

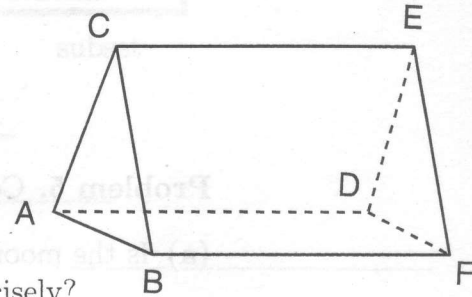
February 23, 2011

Professor Ilya Kofman

NAME: _____

Problem 1.

Suppose $CE \cong AD \cong BF$ and $CE \parallel AD \parallel BF$.



- (a) If $BCEF$ is a rectangle, what is this figure called precisely?
- (b) If $\angle CBF$ is obtuse, what is this figure called precisely?
- (c) Verify Euler's formula for this figure.

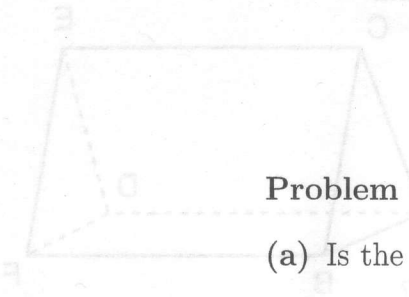
Problem 2. (a) If a prism has a 50-gon for its base, how many vertices, edges and faces does it have? Verify Euler's formula for this prism.

(b) If a prism has 120 edges, how many vertices and faces does it have? Verify Euler's formula for this prism.

Problem 3. (a) What is the measure of an interior angle of a regular decagon?

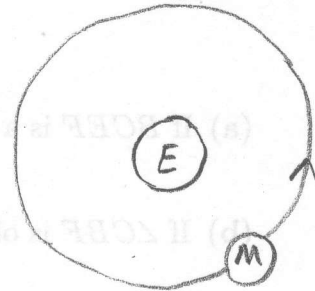
(b) Explain why it cannot be the face of a regular polyhedron.

Problem 4. One semiregular tiling of the plane consists of these three regular polygons at every vertex: a dodecagon (12-gon), a square, and what other polygon? Justify.



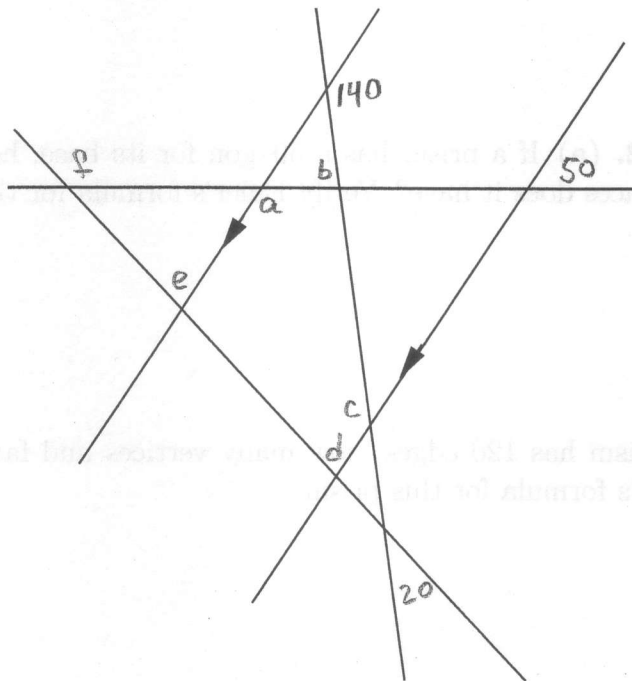
Problem 5. Consider the earth and moon as shown.

- (a) Is the moon new, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, or full?
 (b) Is it waxing or waning?



Problem 6. Find the missing angle measures indicated by letters in the diagram below. Two parallel lines are indicated by arrows.

