

Valentine's Day maths for IB Maths SL and HL

IB Math Revision · IB Maths SL and HL (AA and AI) · 14 February · Student sheet

Name _____

Class _____

Date _____

The starter is non-calculator. A GDC is needed for the main activity.

Starter (5 minutes)

1. Find the area of a circle of radius 3, in terms of π .
2. Work out $4!$.
3. Two fair coins are tossed. Find the probability of two heads.
4. Solve $|x|^{2/3} = 4$.

Main activity (35 minutes)

Task A: A heart from simple shapes

A heart is made from a square of side s cm, turned to stand on a corner, with a semicircle on each of its two upper sides.

- a. Take $s = 10$. Find the area of the heart, exactly and to 3 significant figures.
- b. Find the perimeter of the heart, to 3 significant figures.
- c. A card designer wants a heart of this shape with area 500 cm^2 . Find s , to 3 significant figures.

Task B: Secret card swap

Four friends each write their name on a card. The cards are shuffled and each friend takes one at random.

- In how many different ways can the four cards be handed out?
- List the ways in which nobody gets their own card. Find the probability that nobody gets their own card.
- Find the probability that exactly one friend gets their own card.
- (HL) For a class of 30, the probability that nobody gets their own card is very close to $1/e$. Find $1/e$ to 3 significant figures.

Task C: A heart-shaped curve

The curve $x^2 + (y - |x|^{2/3})^2 = 1$ is heart-shaped. Plot it on your GDC as two functions.

- Show that the curve is $y = |x|^{2/3} \pm \sqrt{1 - x^2}$ for $-1 \leq x \leq 1$. Find where it crosses the y -axis.
- Show that the vertical distance between the two halves of the curve at x is $2\sqrt{1 - x^2}$. Hence explain why the area inside the heart equals the area of a circle of radius 1, and write it down.
- Use your GDC to find the highest points of the heart, to 3 significant figures.

Extension

- People each choose a whole number from 1 to 20 at random. Find the probability that two people choose the same number. How many people are needed for the probability that at least two of them match to be more than $\frac{1}{2}$?