(14) 1. Fill in the blank to make a complete and true statement.
   a. The number of distinct points necessary to determine a specific plane is
   b. The number of distinct points necessary to determine a specific line is
   c. The minimum number of faces on a convex polyhedron is
   d. The minimum number of faces necessary on a prism is
   e. The number of triangles having sides of lengths 5 cm, 6 cm and 10 cm is
   f. The number of triangles having sides of lengths 3 cm, 6 cm and 10 cm is
   g. The number of line segments connecting nine points, with no 3 collinear, is

(16) 2. Multiple choice. For each statement, choose the best completion of the statement from this list:

A circle  B cube  C dodecahedron  D line  E octahedron  F parallelogram
G plane  H point  I polygon  J polyhedron  K prism  L pyramid
M quadrilateral  N rectangle  O rhombus  P sphere  Q square  R tetrahedron

and place its LETTER in the box.

a. A simple closed curve consisting of line segments is a
b. The polyhedron illustrated in figure 2b is called a
   fig 2b
   E
   T
   E
   tetrahedron
   See # 9 !
   That’s “SSS” !!!
   3 + 6 = 9, too short!
   (8 + 7 + 6 + 5 + 4 + 3 + 2 + 1)

c. Figure 2c can be folded up into a polyhedron called a
   fig 2c
   K
   K
   tetrahedron
   See # 9 !
   That’s “SSS” !!!
   3 + 6 = 9, too short!
   (8 + 7 + 6 + 5 + 4 + 3 + 2 + 1)

(6) 4. Given \( \ell \) and \( m \) are parallel lines, find the measure of the angle marked \( y \).

\[
\text{Method ONE:}
\]
Picture a line \( k \parallel \) to both \( \ell \) & \( m \); use alt. int. \( \angle \)s to get \( y = 60^\circ + 53^\circ \)

\[
\text{Method TWO:}
\]
Use alt int \( \angle \)s at \( \ell \) and \( m \) to get \( \alpha = 60^\circ \)
So the 3rd angle in that triangle is \( 180^\circ - 113^\circ \). Thus \( y = 113^\circ \)

\[
x \text{ and } 3x + 20^\circ \text{ form a straight angle, so}
\]
\[
x + 3x + 20^\circ = 180^\circ
\]
\[
4x + 20^\circ = 180^\circ
\]
\[
x = 40^\circ \text{ ("degrees" necessary in the answer ! )}
\]

(4) 5. The measure of an angle is \( 25^\circ 31' 31" \). Find the measure of its supplement.

\[
180^\circ - 25^\circ 31' 31" = 179^\circ 59' 60"
\]
\[
- 25^\circ 31' 31" = 154^\circ 28' 29"
\]
5. Without using a protractor, and showing your work, find the sum of the measures of the interior angles in the polygon at right:

\[ m(\angle x) + m(\angle y) + m(\angle z) + m(\angle a) + m(\angle b) = 540^\circ \]

Work: As you can see, 3 triangles cover this polygon without overlap. The triangles’ interior angles add up to the pentagon’s interior angles. Thus the total is 3 \(\cdot\) 180°. Or (5–2) \(\cdot\) 180°.

What is the measure of one interior angle of a regular pentagon?

One-fifth of the total, or \(\frac{1}{5}\) \(\cdot\) 540° = 108°

10a. Sketch (neatly & correctly) a prism with a pentagonal base.

b. State the number of faces: 7 2 bases + 5 lateral faces

and vertices: 10 5 at the top, 5 at bottom

and edges: 15 5 + 5 + 5

2. All isosceles triangles are equilateral triangles. Here is an isosceles triangle that is not equilateral:

F All equilateral triangles are isosceles triangles.

8. Prove the sum of the measures of the interior angles of any triangle is 180°. Justification of all statements must be given. Hint: A certain additional line helps!

By the 5th Postulate, there is a line \(\ell\) through \(C\) parallel to \(AB\).

\(\angle 4 = \angle 1\) and \(\angle 5 = \angle 2\) by the alternate interior angles theorem.

(Since parallels \(\ell\) and \(AB\) are cut by transversals \(AC\) and \(BC\).)

Since the adjacent angles 3 & 4 & 5 form straight angle \(\ell\)

\[ m(\angle 4) + m(\angle 5) + m(\angle 3) = 180^\circ \]

Substituting \(m(\angle 4)\) for \(m(\angle 5)\), since 1 & 4 are congruent, and similarly substituting \(m(\angle 2)\) for \(m(\angle 5)\) we get:

\[ m(\angle 1) + m(\angle 2) + m(\angle 3) = 180^\circ \]

QED! [“which is what we were supposed to demonstrate”].

9. Name the figure illustrated at right as specifically as possible.

Right Triangular Prism

How many faces? 5 (Note this helps answer #1.)
(7) 10. Construct the bisector of angle ABC. Marks that are necessary to the construction MUST be shown; unnecessary marks should NOT be shown.

First we drew an arc of a circle centered at B. This intersected the rays of \( \angle ABC \) at D and E. With compass centered at D, then at E, we drew arcs with equal radii to intersect at F.

BF is the ray that bisects \( \angle ABC \).

Note: radii on each end of the arcs drawn are included so the center is clear. This is not the only method.

(12) 11. Prove the following:

In quadrilateral ABCD, if \( AB \parallel CD \) and \( AC \parallel BD \), then ABCD is a parallelogram. Partial Credit possible. Hints available (not free).

**Given:**
(1) ABCD is a quadrilateral,
(2) \( AB \parallel CD \),
(3) \( AC \parallel BD \).

We draw segment AD, and note that (4) \( AD \equiv AD \).

Thus \( \triangle ACD \equiv \triangle DBA \) from (2) & (3) & (4) using SSS theorem.

Since Corresponding Parts of Congruent Triangles are Congruent,

We can now conclude that \( \angle CAD (\angle 1) \equiv \angle BDA (\angle 3) \). [CPCTC]

\( AC \parallel BD \) since AD forms a transversal and the alternate interior angles 1 and 3 are congruent.

Similarly, \( \angle CDA (\angle 4) \equiv \angle BAD (\angle 2) \) and, in turn, \( AB \parallel CD \).

Thus the quadrilateral ABCD is a parallelogram, because opposite sides are parallel (definition of \( \square \)).

[ Bolded items are the critical points to be made in the proof. ]

(3) 12. Using your protractor, carefully measure the angle shown.

\( m(\angle ABC) \approx 142^\circ \)

Your answer may differ, some are \( 127^\circ \).
(5) 13. *Showing all necessary marks, construct* a line through point A perpendicular to BC.

(3) 14. *Showing your work, carefully construct* a circle passing through the vertices of triangle ABC below.

*We construct the \( \perp \) bisector of any side, in this case AB.* Then ditto for another side, say AC.

(4) 15. Carefully illustrate (sketch) the three altitudes of the triangle ABC.

(3) 16. Carefully draw two different (not congruent) triangles using lengths x and y for two sides:

\[
\begin{align*}
\text{That is, sketch } \triangle ABC & \text{ & } \triangle DEF \text{ where both } \triangle s \\
& \text{have sides } x \text{ & } y, \text{ but } \triangle ABC \neq \triangle DEF. \\
& \text{Use a ruler!}
\end{align*}
\]