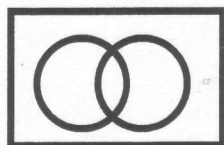
- a = _____
 b = _____
 c = _____
 d = _____
 e = _____
 f = _____



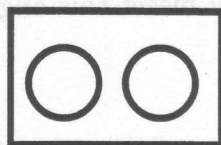
Problem 7. Convex or concave?

- (a) Trapezoid _____
 (b) Obtuse triangle _____
 (c) Two regular hexagons glued along a common edge _____
 (d) Regular polyhedron _____
 (e) Oblique pyramid _____

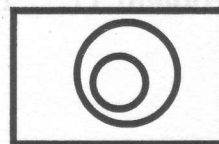
Problem 8. For each of the following pairs, identify which type of Venn diagram describes their relationship.



overlapping



disjoint



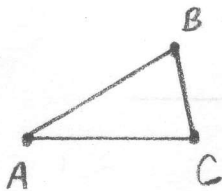
subset

- (a) Rectangles and kites _____
- (b) Rhombi and parallelograms _____
- (c) Rhombi and quadrilaterals with congruent diagonals _____
- (d) Rectangles and trapezoids _____
- (e) Kites and squares _____
- (f) Isosceles triangles and obtuse triangles _____
- (g) Regular polyhedra and pyramids _____
- (h) Prisms and pyramids _____

Problem 9. Among parallelograms, rectangles, rhombi, and isosceles trapezoids, list all for which the following statements always true:

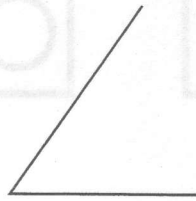
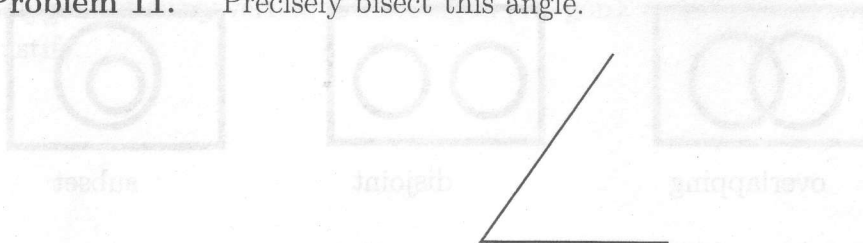
- (a) Adjacent angles are congruent. _____
- (b) Opposite angles are congruent. _____
- (c) Diagonals bisect angles. _____
- (d) Diagonals are congruent. _____
- (e) Diagonals cross at right angles. _____
- (f) Diagonals cross at midpoints. _____

Problem 10. In $\triangle ABC$, $\angle A = 30^\circ$ and $\angle B = 70^\circ$. Use either Euclid's Parallel Postulate or the rotation angles method to precisely explain why $\angle C = 80^\circ$.

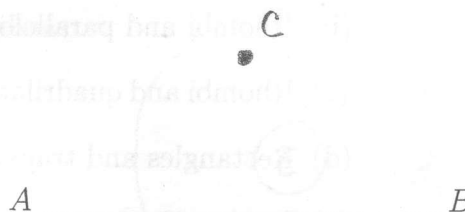


Compass and straightedge constructions. Please number your arcs.

Problem 11. Precisely bisect this angle.



Problem 12. Given segment AB and point C .
Construct a line parallel to AB
through C by copying an angle.

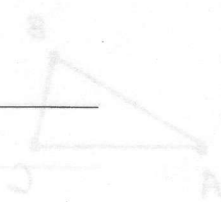


Problem 13. E _____ F

Construct a square with given side EF .

Problem 14. P _____ Q

Construct a regular hexagon with given side PQ .
Hint: First construct an equilateral triangle.



(a) Trapezoid

(b) Equilateral triangle

(c) Two regular hexagons glued along a common edge

(d) Regular polyhedron

(e) Oblique pyramid