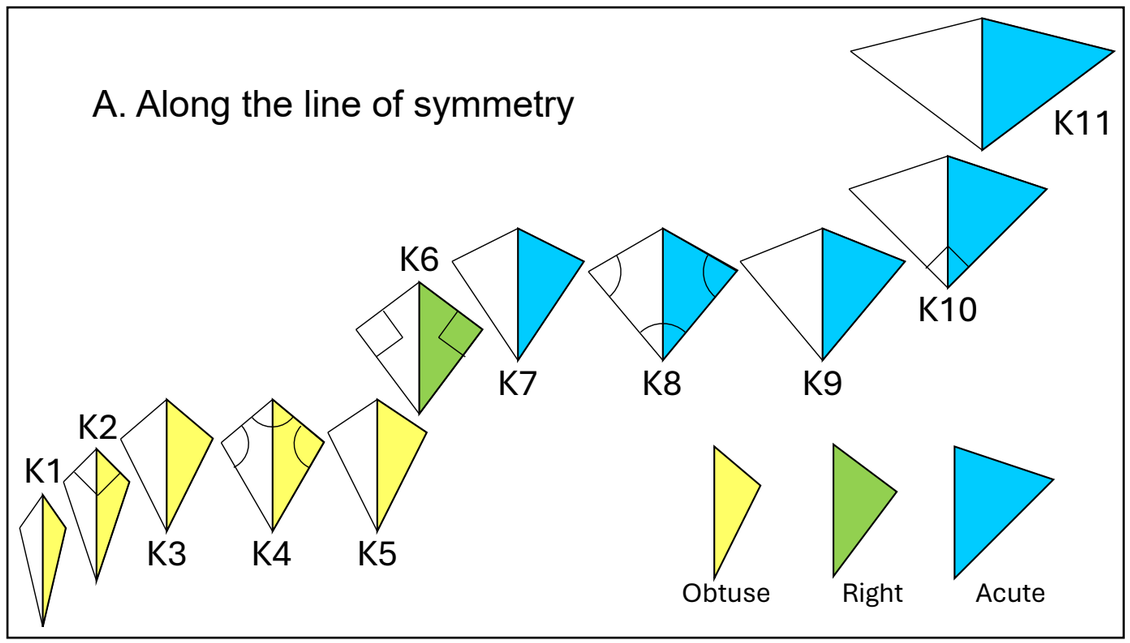
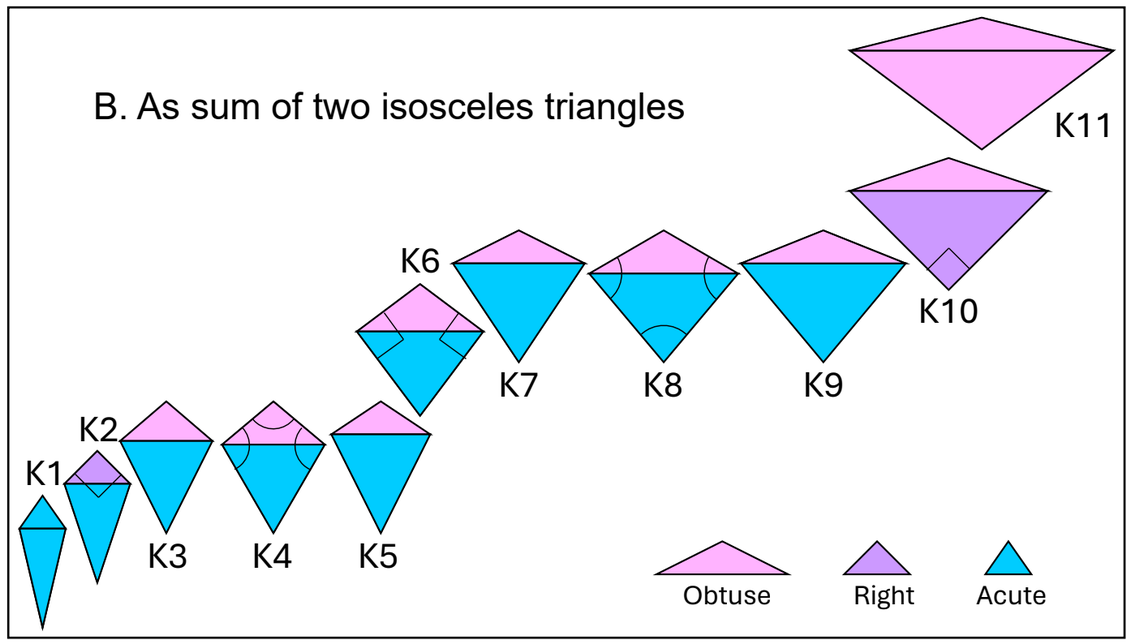
