Assignment 2

Instructions	تعليمات
1) This assignment consists of 6 questions: **Section A:** requires numerical answers only. **Section B:** requires full solutions.	1) يتكون هذا الواجب من 6 أسئلة : **القسم A :** يتطلب إجابات عددية فقط. (4 أسئلة) **القسم B :** يتطلب حلولًا كاملة. (2 أسئلة)
2) Each question in Section A is worth 5 points. No partial credit are given, but you must not give more than the number of answers being asked for. For questions asking for several answers, full credit will only be given if all correct answers are found.	2) كل سؤال في **القسم A** يساوي **5 نقاط**. لا تُمنح نقاط جزئية. ويجب ألا تعطي أكثر من عدد الإجابات المطلوب. بالنسبة للأسئلة التي تطلب عدة إجابات، تُمنح الدرجة الكاملة فقط إذا تم العثور على جميع الإجابات الصحيحة.
3) Each question in Section B is worth 20 points. Partial credits may be awarded.	3) كل سؤال في **القسم B** يساوي **20 نقطة**. يمكن منح نقاط جزئية.
4) Diagrams shown may not be drawn to scale.	4) قد لا تكون الرسوم التوضيحية المرفقة مرسومة على مقياس صحيح.
5) You cannot use instruments such as protractors, calculators and electronic devices, smart watches.	5) لا يمكنك استخدام أدوات مثل المنقلة، الآلات الحاسبة، الأجهزة الإلكترونية أو الساعات الذكية

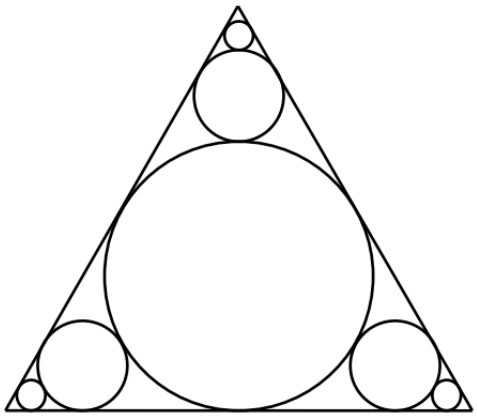
SECTION A

Problem 1 :

Let x be some real number, and $y = \sqrt{3x+4} + \sqrt{4-3x}$.
What is the minimum possible value of y^2?

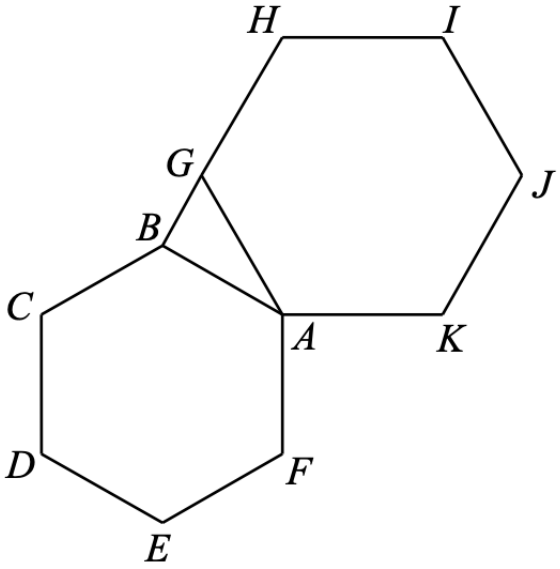
Problem 2 :

A circle of radius 1 cm is drawn touching the three edges of an equilateral triangle. Starting from this circle, three infinite sequences of smaller circles are then drawn, one at each corner, such that each circle touches tangentially the previous circle and two of the edges of the triangle, as shown in the diagram below. What is the sum of the circumferences, in cm, of all the circles? (Take $\pi = 3.14$)



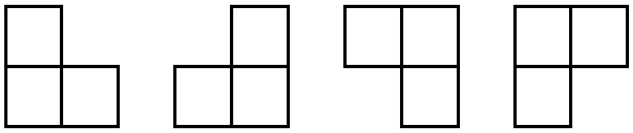
Problem 3 :

Let $ABCDEF$ and $AGHIJK$ be two regular hexagons that do not overlap, as shown in the diagram below. Assume that $\angle FAK = 90°$ and that the areas satisfy $3 \times [AGHIJK] = 4 \times [ABCDEF]$. What is the ratio of $[ABG] : [AGHIJK]$?
(Note: $[P]$ denotes the area of polygon P.)



Problem 4 :

A V-Tromino is made up of three 1×1 squares, as diagrams shown below:



All the V-Trominos must be aligned with the board cells. What is the minimum number of the V-Trominos needed to be placed on an 8×8 board so that one cannot fit a 2×2 square in the remaining space?

SECTION B

Problem 5 :

What is the number of real number solutions of the equation $x^2 - 8[x] + 7 = 0$?
Note: $[x]$ denotes the largest integer that is not greater than x. For example, $[3.14] = 3$ and $[-3.14] = -4$.

Problem 6 :

In triangle ABC, M is the midpoint of BC. We draw the circle with centre O that passes through the points A and C and is tangent to the line AM. The extension of BA intersects the circle at D and the extension of CD intersects the extension of MA at P, as shown in the diagram below. Prove that $OP \perp BC$.