Tarsia puzzle for integration of trig functions

Purpose

This puzzle was created to use with a Use of Maths A2 class, but is also useful for the first section of integrating trig functions in A2 Maths. If only uses integrals of $a \sin kx$ and $a \cos bx$ and provides routine practice of that skill.

How was it made?

The software is available for free and includes quite a good set of tools for typing mathematical equations. The cards can be printed in a variety of ways, allowing for a giant set to do as a class activity, or a standard set for use in small groups, or a reduced set for a group of students who need an easier challenge. The orientation of the cards means it can be used "in the round" as there is no right way up.

How was it used?

The activity requires some preparation, although you can get the students to do the cutting – I don't! I find it best to print each set on a different colour of card so that a lost card can easily be put back with the proper set. I find the solution is usually too small to use projected on the whiteboard, so print off the solution and pass it round the classroom as groups finish.

Tips for creating good resources like this

The best tip for writing a puzzle is to make sure that you make them think! In this activity, it could be made very easy by having every pair with a different coefficient of x, and the thinking about signs and coefficients in the final answer would be cut out. Here I have several with sin2x so that thought is needed to get signs and coefficients right. I have found that if you have questions which give exactly the same answer, the students have to choose at random which of the cards to use, so correct mathematics doesn't always give a correct jigsaw – my students hated that.

My experience of using puzzles like this

Care needs to be taken when the students are working to ensure that all of them are engaged and not letting their noisy neighbours do all the work. No record is automatically generated of their work – you can ask them to take photographs on their phones, or ask them to select the ones they found tricky and write them up. There is always a difficulty in finding stretch and challenge material for the groups that finish first, but it is usually worth the effort – an open ended problem can work well. For this activity you could get your A level class to think about an integral like $\tan x$ or $\sin^2 x$ as an introduction to the next lesson.
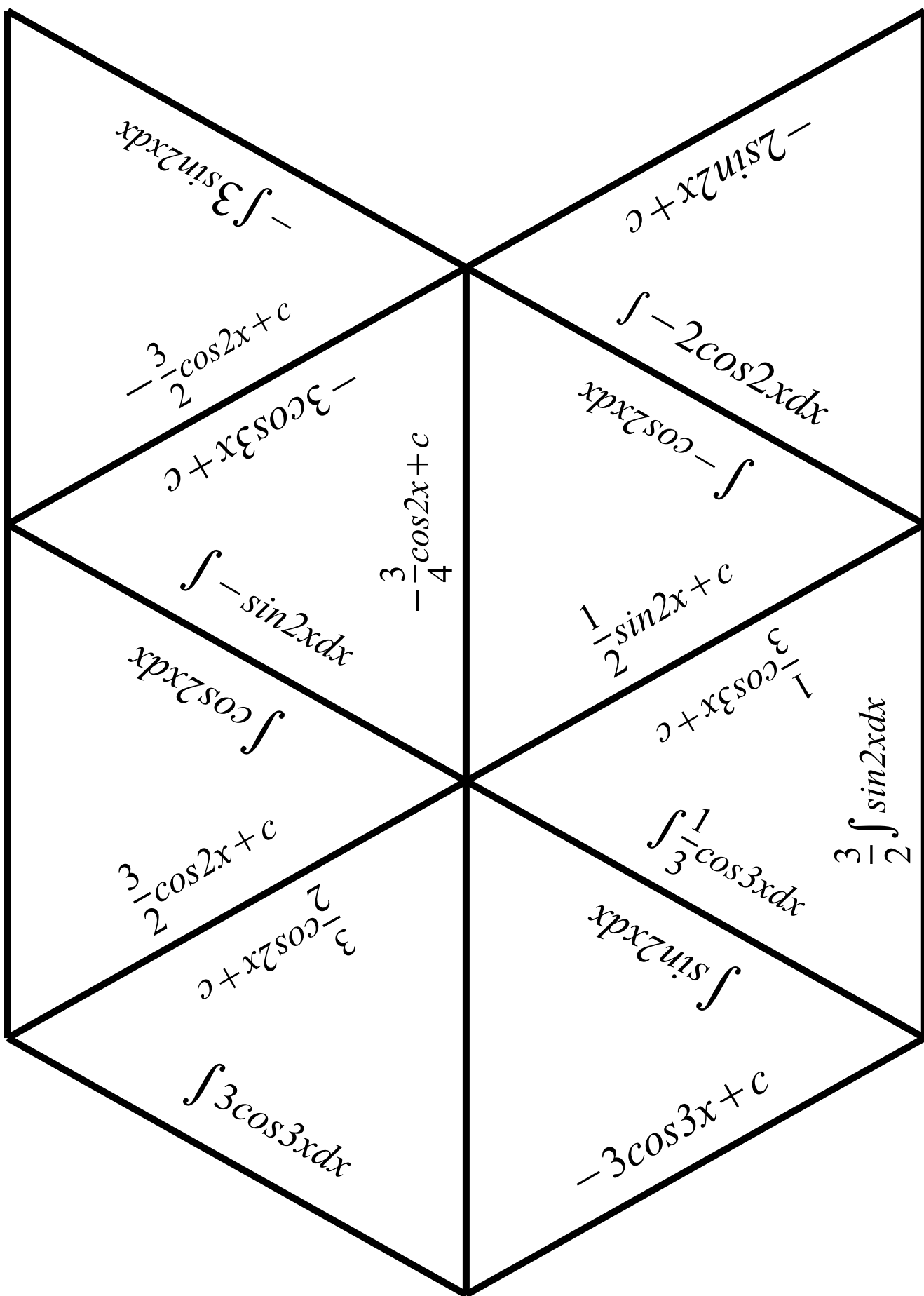
How can they be stored and shared?