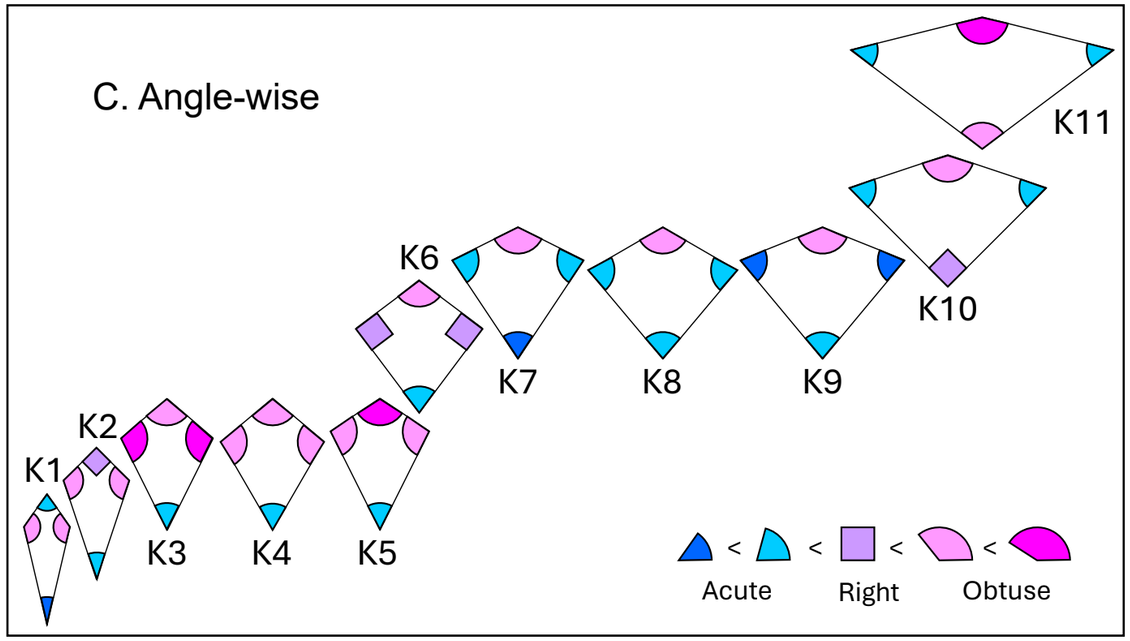
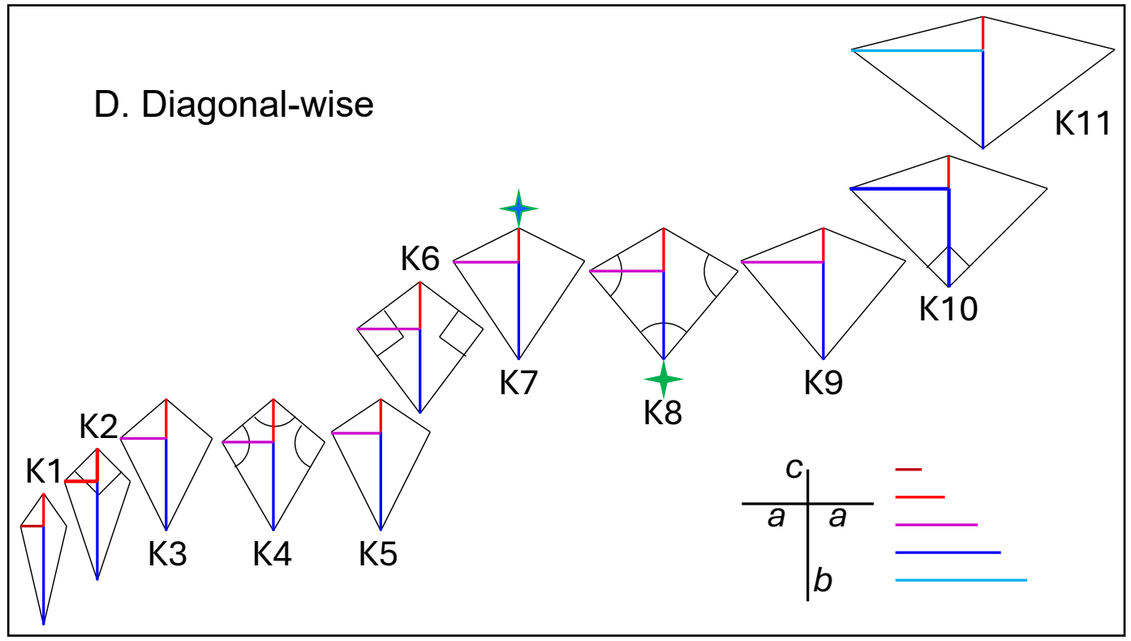
Kite Families









