MATH 213 / Final Review Questions

1. Sketch a **concave polygon** and explain why it is both **concave and a polygon.**
2. Sketch a **simple closed curve** and explain why it is both **simple** and **closed**.
3. Determine the measure of the **vertex, central and exterior angles** of a **regular heptagon, octagon and nonagon**.
4. Determine whether each figure is a regular polygon. If it is, explain why. If it is not, state which condition it dos not satisfy.
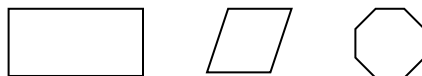
5. A prism has 69 edges. How many vertices and faces does it have?
6. A pyramid has 68 edges. How many vertices and faces does it have?
7. A prism has 24 faces. How many edges and vertices does it have?
8. A pyramid has 24 faces. How many edges and vertices does it have?
9. Which regular polygons tessellate? Explain and illustrate your answer with a sketch.
10. Sketch a pattern block figure with exactly four rotational symmetries and no lines of symmetry. List the angles of rotation.
11. Sketch a pattern block figure that is not a regular polygon, with exactly three lines of symmetry. Mark the lines and label them L1, L2 and L3
12. What are these nets for? Be exact:
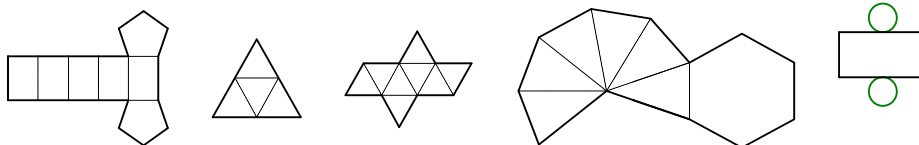
13. In the following figure, line l is parallel to line m. Given the angle measures indicated on the figure, find the measures of al of the angles. Use mathematics, not a protractor.
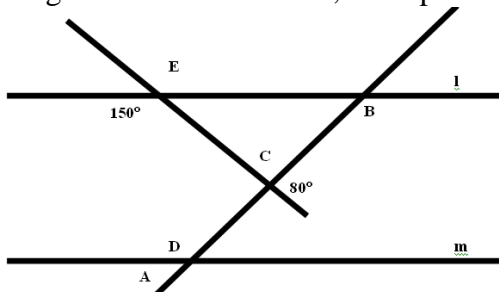
14. If you halve the length of each side of a rectangle, by what factor does the PERIMETER of the rectangle expand or contract? What if you alter the length by a factor of A?
15. If you double the length of each side of a rectangular prism, by what factor does the SURFACE AREA of the prism expand or contract? What if you alter the length by a factor of A?
16. If you double the radius of a sphere, by what factor does the VOLUME of the sphere expand or contract? What if you alter the length by a factor of A?
17. How many CUBIC FEET of gravel are needed to cover a 2 yard x 3 yard area filled to 0.9 yard high?
18. If five tennis balls of diameter 6.5 cm. are packed into a cylindrical can that exactly holds the five balls (the can also has diameter 6.5 cm.); what is the volume of the UNUSED SPACE in the can?
19. Modify all three sides of an equilateral triangle to create a shape that tessellates. Briefly explain your work and use tracing paper to aid you as you sketch the beginning of a tessellation using this template. What type of tessellation is it?

20. Find the surface area and volume of the following objects.

3 cm

13 cm

8 cm

15 cm

5 cm

5 cm
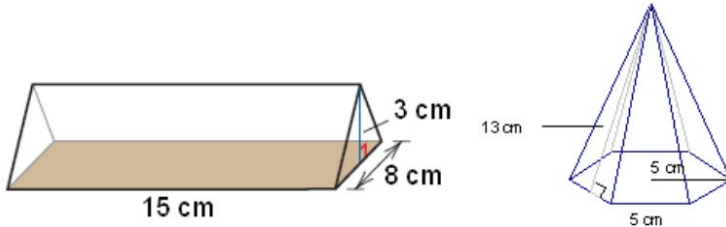
21. The following equilateral triangle has three circular regions surrounding it. What is the area of the shaded portion of the diagram?

