuboid measures *x* by *x* by *h* units. The volume is 125 units^2.



(a) Show that the surface area of this Cuboid is given by $A(x) = 2x^2 + \frac{500}{x}$

(b) Find the value of *x* such that the surface area is minimised.

5. An open trough is in the shape of a triangular prism, the trough has a capacity of 256 000 cm^3.

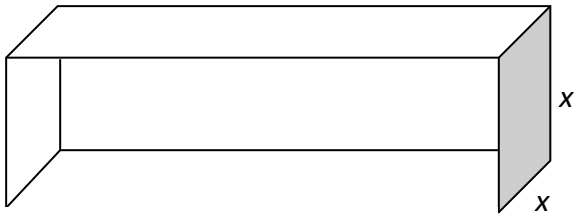


(a) Show that the surface area of this trough is given by

$$A(x) = x^2 + \frac{1024\,000}{x}$$

(b) Find the value of *x* such that the surface area is minimised.

6. A shelter consists of two square sides (x meters), a rectangular top and back. The total amount of material used to make the shelter is 96 m^2

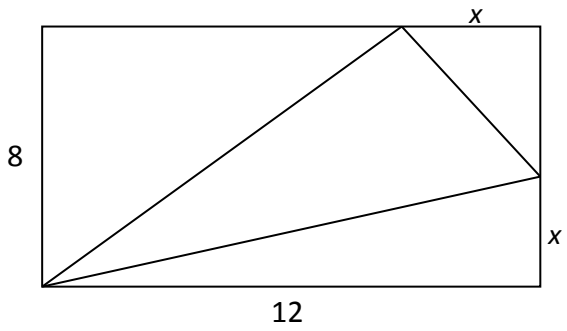


(a) Show that the volume of the shelter is given by

$$V(x) = x(48 - x^2)$$

(b) Find the dimensions of the shelter with the maximum volume.

7. A triangular piece of material is cut out of a rectangular sheet, the dimensions are shown on the diagram.



(a) Show that the area of the triangle is given by the formula

$$A(x) = 48 - 6x + \frac{1}{2}x^2$$

(b) Find the biggest area of triangle possible.