Name: Section 003 Answer Key Score: ____________

MA 202 EXAM 1: February 6, 2018

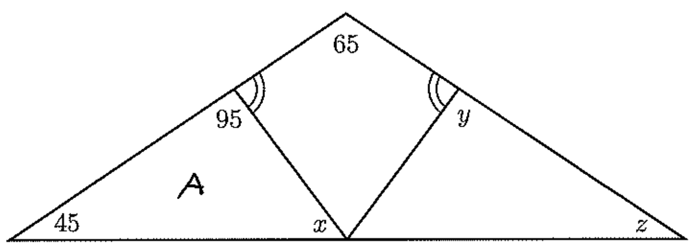
Instructions: The following exam has 100 possible points. The point value of each question is stated explicitly. No books or notes may be used on this exam. Please write legibly and keep your paper as organized as possible. You **may not** use a calculator on this exam. **Show all your work!** Answers without explanation will not receive full credit. Use complete sentences where appropriate. If you have any questions, be sure to ask. Good luck!

Question	Points	Score
1	10	
2	8	
3	8	
4	10	
5	6	
6	6	
7	12	
8	10	
9	10	
10	8	
11	12	
Total:	100	

1. (10 points) Place check marks to indicate the sets of numbers to which each number belongs.

	Natural	Integer	Rational	Irrational	Real
$\sqrt{4}$	✓	✓	✓		✓
$\sqrt{11}$				✓	✓
-3		✓	✓		✓
4.713			✓		✓
$1.\overline{21}$			✓		✓

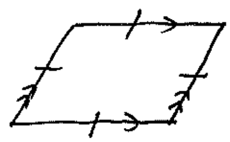
2. (8 points) Determine the missing angles in the diagram below. The diagram may not be drawn to scale.



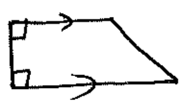
- $\triangle A$: $45^\circ + 95^\circ + x^\circ = 180^\circ \Rightarrow \boxed{x = 40^\circ}$
- $95^\circ + \angle)) = 180^\circ$ and $\angle)) + y = 180^\circ$, so $\boxed{y = 95^\circ}$
- large $\triangle$: $65^\circ + 45^\circ + z^\circ = 180^\circ \Rightarrow \boxed{z = 70^\circ}$

3. (8 points) Draw an example of each of the following figures, making sure to label angles and sides appropriately:

(a) Rhombus.



(b) Right trapezoid.



(c) Concave hexagon.

(d) Obtuse triangle.

4. (10 points) For each part, give an answer with a justification written in complete sentences.

(a) Which rational number is its own multiplicative inverse? (4 points)

Either 1 or -1. In each case $1 \cdot 1 = 1$ and $-1 \cdot -1 = 1$, so the number is its own multiplicative inverse.

(b) Is $-\sqrt{5}$ an irrational number? (2 points)

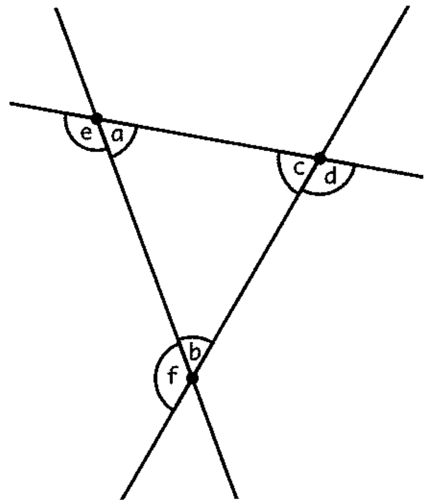
Yes. Any square root of an integer that is not a perfect square is irrational.

(c) Show that the set of irrational numbers is not closed under addition, giving an example and explanation. (4 points)

$\sqrt{5} + (-\sqrt{5}) = 0.$

From above, $\sqrt{5}$ and $-\sqrt{5}$ are irrational, but their sum is 0 which is rational. Hence the set of irrational numbers is not closed under addition.

