Quadratic Models

Tuesday, 13 March 2018 6:07 PM

Work to be completed at the end of teaching:

Quadratic Models	MM Ex. 3L	1 2 3 4 5 6 8 9

RECAP:

Good news!
This is the last lesson on this topic.
Some revision and we can put a big tick under the heading of Quadratics!
Everything we have learnt so far can really be described as "tools". They are techniques which help us solve bigger problems.
We're now going to start looking at those bigger problems!

Modelling

Whilst we all aspire to walk the cat walk ... we're not talking about that type of modelling.

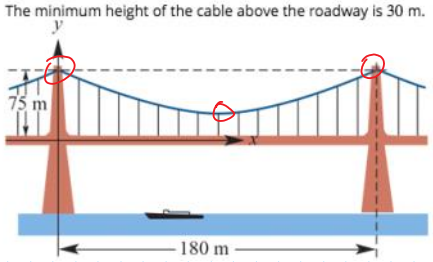
We're talking about taking real life situations and using Mathematics to model a solution.

We already had a taste of this last lesson ...



"A model ... LOL"

11 Assuming that the suspension cable shown in the diagram forms a parabola, find the rule which describes its shape. The minimum height of the cable above the roadway is 30 m.



$y = ax^2 + bx + c$

$f(x) = ax^2 + bx + c$

$f(0) = 75$

$f(90) = 30$

$f(180) = 75$

a, b, c

This was a bridge problem, which we later discovered could be modelled as a quadratic equation.
All we needed to do was:

- Visualise the quadratic
- Discover what information they have given us
- Fit it to the correct "Quadratic Form"
- Solve using CAS or other means.

Common types of questions

The good news is ... there are common types of questions!

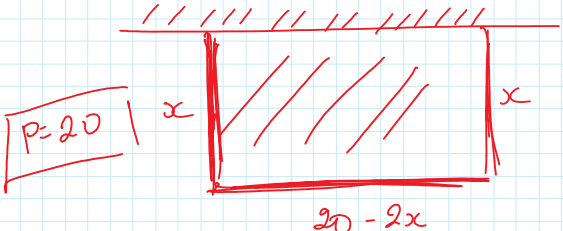
1. The fence around a field/hedge/pool etc



These questions will generally ask you to find the Area of a shape in terms of x.
It will then ask you to sketch the graph of Area against x.
It will ask you for a maximum Area or Minimum Area which can be effectively read from a graph.

Example:

A rectangle has a perimeter of 20 m. Let x m be the length of one side. Find a formula for the area A of the rectangle in terms of x. Hence find the maximum area A.



