

Maths art for A Level Maths: curve stitching, tessellations and graph pictures: answers

A Level Math Revision · A Level Maths (Year 12 and Year 13) · Teacher answers and notes

No calculator needed. Task C is best done in a graph plotter.

Teacher notes

- Bring squared paper, rulers and coloured pencils.
- Make it a display: curve stitching in coloured pencil (or thread on card), a tessellation tile coloured in groups, and the graph pictures printed with their equations underneath.
- Task C works well in any free online graph plotter: students add their own features (eyebrows as quadratics, hair as a sine wave).

Starter

1. **120°**
 - $(6 - 2) \times 180 \div 6$
2. **-4**
 - $(0 - 8)/(2 - 0)$
3. **$(0, 0); 5$**
 - $r^2 = 25$

Task A: Curve stitching

- a. **$y = -4x + 8$**
 - Gradient $= (8 - 0)/(0 - 2) = -4$
 - y-intercept 8
- b. **$7x + 3y = 21$**
 - Gradient $-7/3$, intercept 7: $y = -7x/3 + 7$
 - Multiply by 3: $7x + 3y = 21$
- c. **Both points satisfy it**
 - At $(k, 0)$: $(10 - k)k = k(10 - k)$. At $(0, 10 - k)$: $k(10 - k) = k(10 - k)$.
 - A linear equation through both points is the line.

Task B: Tessellations

- a. **Triangles, squares and hexagons ($n = 3, 4, 6$)**
 - Interior angle $= 180 - 360/n$.
 - Checking $n = 3$ to 12 and beyond: only 60, 90 and 120 divide 360 (the angle is always between 120 and 180 for $n > 6$).
- b. **$90 + 120 + 150 = 360$**
 - 12-gon: $180 - 30 = 150$
- c. **$1/4 + 1/6 + 1/12 = 1/2$**
 - $3/12 + 2/12 + 1/12 = 6/12$

Task C: Graph pictures

a. $(x - 2)^2 + (y - 2)^2 = 0.25$

- $(x - a)^2 + (y - b)^2 = r^2$

b. -1.2

- $0.2 \times 9 - 3 = -1.2$

c. $9 + 1.44 = 10.44 < 25$

- At $(3, -1.2)$: $x^2 + y^2 = 10.44$, less than 25.

Extension

1. Both pass through $(2.5, 2.5)$ with gradient -1

- $\sqrt{2.5} + \sqrt{2.5} = 2\sqrt{2.5} = \sqrt{10}$, and $2.5 + 2.5 = 5$.
- On the curve, $dy/dx = -\sqrt{y}/\sqrt{x} = -1$ at $(2.5, 2.5)$, the gradient of the line.

Every question is original and every answer was recomputed by computer before publishing.