5. (6 points) In the figure below, what is the sum of the measures of angles d, e, and f? (Hint: How do d, e, and f relate to a, b, and c?)



Each pair (a,e), (c,d), and (b,f) is supplementary.

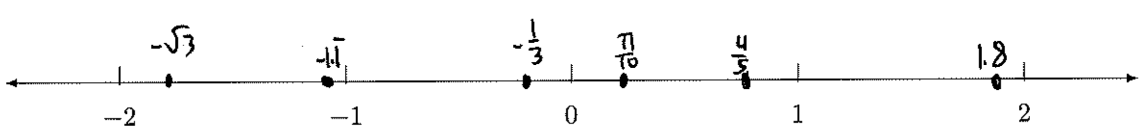
So $d = 180 - c$, $e = 180 - a$, $f = 180 - b$.

Also, $a+b+c = 180$ since these angles form a Δ.

Thus $d+e+f = 180 - c + 180 - a + 180 - b$
$= 3 \cdot 180 - (a+b+c)$
$= 3 \cdot 180 - 180$
$= \boxed{360^\circ}$

6. (6 points) Graph the following on the given real number line: (Recall that $\pi \approx 3.14$).

$$\frac{4}{5}, 1.8, -1.\overline{1}, -\frac{1}{3}, \frac{\pi}{10}, -\sqrt{3}$$



7. (12 points) (a) Determine whether or not $y = 5$ is a solution to the equation

$$\frac{1}{10}y - 7 = -\frac{13}{2}.$$

Be sure to show your work. (4 points)

Check: $\frac{5}{10} - 7 = \frac{1}{2} - 7 = \frac{1}{2} - \frac{14}{2} = -\frac{13}{2}$ ✓

So $y=5$ is a solution.

(b) Solve the equation for z. (4 points)

$$\frac{4}{3}z - \frac{5}{4} = 2.$$

$\frac{4}{3}z - \frac{5}{4} = 2$

$\frac{4}{3}z = 2 + \frac{5}{4} = \frac{8}{4} + \frac{5}{4} = \frac{13}{4}$

$z = \frac{13}{4} \cdot \frac{3}{4} = \boxed{\frac{39}{16}}$

(c) Set up an equation that models the following scenario, indicating clearly what your variable represents. You do NOT need to solve the equation.

A fair charges an entrance fee of \$20 and \$2.25 per ride. If a student spends \$40.25, how many rides will the student go on? (4 points)

Let n = # of rides the student goes on.

Then $2.25n + 20 = 40.25$

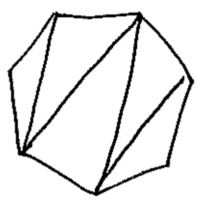
8. (10 points) (a) State the formula for the sum of the interior angles of an n-gon.

$(n-2)\cdot 180$

(b) Use the formula from part (a) to find the sum of the interior angles of a heptagon.

$n=7$: $(7-2)\cdot 180 = 5\cdot 180 = 900^\circ$

(c) Use a *different* method to determine the interior angles of a heptagon. Include a diagram in your description and explain your reasoning using **complete sentences**.



Divide the heptagon into 5 triangles. The angles of the triangles divide the angles of the heptagon, so their sum is the same as the sum of the angles of the heptagon.
Since each triangle has 180° total, the heptagon has $5\cdot 180^\circ = 900^\circ$ total.

(d) Determine the measure of one interior angle of a *regular* heptagon. Your answer should be exact (i.e. either a complex fraction or a mixed number).

