MTH/SLS 218–6816 Exam 1

February 27, 2008 — Professor Ilya Kofman

NAME: _____

Problem 1. Consider an equilateral $\triangle ABC$. A person begins walking straight at point A, turns at B and then at C, and returns to A but does not turn. What is the total number of degrees that the walker has turned? Justify your answer.

Problem 2. **(a)** If a pyramid has a 100–gon for its base, how many vertices, edges and faces does it have?

(b) If a pyramid has 14 edges, how many faces does it have?

(c) Verify that your numbers in (a) and (b) satisfy Euler's formula.

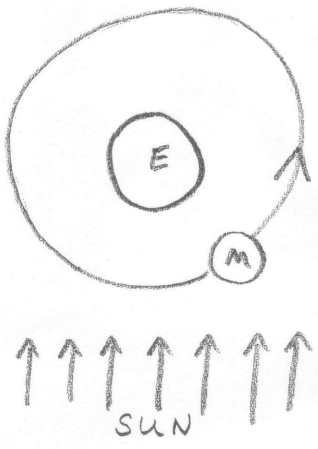
Problem 3. What fact about intersecting spheres enables <u>three</u> GPS satellites to determine your exact location on Earth?

Problem 4. What fact about the interior angles of a regular octagon shows that a regular polyhedron cannot have octagonal faces?

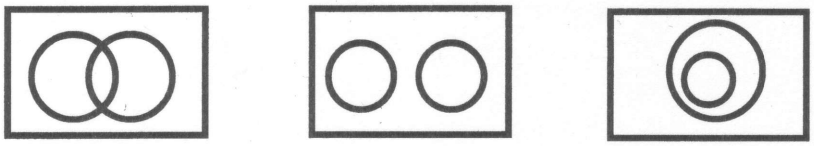
Problem 5. Consider the earth and moon as shown.

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

(b) Is it waxing or waning?



Problem 6. For each of the following pairs, identify which type of Venn diagram describes their relationship.



overlapping disjoint subset

(a) Concave shapes and polygons _____

(b) Convex shapes and parallelograms _____

(c) Isosceles triangles and right triangles _____

(d) Rectangles and regular quadrilaterals _____

(e) Platonic solids and pyramids _____

(f) Prisms and spheres _____

(g) Parallelograms and rhombi _____

(h) Kites and rhombi _____

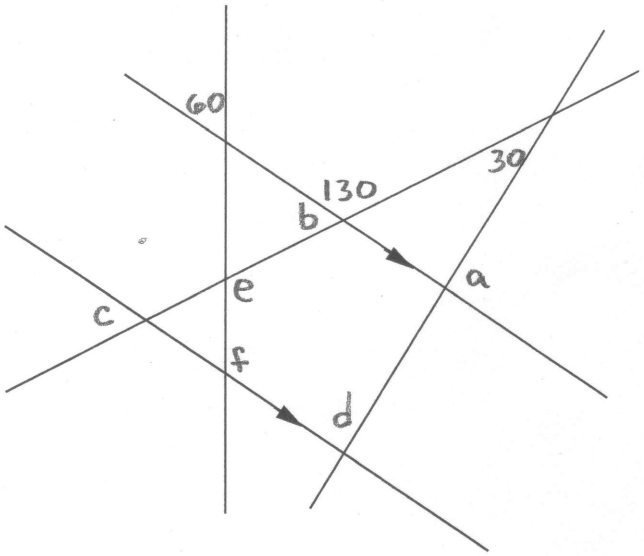
Problem 7. Among parallelograms, rectangles, rhombi, and isosceles trapezoids, for which ones are the following statements always true:

(a) Diagonals are the same length. _____

(b) Diagonals bisect angles. _____

(c) Diagonals cross at right angles. _____

Problem 8. Find the missing angle measures indicated by letters in the diagram below. Two parallel lines are indicated by arrows.



Compass and straightedge constructions. Please do each one separately.

Problem 9. A _____ B

Given segment AB, construct an equilateral triangle with side AB.

Problem 10. Draw an angle that is approximately $60°$. Precisely bisect this angle.

Problem 11. A _____ B

Given segment AB, draw a point C above it. Construct a line parallel to AB through C by copying an angle.

BONUS 12. A _____ B C _____ D

Construct a rectangle with given sides AB and CD.