There are 11 types of kites (excluding rhombi) according to these pictures. K6 with 2 right angles is a special one, why? Can you characterise each of K1, K2… K11? Can you draw a kite for each of these 11 categories by specifying angles or sides-diagonals? Can you draw more than one for each category?

Is the halving diagonal (the line of symmetry) always the longer one? In “Diagonal-wise”, the 2 categories marked with stars can have equal diagonals. The blue star category K6 includes kites of all 3 kinds (i) halving diagonal longer, (ii) equal diagonals and (iii) halving diagonal shorter. The green star category K8 includes kites with the halving diagonal being the longer one, and when the diagonals are equal, it becomes a square!

Here are some questions students can explore.

A. Along the line of symmetry

1. What is the line of symmetry in each kite?
2. Why is it the line of symmetry?
3. Consider the triangles formed by the line of symmetry. Based on these triangles, in how many distinct groups can you classify K1, K2… K11? What are these groups?
4. These groups categorize the pair of equal (and opposite) angles of the kite. Can there be subgroups within each group? What do these subgroups categorize?
5. Optional: Can you form a tree diagram?
6. If we consider rhombi instead of kites, how many possibilities are there considering the triangles formed by a line of symmetry?

B. As sum of two isosceles triangles

1. Take any kite. Consider the common side of the two isosceles triangles. How is this side related to the kite?
2. Consider all possible isosceles triangles – acute, right, obtuse. What are the possible combinations that generate:
   a. A kite
   b. A rhombus
   c. Any other special quadrilateral possible? Which one?
3. What would be the equal angles (acute/right/obtuse) of each such kite?
4. Classify K1, K2… K11 based on the classification in 2a. Can you find a kite outside K1, K2… K11?

C. Angle-wise

1. Consider the largest angle in any kite. What type of angle is it?
2. What type of angle is the smallest one?
3. A kite has a pair of equal and opposite angles. How many types of kites are there based on this pair?
4. Why does K2 have a light blue angle < the darker blue angle of K7?
5. Can you form a tree diagram classifying different types of kites based on the angles? Indicate where each of K1, K2… K11 are on this diagram.
6. Can you give examples for each of K1, K2… K11? E.g., K6: 120°-90°-90°-60°
7. Can you find a kite with an angle combination outside K1, K2… K11?
8. Draw a K6 kite. Draw a circle with the halving diagonal (or line of symmetry) as the diameter. What do you observe? Do you observe the same for K1, K2... K5 or K7, K8… K11?

D. Diagonal-wise

1. Describe each of K1, K2… K11 in terms of the parts of the diagonal *a*, *b* and *c*. E.g., K2: $a = c < b$
2. Draw a kite for each of K1, K2… K11 using your choice of *a*, *b* and *c*. Ensure $b > c$.
3. Which diagonal is longer for K1, K2… K6? Which one for K9, K10 and K11? Why?
4. Find the relation among *a*, *b* and *c* if the diagonals of a kite are equal.
5. Now draw 3 K7 kites as follows:
   a. Halving diagonal longer than the other one
   b. Both diagonals equal
   c. Halving diagonal shorter
6. Challenge: Prove that if the diagonals of a kite are equal then the equal (and opposite) angles must be acute.

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