1 cm

1 cm

4 cm: Side length of triangle

1 cm

mAB = 2.9 inches

nCD = 2.75 inches

B

D

A   C
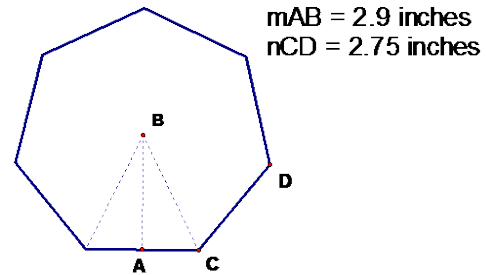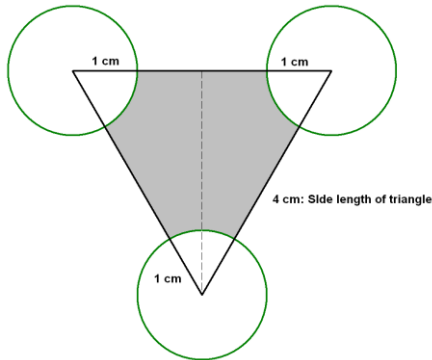
22. What is the area of the regular heptagon pictured above? Show your work. Include units.

23. Lisa is buying special hardwood flooring from Germany and the cost (in US dollars) is $1500 per bundle. Each bundle will cover 12 square meters. If Lisa wants to put the flooring in a room that is 18 feet by 20 feet, how much will the flooring cost? Note: Lisa can only buy whole bundles (e.g. she can't buy 1/2 of a bundle, etc). Show all work and conversions. Note 1 yard ≈ .915 meters.

24. This package is 12 inches longer than it is wide. It is also 6 inches wider than it is high. If the total length of the ribbon needed to go around both ways is 96 inches long, what is the length of the package?
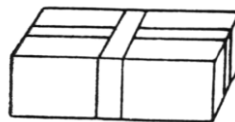
25. The following two figures are similar. Each dimension of the larger figure is TRIPLE the corresponding dimension of the smaller figure. If this tripling of dimensions is continued, how many cubes will there be in the **FOURTH (nth)** figure? If the dimensions of the first figure are doubled rather than tripled, how many cubes would there be in the **SECOND (nth)** figure?
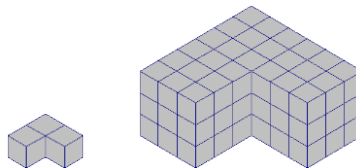
26. Julia and James just bought their first house. They are so excited they had a scale model of their new house made. The scale factor relating their model to the actual house is 75. If the length of one side of the actual house is 50 feet, how many **inches** long is the corresponding side of the model house? If the volume of the model of the house is 0.10 feet^3, what is the volume of the actual house?

