Math 310 ■ Spring 2009 ♦ GEOquiz #2 ▲ NAME★

#1-8: Mark T for true statements, F for false.
If the statement is false, give a counterexample, or explanation.

1. TF A square is a rhombus.

2. TF A rhombus is a parallelogram.

3. TF A parallelogram is a quadrilateral.

4. TF A square is a rectangle.

5. TF A quadrilateral may have exactly one right interior angle.
TF A quadrilateral may have exactly three right interior angles.

6. TF A rhombus is a regular quadrilateral.

7. TF The sum of the measures of the interior angles of *any* hexagon is 720°.

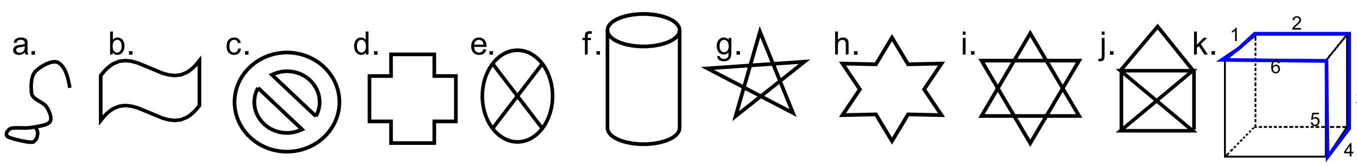
8. TF The number of diagonals in a regular hexagon is 15.

9. If possible, sketch a concave pentagon.

If possible, sketch a concave quadrilateral.

10. Sketch a polygon with only two sides.

11. Which of the following is a curve?

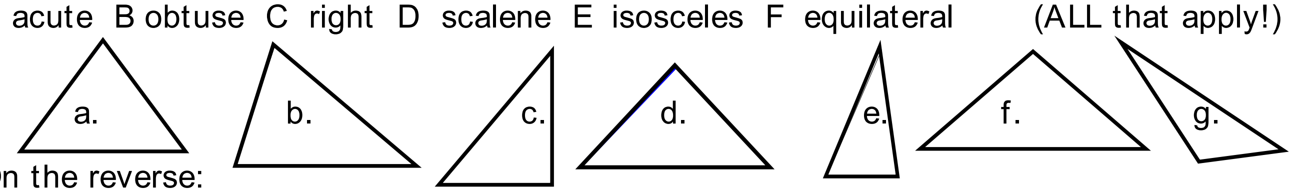


13 Which of the above figures is a simple closed plane curve? (If it is not, why not?)
Note about figure k: The figure is comprised of only the numbered edges of the cube.
The cube itself is not part of the figure, but is shown to make the figure understood.

14. Which of the figures in #11, if any, is a polygon?

15. Identify each of the following triangles as

A acute B obtuse C right D scalene E isosceles F equilateral (ALL that apply!)



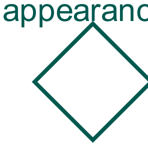
On the reverse:

16. Prove that vertical angles are congruent.

17. Prove that the sum of the measures of the interior angles of a triangle is 180°.

#1-8: T indicates statement is true; F, false.
False statements are accompanied by a reason or counterexample.

1. T A square is a rhombus.
True; a square has the required properties (of a rhombus– quadrilateral with 4 sides ≅).
It is NOT required that a rhombus have a "diamond" shape, with one diagonal shorter than the other. In fact a square turned 45° does indeed have a "diamond-shaped" appearance…

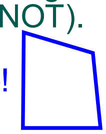


2. T A rhombus is a parallelogram.
True; a rhombus has the required properties
(of a parallelogram– quadrilateral with opposite sides parallel).
If you said false, you probably perceive, incorrectly, that one of the properties of a parallelogram is having two different size sides. Not so!

3. T A parallelogram is a quadrilateral.
True; a parallelogram has the required properties (of a quadrilateral– four-sided polygon).

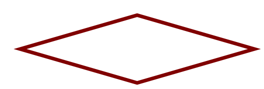
4. T A square is a rectangle.
True, a square has the required properties of a rectangle (quadrilateral with all right angles).
If you said false, you probably perceive, incorrectly, that one of the properties of a rectangle is having two different length sides. A rectangle MAY have 2 different length sides (or NOT).

5. T A quadrilateral may have exactly one right interior angle. True, just draw one!
…like this:



F A quadrilateral may have exactly three right angles.
NEVER! Since the sum of all the interior angles of any quadrilateral is 360°,
if three of those interior angles measure 90°, the fourth must also be 90°.

6. F A rhombus is a regular quadrilateral.

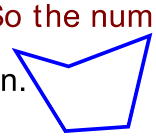


No, a rhombus may have two different sizes of interior angles (➜)…
which violates the requirement that a regular polygon be equiangular (as well as equilateral).
A rhombus *may be* a square, but *might not be*, so we cannot claim it is a regular polygon.

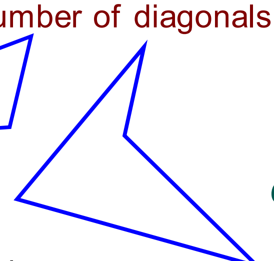
7. T The sum of the measures of the interior angles of *any* hexagon is 720°.
True. Triangulation is probably the simplest way to demonstrate this fact.

8. F The number of diagonals in a regular hexagon is 15.
No, the number of ways to connect 6 no-3-collinear points with line segments is 1+ 2+ 3+ 4+ 5 = 5•6/2 = 15, but *six* of those connecting segments are *sides* of the hexagon, *not diagonals*. So the number of diagonals is 15 – 6, which is 9.

