Math 247 final exam review
Geometry practice problems
1. a. Find the perimeter of this shape
The side along the top is 5 cm long.
The diagonal side is the hypotenuse of a right triangle with legs of length 1 and
3, so its length is:

$$1^2 + 3^2 = c^2$$

$$10 = c^2$$

$$\sqrt{10} = c$$

The quarter circle has radius 4, so its center must be at the dot (drawn in above), so there is another horizontal
length 3 segment at the bottom.

The quarter circle arc has length $\dfrac{1}{4} 2\pi \cdot 3 = \dfrac{3\pi}{2}$

The perimeter is $6 + \sqrt{10} + \dfrac{3\pi}{2}$ cm ≈ 13.87 cm

b. assuming that the grid is a 1 cm grid, what are the correct units for the perimeter? cm

c. Find the area of this shape

The triangle on the left can be measured with base and height 1 and 3 (in either order). The triangle area is
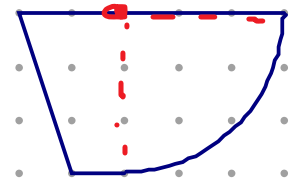
$$\dfrac{1}{2} \cdot 1 \cdot 3 = \dfrac{3}{2}$$
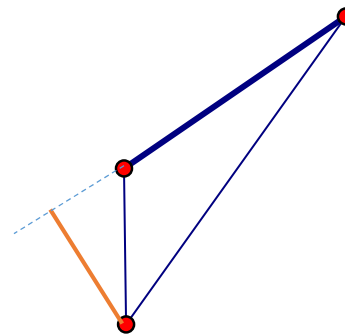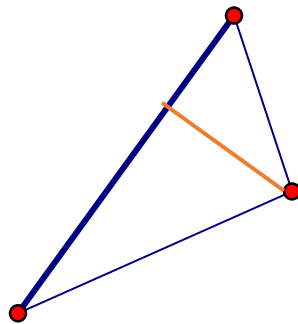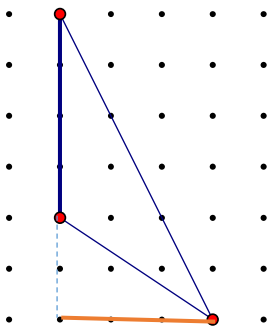
There is a 1 × 3 rectangle with area 3

There is a quarter circle with radius 3 and area $\dfrac{1}{4} \pi \cdot 3^2 = \dfrac{9\pi}{4}$

The total area is $4\dfrac{1}{2} + \dfrac{9\pi}{4}$ cm^2 ≈ 11.57 cm^2

d. assuming that the grid is a 1 cm grid, what are the correct units for the area? cm^2

2. Using the bold side as the base, draw the height for each of these triangles:

3. Explain how the area of a triangle and the area of a parallelogram formula are related.
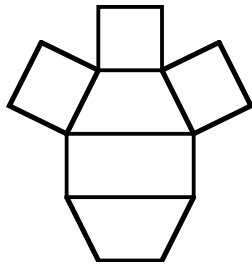The area of a triangle is half of the area of a parallelogram with the same base and height, because you can
always make a parallelogram out of two copies of the triangle.

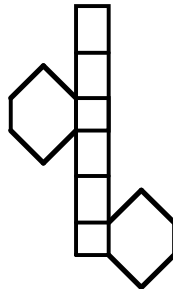4. Describe/name the polyhedron that would be constructed from this net

a.   b.   c.
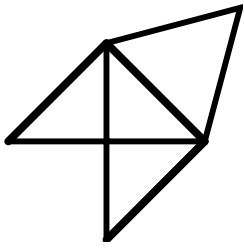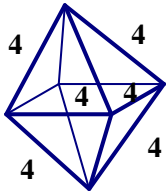
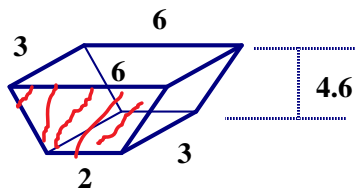a. triangular pyramid   b. trapezoidal prism   c. hexagonal prism

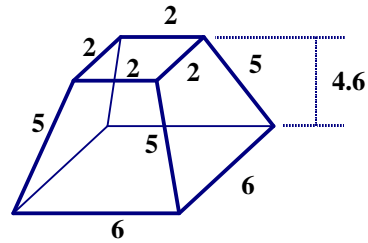5. Which of the following is a prism?

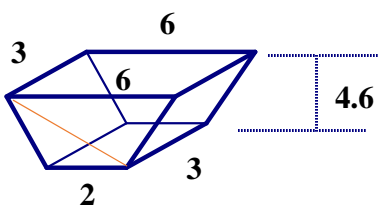| a.	b.	c.
Not a prism (no parallelogram faces). Not a pyramid (all faces are triangles, but no choice of a face to be the base gives a point where the rest of the triangles all meet)	prism with base shown	Not a prism (no identical parallel bases, and not enough parallelogram faces). Not a pyramid (no triangular faces)

6. Find the surface area of:

Area of trapezoidal faces (cut into two triangles)

$$\frac{1}{2}\cdot6\cdot4.6+\frac{1}{2}\cdot2\cdot4.6=18.4$$
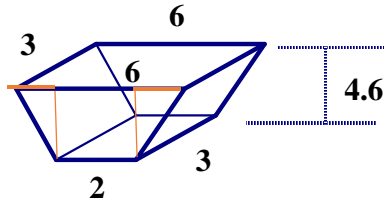
Length of diagonal edges (use Pythagorean theorem)

$$2^2+4.6^2=c^2$$

$$25.16=c^2$$

$$c=\sqrt{25.16}\approx5.016$$

Area of diagonal face:

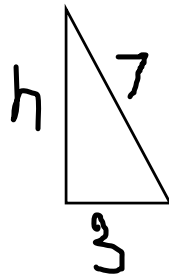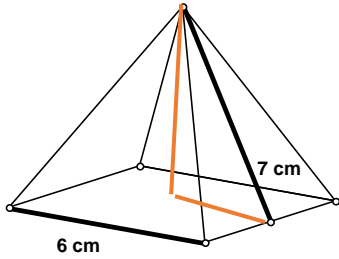$$3\sqrt{25.16}\approx15.048$$

Area of top and bottom faces:

$3\cdot6=18$ and $3\cdot2=6$

Total surface area:

$$2\cdot18.4+2\sqrt{25.16}+18+6=$$

$$60.8+2\sqrt{25.16}\approx70.83$$

7. a. Find the height of this pyramid with a square base:
b. Find the volume of this pyramid with a square base:
c. Find the surface area of this pyramid with a square base:

a. Note that one side of the right triangle is 3 which is half of 6 $$3^2 + h^2 = 7^2$$ $$9 + h^2 = 49$$ $$h^2 = 40$$ $$h = \sqrt{40}\,\text{cm} \approx 6.33\,\text{cm}$$	b. Volume: $$\frac{1}{3}6^2\sqrt{40}\,\text{cm}^3 = \frac{36\sqrt{40}}{3}\,\text{cm}^3$$ $$= 12\sqrt{40}\,\text{cm}^3 \approx 75.89\,\text{cm}^3$$	c. Area of one triangle is: $$\frac{1}{2}\cdot 6\cdot 7 = 21\,\text{cm}^2$$ Total surface area is $$6^2 + 4\cdot 21 = 120\,\text{cm}^2$$

8. Which pair(s) of these triangles are similar? a and c are similar because the side lengths in c are double the side lengths in a. Alternately, because the side ratios are equal: $$\frac{2}{4} = \frac{4}{8}$$ b is not similar to either a or c.	9. These shapes are similar. Find the length of the missing side The missing side has length $27\frac{1}{2}$ One way to find it is to set up the equal ratios: $\dfrac{15}{12} = \dfrac{x}{22}$ and solve by multiplying by 22: $x = \dfrac{15\cdot 22}{12} = \dfrac{55}{2} = 27.5$

10. Fill in the missing scale factor, lengths and areas for this pair of similar shapes:

1.	original	scale factor	new
beak	1 cm	3	3 cm
wing	4 cm	3	12 cm
tail	3 cm	3	9 cm
Area	11 cm^2	9	99 cm^2
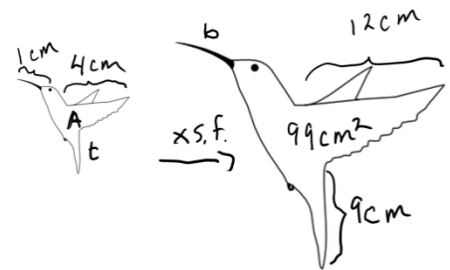
Start by finding the (length) scale factor: $4\cdot 3 = 12$ so the scale factor is 3.
Use that to find the beak and tail lengths: $1\cdot 3 = 3$ and $9\div 3 = 3$
Then find the area scale/change factor: $3^2 = 9$ and use it to find the smaller area: $99\div 9 = 11$

11. Jan built a 1/50 scale model of the new library before it was built.
a. The length of one side of the scale model is 3 feet, what is the length of the corresponding side of the library?
$3 \cdot 50 = 150 \, \text{ft}$
b. Jan used 2 square feet of glass for the windows in the model, how many square feet of glass will the library have? Area changes by 50^2 so the real class will cover $2 \cdot 50^2 = 2 \cdot 2500 = 5000$ square feet.

12. What common misconceptions might lead to these wrong answers when finding the perimeter of these shapes:

perimeter = 18   perimeter = 9   perimeter = 8 $+2\sqrt{2}$
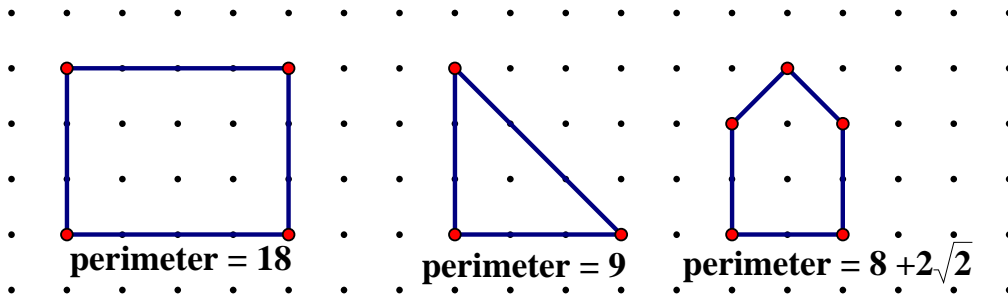
a. The most common error would be to count the dots for each side length instead of counting the spaces between the dots: 5+4+5+4=18
b. The most common error would be to count the spaces between the dots on the diagonal as if they were the same unit length as the length between dots horizontally and vertically.
c. The most common error would be to find the perimeter of the square (4+4+4+4) and then add the two diagonal sides (the top side of the square is not part of the perimeter and shouldn't be counted).