27. Sketch the translated image of POLY for the mapping that maps A to B.
28. Sketch the rotated image of BOB for a 90° counterclockwise rotation about point A:
29. Sketch the reflected image of ALLY over the line L
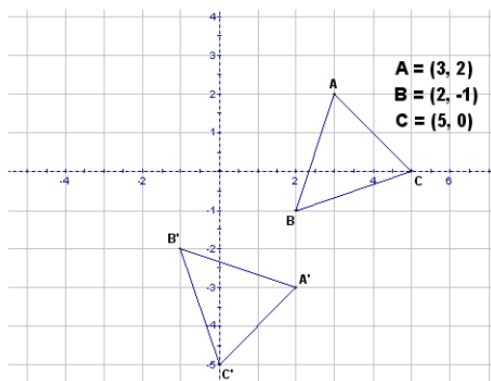30. Use the motion; point A to point B and line L to sketch a translation followed by a reflection of the triangle
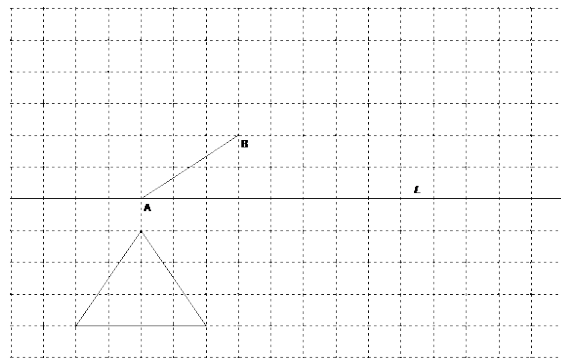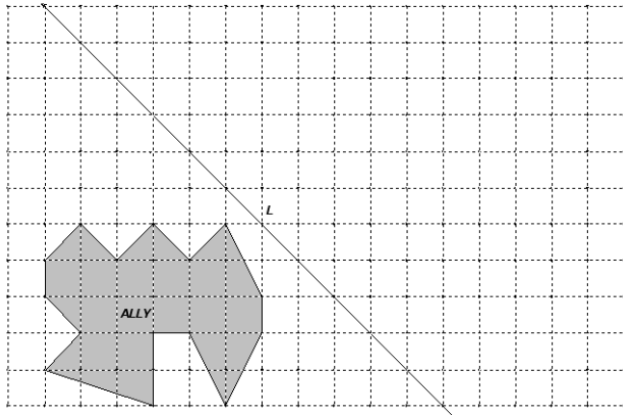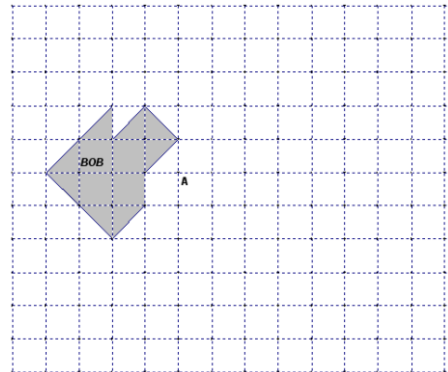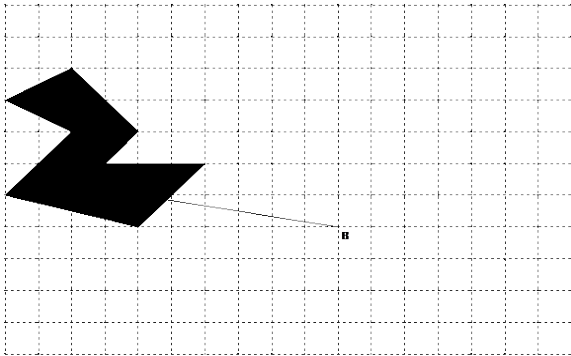
31. In the diagram below triangle A′B′C′ is the image of triangle ABC under a rotation through 90° clockwise centered at the origin.

A = (3, 2)
B = (2, -1)
C = (5, 0)

What are the coordinates of A′, B′ and C′?

Generalize the rule for this rotation, i.e., create a rule that would move any point the same way.
(x, y) is moved to the point (_____, _____)

32. The following figure is made using two tan parallelograms and one red trapezoid from the pattern blocks. Sketch an enlargement of the figure by a scale factor of 2. If instead you were to sketch an enlargement by a scale factor of 3 (or 4 or 5), how many tan parallelograms and how many red trapezoids would be in your figure?

33. Match the triangles into CONGRUENT or (only) SIMILAR pairs. In each case, solve for unknown values in the triangles (only as needed) and use triangle properties to show why the matched triangle pair is CONGRUENT or SIMILAR. Explain as needed. Show your work. Triangles are not to scale.

