Name: ______________ 5-a-day Further Maths

9th August

Corbettmaths

The first five terms of a sequence are shown below.

$-18, \ -31, \ -50, \ -75, \ -106 \ \ldots \ \ldots$

$-13 \quad -19$

-6

Work out an expression for the nth term of the sequence

$t(n) = an^2 + bn + c$

$a + b + c = -18$

$3a + b = -13$

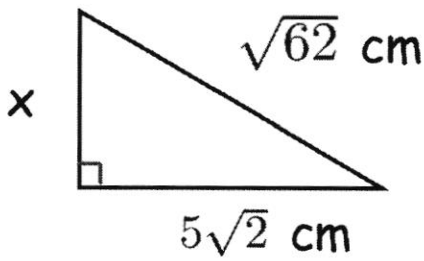
$2a = -6 \Rightarrow a = -3$

$\Rightarrow -9 + b = -13 \Rightarrow b = -4$

$\Rightarrow -3 - 4 + c = -18 \Rightarrow c = -11$

$\Rightarrow \underline{t(n) = -3n^2 - 4n - 11}$

Shown below is a right angled triangle.



Find the length of the side labelled x.

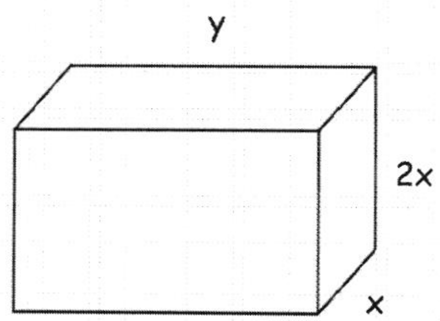
$x^2 + (5\sqrt{2})^2 = 62$

$x^2 + 50 = 62$

$x^2 = 12$

$\underline{x = \sqrt{12} = 2\sqrt{3} \text{ cm}}$

Shown below is a cuboid.



The surface area of the cuboid is 120cm².

The volume of the cuboid is V.

Show that $y = \dfrac{20}{x} - \dfrac{2x}{3}$

$SA = 2(2xy) + 2(2x^2) + 2xy$

$= 6xy + 4x^2 = 120$

$\Rightarrow 6xy = 120 - 4x^2$

$\Rightarrow \underline{y = \dfrac{20}{x} - \dfrac{2x}{3}}$

Show that $V = 40x - \dfrac{4x^3}{3}$

$V = 2x^2y = 2x^2\left(\dfrac{20}{x} - \dfrac{2x}{3}\right)$

$= \underline{40x - \dfrac{4}{3}x^3}$

Use differentiation to find the value of x for which V is a maximum

$\dfrac{dV}{dx} = 40 - 4x^2$

At max $40 - 4x^2 = 0$

$\Rightarrow x^2 = 10$

$\Rightarrow \underline{x = \sqrt{10} \ (3.16\text{cm})}$