$A = x(20 - 2x)$

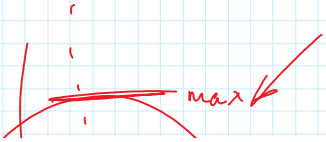
$A = 20x - 2x^2$

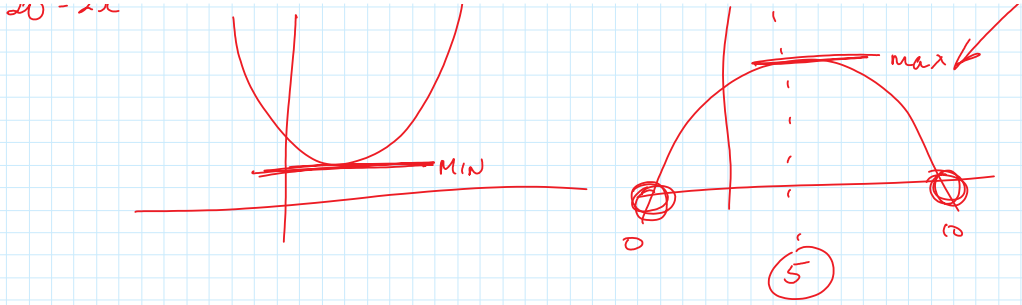
$A = -2x^2 + 20x$

$x(20 - 2x) = 0$

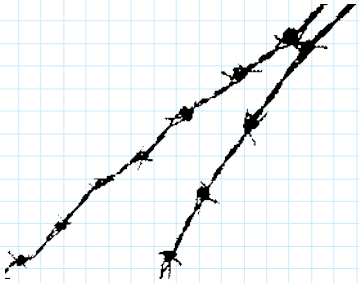
$x = 0$ $\quad 20 - 2x = 0$

$x = 10$

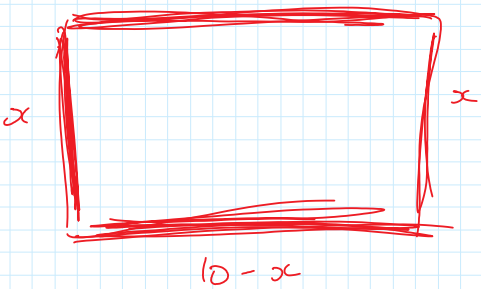


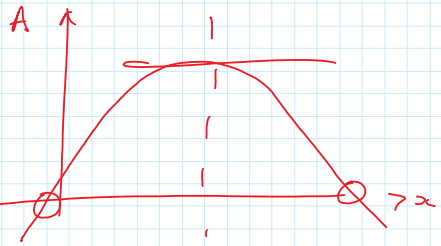


2. A wire of length ??? is bent into a rectangle.



These questions will try and ask you the same as those above!
They will generally ask you to find the Area of a shape in terms of x.
It will then ask you to sketch the graph of Area against x.
It will ask you for a maximum Area or Minimum Area which can be effectively read from a graph.





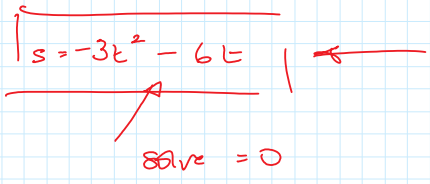
3. Questions where they give you a quadratic which describes a particular situation and asks you to use the formula/interpret it in some way!

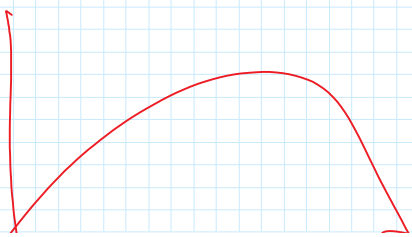






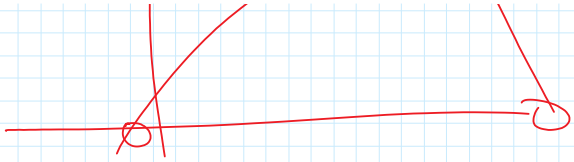
The formula they give you will be a quadratic of some form.
They will ask you to sketch the quadratic somewhere (use your CAS).
They will ask you about the maximum and minimum.
They might ask you about particular values.







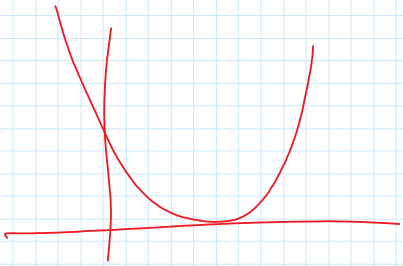




Important to note:

Every one of these questions has the same general idea:

1. Find an equation which will be a quadratic
2. Solve it in some way to find the points it crosses the x-axis.
    a. This will be the effective domain of the function!
3. Find the maximum or minimum depending on the function they have given you.
4. Ask you to find points on the curve.



In every case … use your CAS to sketch the graph! This will save hours of time.

The hardest part of these questions is generally trying to find the quadratic and set up the equation. When you don't know a side length, call it x. Then relate all other measurements on the diagram in terms of that x.

Generally they ask you to find an equation for an areas in terms of x. Remember that an area is simply base times height for a rectangle.

