Curve Stitching Masterclass

Thanks for helping with this Masterclass session! Your support is much appreciated.

The session leader should be able to tell you more about the content of the session, and exactly how they'd like you to help, but this sheet should give you some basic information you may find useful. If any of this seems obvious to you, that's great!

In general, for Masterclass sessions:

- While the session leader is talking to the group, don't interrupt them or distract the students unless something is wrong that needs fixing urgently. You should also watch and pay attention to what they're saying, to set a good example.
- If things need handing out to the students, wait for the session leader to signal you to do this, as it can distract the students if you start to hand things out before they're ready.
- If the students are given a task to work on, you should circulate the room to talk to the students. Wait until they've had a chance to tackle the problem before you interrupt them, and encourage anyone who looks like they haven't started yet.
- Try not to give away the answers to the students, especially if they're working on the problem and about to discover it for themselves - if they are really struggling, you can give them a hint or suggest where they might start looking.

In this session:

This workshop is an exploration of the parabola shape - a very common one in a number of everyday contexts. It is the shape made by water travelling initially upwards from fountains, and the shape traced by a ball between bounces. The workshop will explore ways to use straight lines to make the parabola curve.

The main activities are:

1. Throwing a parabola – thought experiment
2. Folding a parabola
3. Ruling a parabola
4. Stitching a parabola

There is a great deal more background information available on a separate sheet, if you would like more detail. Please ask the session leader if you'd like to see it.

Thanks again for your help with this session! If you have any other questions, please ask the session leader.

In this session:

Throwing a Parabola

Before the introduction, the students will be asked to think about the shape that's made when a ball is thrown across the room (without actually throwing anything!).

They should try to sketch the shape they think they'll see. Some might think it will be a semicircle shape - this is close to the right answer, so don't discourage this, but ask them to think about what that shape looks like - if you throw the ball straight up in the air rather than across the room, what will happen? How fast will the ball be moving at different times during the throw?

The session leader will show a video of a ball being thrown.

Folding a Parabola

Students will now be asked to fold paper in half length-ways (this will be axis of symmetry) and draw a dot near the bottom of the page. Their dot should be in the middle, around 3cm from the bottom of the page, which should be placed portrait on the table. Following the instructions on the screen, they will use a folding technique to create a curve from straight lines.

The students will be asked to make more folds at different angles (but always satisfying the condition that the bottom edge of the paper lies on the dot). Help students investigate the possibilities within the constraint. Some will struggle to understand the concept, so please help them as much as you can.

The folds made should be straight - if you see anyone trying to make a curved fold as they're expecting to be making a curve, you should tell them to make the folds straight. Creasing each fold well will make it more visible. Drawinga thin pencil line along each crease will also help make them visible. If students have extra time they can always add more folds.
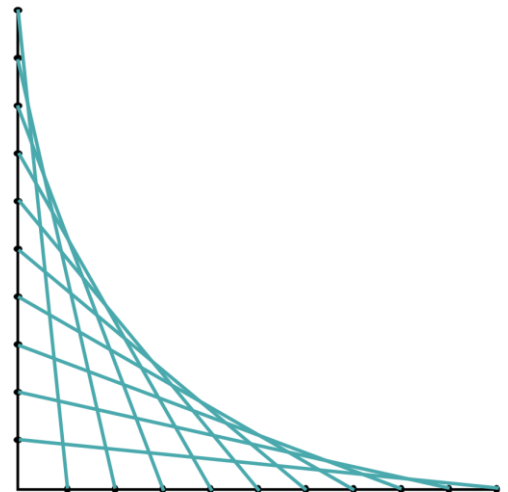
Ruling a Parabola

The next activity involves drawing a pair of axes in the bottom left of the page. The axes must be at right angles, and have notches along each line - anywhere between 6 & 10 notches is fine, although it's important there are the same number of notches on each line (and that the spacing between notches is the same in each direction). The students will be given a ruler to draw the axes with, and might find they can fit axes that measure around 18cm across the page, so measuring a similar distance upwards will give two axes the same length. They can decide how far apart to make the notches, as long as they are measured accurately.

If any student is struggling with drawing the axes, and it looks like they will fall behind the rest of the group on the activity, there is a pre-printed sheet with axes available. The session leader may also choose to use this for everyone if time is short.

Once students have constructed their axes, they need to join them up to create a parabola - joining the top notch to the first notch along on the bottom, the second notch to the second notch along, and so on.

Once they've made this basic shape, students will be encouraged to experiment with other forms - starting from axes that are not at right angles to each other, or using the outline of a shape to create multiple overlapping parabolas. A separate worksheet, with a square, triangle and hexagon to draw parabolae on, is provided. They can also experiment with closer or wider spaced notches, using different colours for the lines, and colouring in the spaces between the lines.

Stitching a Parabola

Having played with the possibilities for parabolae, the students need to choose their favourite design to make into an A6 card. A simple design, consisting of one parabola, with 6-10 pairs of holes, is realistic in the time they'll be given. If students are indecisive, help them by suggesting a simple option from the designs they've drawn.

They'll need to draw their axes on carefully in pencil, then using the provided foam mat and pin, carefully make holes through the card where their notches are on the axes. If you see any students working directly on the table, or being unsafe, warn them to take care not to damage the table (or themselves!)

Once the holes are made, students can use a piece of thread to create straight lines - coming through from the back of the piece, where they can tie a knot or use tape to hold down the end, then coming back through at the other end of each line. They should be aware anything on the front of the piece will be visible, but threads on the back will not - although it's a good idea to go back through each time at the next closest hole to where they came out, to keep thread on the back to a minimum. They should aim to start with a piece of thread long enough so they don't need to tie any together - but if they do run out, you can tie on an extra length of thread, as long as the knot ends up on the back.

When they've finished, if the organiser has brought materials to do so, the students can make their A6 card into an A6 greetings card - they can fold a piece of A5 card in half, trim their finished parabola piece slightly and glue it on to the front.

Parabolic Christmas cards, by Vicky Neale
(Photo: Jennifer Balakrishnan)