△ABC
C
4 cm
A   3 cm   B

△PQR
R   Q
55°
4 cm
30°
P

△CAT
C
3 cm
65°   2.5 cm
T
A

△RST
5 cm   S
T
4 cm
R

△DEF
E
45°   45°
D   2√2 cm   F

△XYZ
Z
2.5 cm
65°
X   3 cm   Y

△UVW
W   1 cm   V
1 cm
U

△FOX
O
95°
55°
F   4 cm   X
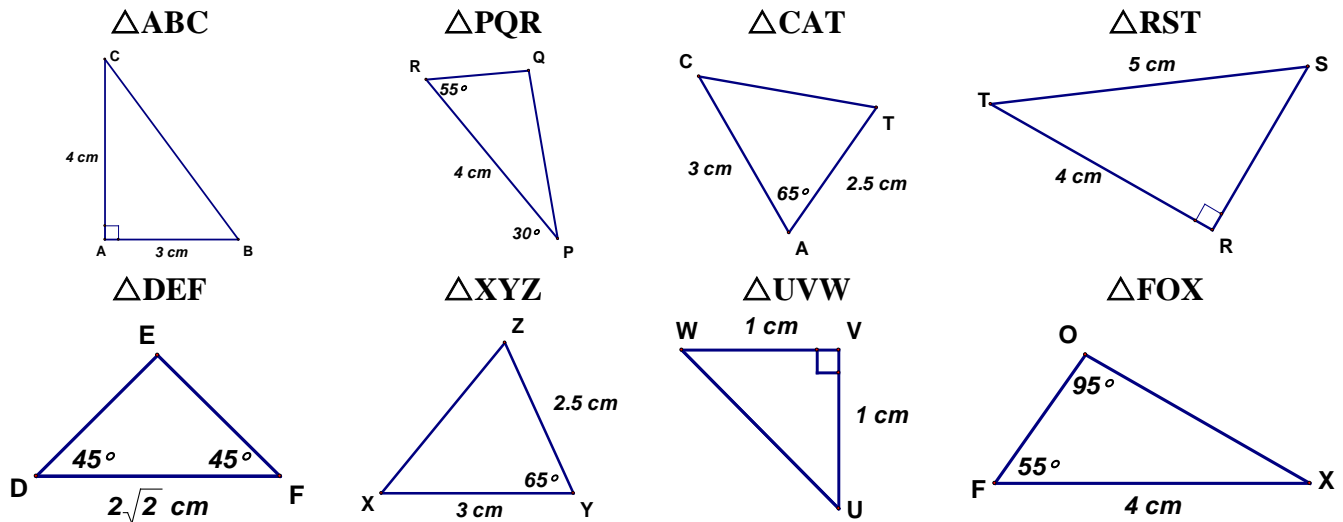
34. In the following diagram a clinometer was used to determine that the angle of elevation, angle PEF, from the observers eye to the top of the statue is 23°. This knowledge enables us to correctly draw the scale model of triangle PEF which is similar to the actual triangle formed by the observer's eye and the two parts of the statue as shown in the picture. In our scale triangle, the length of side EP is 9 inches and the length of side EF is 10.82 inches. Suppose both the observer and the statue are at ground level, the observer is 40 feet from the statue and the observer's eye is 5 feet above ground. What is the height of the statue?

F
E
P
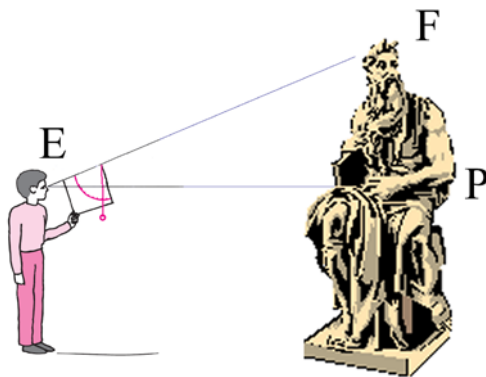
True & False: Determine if each of the following is true or false. In each case, explain your answer in detail or correct the question if it is false. For both true and for false answers, try to create / find a similar question from class notes / texts to practice the stated (or corrected) techniques or ideas.
1. All triangles are similar.
2. All quadrilaterals are similar
3. All rectangles are similar.
4. All rhombi are similar.
5. All regular hexagons are similar.
6. Any pair of similar triangles are also congruent
7. Any pair of congruent triangles is also similar.
8. All equilateral triangles are similar.