9. Sketch a concave pentagon.



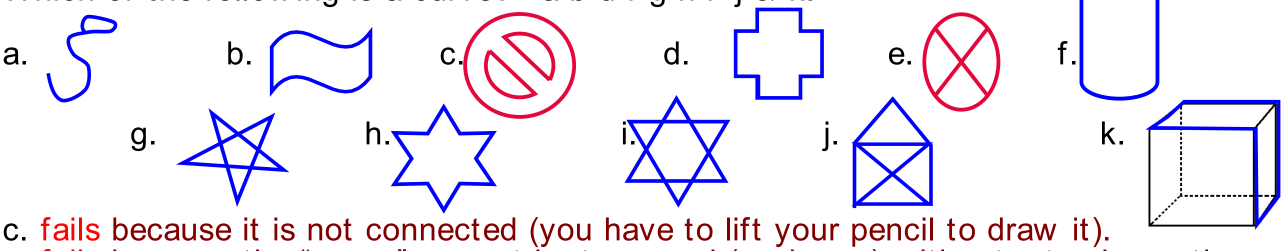
Sketch a concave quadrilateral.



Can you sketch a concave triangle?

10. Sketch a polygon with only two sides.
This is impossible. A polygon is a CLOSED curve. If the second segment comes back to the same point where the first segment began, then the second segment is identical with the first. (Two points determine ONE line segment.) So the second segment retraces all the points covered by the first. This is not even a curve.

11. Which of the following is a curve? a b d f g h i j & k.

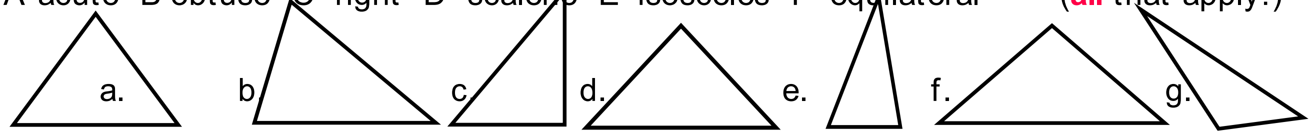


c. fails because it is not connected (you have to lift your pencil to draw it).
e. fails because the "curve" cannot be traversed (or drawn) without retracing paths.
(Those four ODD vertices give it away as untraversable.)
Note about f: if you took this to be a cylinder, then your answer would be that it is not a curve, because a cylinder is a 2-dimensional SURFACE, not the 1-dimensional set of points that is required to be a curve.

13. Which of the above figures is a simple closed plane curve? (If it is not, why not?)
Only b and d and h are simple closed plane curves.
a is **not closed** (does not end where it began) and **not simple**.
c & e are **not** even **curves** (this was explained in #11).
f is **not simple** (it meets itself, and not just by ending where it began).
g & I & j are also **not simple** .
k is a simple closed curve, but it is **not a plane curve**.

14. Which of the figures in #12, if any, is a polygon?
Since a polygon is a simple closed plane curve consisting of straight segments, the only ones to consider are the SCPC: b and d and h. Curve b does not consist entirely of straight segments, so it is not a polygon. The other two, d & h, are polygons.

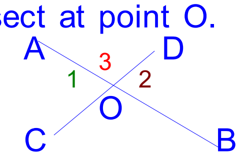
15. Identify each of the following triangles as
A acute B obtuse C right D scalene E isosceles F equilateral (**all** that apply!)



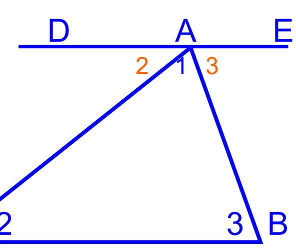
a.	b	c.	d.	e.	f.	g.
A, E	A, D	C, D	C, E	A, D	B, E	B, D
Acute	Acute	Right	Right ✻	Acute	Obtuse ✻	Obtuse
Isosceles	Scalene	Scalene	Isosceles	Scalene✷	Isosceles	Scalene

✻ Cheap trick : Use the corner of your paper to check the angle!
✷ Yes, it is *close* to being isosceles. But notice how the top "leans right"– the vertex is not centered over the base; if isosceles, should be symmetric– top centered, base ∠s ≅!
BTW: "Acute" means ALL the angles of the triangle are acute. EVERY triangle contains at least TWO acute angles!

16. Suppose two lines, one through A & B, the other through C & D, intersect at point O. Then the vertical angles, ∠AOC and ∠DOB are congruent because:
∠AOC is supplementary to ∠AOD; ∠DOB is supplementary to ∠AOD.
Thus both angles, ∠AOC & ∠DOB, have measure 180° – m(∠AOD).
Since they have the same measure, they are congruent.



17. Let ABC be any triangle with interior angles 1,2,3. (Numbering them is a convenience to avoid the naming confusion evident above.)
Let DAE be a line through A parallel to the line through BC.



Since DAE is parallel to CB, by the "alternate interior angles" theorem, ∠DAC is congruent to ∠2 [to emphasize this, we marked it "2"]

Similarly, ∠EAB is congruent to ∠3. (So we marked ∠EAB "3".)

Clearly ∠EAB, (≅∠3) and ∠1 and ∠DAC (≅∠2) together form the line DAE, and so their measures total 180°.
Therefore measures of angles 1, 2 and 3 must total 180°