I store the cards in tiny sealing plastic bags and file in drawers by module in the office, printing off the masters, solutions and any hints for use so that colleagues can easily find them in a plastic wallet. We ran a booking system for card sets.

$\int sin2x dx$	$-\dfrac{1}{2}cos2x + c$
$\int -3sin2x dx$	$\dfrac{3}{2}cos2x + c$
$\int cos2x dx$	$\dfrac{1}{2}sin2x + c$
$\int -cos2x dx$	$-\dfrac{1}{2}sin2x + c$
$\int -4cos2x dx$	$-2sin2x + c$
$\int -2cos2x dx$	$-sin2x + c$
$\int 3sin2x dx$	$-\dfrac{3}{2}cos2x + c$
$-\int 3sin2x dx$	$\dfrac{3}{2}cos2x + c$
$\int 3cos3x dx$	$sin3x + c$
$\int 9sin3x dx$	$-3cos3x + c$

$9 \int \sin 3x \, dx$	$-3\cos 3x + c$
$\int -\sin 2x \, dx$	$\dfrac{1}{2}\cos 2x + c$
$-\int \sin 3x \, dx$	$\dfrac{1}{3}\cos 3x + c$
$\int \dfrac{1}{3}\cos 3x \, dx$	$\dfrac{1}{9}\sin 3x + x$
$\dfrac{3}{2}\int \sin 2x \, dx$	$-\dfrac{3}{4}\cos 2x + c$

$\int cos2xdx$

$\frac{1}{2}sin2x+c$

$\frac{3}{2}cos2x+c$

$\int -3sin2xdx$

$\int -cos2xdx$

$\frac{-1}{2}sin2x+c$

$x+\frac{1}{6}sin3x$

$\frac{1}{3}\int cos3xdx$

$\frac{1}{3}cos3x+c$

$-\int sin3xdx$

$\int -4cos2xdx$

$-2sin2x+c$

$\frac{-1}{2}cos2x+c$

$\int sin2xdx$

$-3cos3x+c$

$\int 9sin3xdx$

$\frac{3}{2}\int sin2xdx$

$\frac{-3}{4}cos2x+c$

$\int -sin2xdx$

$\frac{1}{2}cos2x+c$

$\int -2cos2xdx$

$-sin2x+c$

$-3cos3x+c$

$9\int sin3xdx$

$sin3x+c$

$\int 3cos3xdx$

$\frac{3}{2}cos2x+c$

$-\int 3sin2xdx$

$\frac{-3}{2}cos2x+c$

$\int 3sin2xdx$

$-\int 3\sin 2x dx$

$-2\sin 2x + c$

$-\frac{3}{2}\cos 2x + c$

$\int -2\cos 2x dx$

$-3\cos 3x + c$

$\int -\cos 2x dx$

$-\frac{3}{4}\cos 2x + c$

$\int -\sin 2x dx$

$\frac{1}{2}\sin 2x + c$

$\int \cos 2x dx$

$-\frac{1}{3}\cos 3x + c$

$\frac{3}{2}\int \sin 2x dx$

$\frac{3}{2}\cos 2x + c$

$\int \frac{1}{3}\cos 3x dx$

$\frac{3}{2}\cos 2x + c$

$\int \sin 2x dx$

$\int 3\cos 3x dx$

$-3\cos 3x + c$

$\int -3\sin 2x\,dx$

$x + \dfrac{1}{6}\sin 3x$

$-\dfrac{1}{2}\cos 2x + c$

$\int 3\sin 2x\,dx$

$\dfrac{1}{2}\cos 2x + c$

$-\sin 2x + c$

$$-\frac{1}{2}sin2x + c$$

$$-\int sin3xdx$$

$$\int -4cos2xdx$$

$$\int 9sin3xdx$$

$$sin3x + c$$

$$9\int sin3xdx$$