9. All right triangles are similar.
10. All triangles with the two angle measures the same and any one side the same length are similar.
11. All triangles with the same three angle measures are similar.
12. If a rectangular pyramid is scaled by a factor of 2, the surface area increases by a factor of 2.
13. If a rectangular pyramid is scaled by a factor of 3, the volume increases by a factor of 27.
14. ASA is a triangle congruence relationship.
15. SAS is a triangle congruence relationship.
16. AAS is a triangle congruence relationship.
17. SSA is a triangle congruence relationship.
18. SSS is a triangle congruence relationship.
19. SSS is a triangle similarity relationship.
20. AA is a triangle congruence relationship.
21. AA is a triangle similarity relationship.
22. You can create a tessellation template starting with an equilateral triangle using at least two tessellation techniques.
23. You can create a tessellation template starting with a parallelogram using at least two tessellation techniques.
24. You can sketch the translation image of any shape given a point to point translation.
25. You can sketch the rotation image of any shape given a center of rotation, a degree of rotation and a direction for rotation.
26. You can sketch the glide reflected image of any shape given a center of rotation, a degree of rotation, a direction for rotation and line of reflection.
27. You can sketch a scaled image of any shape given a center of rotation.
28. All reflection images are created by reflecting across a vertical line.
29. The ratio of corresponding sides of similar polygons is constant.
30. The ratio of corresponding sides on similar triangles is constant.
31. If two triangles have the same perimeter, they must have the same area.
32. If two squares have the same perimeter, they must have the same area.
33. The diagonals of a square intersect at right angles.
34. The volume of a cylinder is 3 times the volume of a cone with the same base and height.
35. If the height of a triangle doubles, then its perimeter increases by a factor of 4
36. A mile is longer than a kilometer.
37. An inch is longer than a centimeter.
38. A yard is longer than a meter.
39. If the radius of circle doubles then the area increases by a factor of 4.
40. If the height of a cylinder doubles, then the volume of the cylinder increases by a factor of 8.
41. If the surface area of two cylinders is the same, then the cylinders have the same volume.
42. 50° C is warmer than 50° F.
43. If the length of the diagonal of a square is doubled, then the edge lengths of the square are doubled.
44. A cube of with side length 10cm would fit inside of a sphere with diameter 10cm.
45. 1500 km is longer than 1200 miles.
46. If the surface area of two spheres is the same, then the volume of the spheres must be the same.
47. If the edges of a cube all double, then the volume of the cube increases by a factor of 8.
48. 100 miles/hour is faster than 100 km/hour.
49. 4 pints = 128 ounces
50. If the length of the diagonal of a square is halved, so are the edge lengths of the square.
51. All parallelograms with the same perimeter have the same area.
52. If the height of a cone doubles, and the base remains the same, the volume of the cone doubles.
53. All connected sets of six squares are nets for a cube

54. To compute the area of a regular n-gon, divide the n-gon into n equilateral triangles, find the area of the equilateral triangle and multiply that area by n.
55. The surface area of a prism is always less (disregarding units) than the volume of a prism.
56. There are 27 cubic feet in one cubic yard.
57. One square meter is the same as 100 square centimeters.
58. Every equilateral triangle is isosceles.
59. A rhombus is a regular polygon.
60. Every hexagon is a regular polygon.
61. The acute angles of a right triangle are complementary.
62. The acute angles of a right triangle are supplementary.
63. If two angles are supplementary, one must be either right or obtuse.
64. Every prism has a square base.
65. A quadrilateral may have all acute angles.
66. A quadrilateral may have both a right angle and an obtuse angle.
67. A semi-regular tessellation can be made using only regular hexagons and squares.
68. Every prism has rectangular lateral faces.
69. Some scalene triangles are right triangles.
70. Every pyramid has isosceles triangles sides.
71. All quadrilaterals have at least two lines of symmetry.
72. The top of a cone is called a vertex or apex.
73. If a polygon is concave, then it must have a reflex angle.
74. All regular polygons are convex.
75. 4 quarts = 128 ounces
76. If the area of a circle doubles, so does the radius.
77. 25° C is warmer than 50° F.
78. The volume of a right pyramid is 3 times the volume of a right prism with the same base and height.
79. The diagonals of a kite intersect at right angles.
80. Triangle 1 has side lengths 2 cm, 3 cm and 5 cm. Triangle 2 has side lengths 2 cm, 3 cm and 5 cm. Triangle 1 and Triangle 2 must be similar.
81. If a rectangular prism is scaled by a factor of 3, the surface area increases by a factor of 6.
82. Triangle 1 has angles 40°, 40° and 100° and Triangle 2 has angles 40°, 100° and 40°. Triangle 1 and Triangle 2 must be congruent.