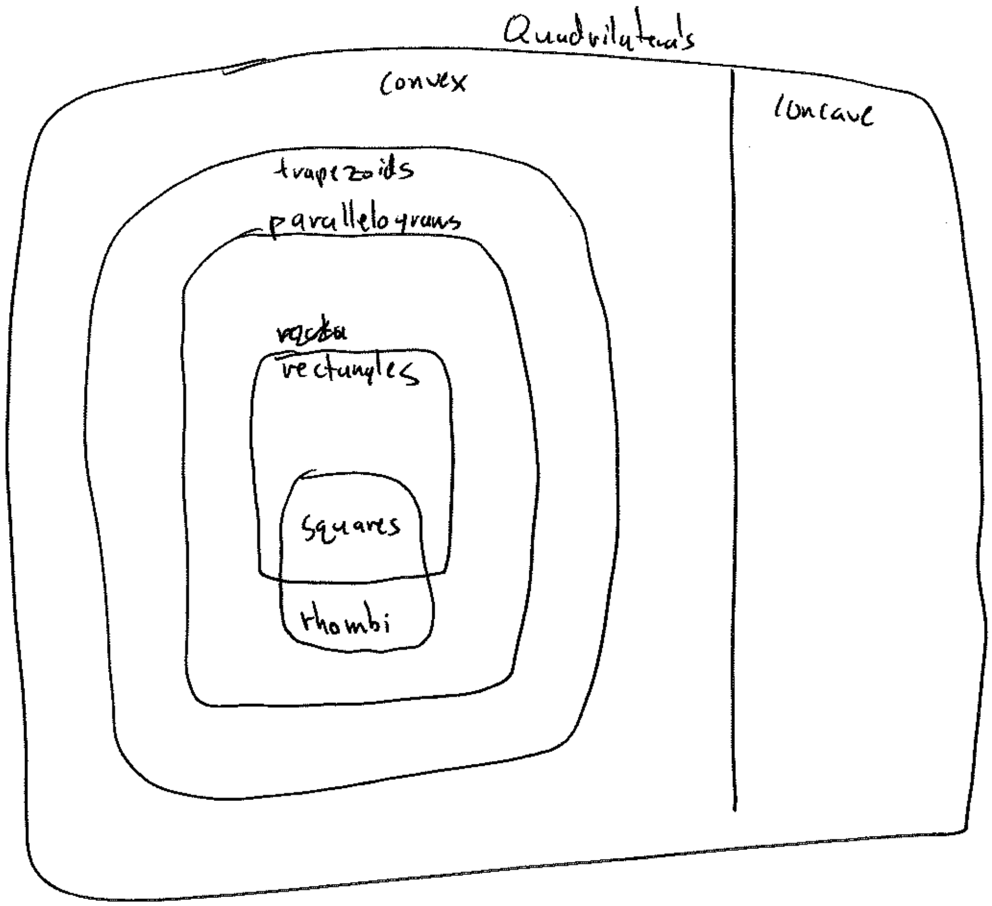
In a regular heptagon each of the 7 angles has the same measure, so

$\frac{900^\circ}{7} = 128\frac{4}{7}^\circ$

(e) Is it possible to arrange three *regular* heptagons so that all three share a vertex and each pair of heptagons shares exactly one side? In other words, is it possible to tessellate the plane using regular heptagons? Explain your reasoning.

No. To tessellate the plane with a regular n-gon, the measure of ~~the~~ an interior angle must divide 360° and $128\frac{4}{7}^\circ$ does not divide 360°.

9. (10 points) Create an Euler (Venn) diagram that demonstrates the relationship between: squares, parallelograms, rectangles, quadrilaterals, and trapezoids. **Bonus:** (3 points) Include rhombi, concave and convex figures in your diagram.



10. (8 points) Use algebra tiles to model and solve the equation $2x + 3 = -3$. Make sure to give the final answer.

Set up: $\boxed{x}\ \boxed{x}\ \oplus\oplus\oplus = \ominus\ominus\ominus$

Add $3\ominus$ to each side and cancel $\oplus\ominus$ pairs: $\boxed{x}\ \boxed{x}\ \cancel{\oplus\oplus\oplus}\ \cancel{\ominus\ominus\ominus} = \ominus\ominus\ominus\ \ominus\ominus\ominus$

Form 2 equal groups: $\boxed{x} = \ominus\ominus\ominus \qquad \boxed{x} = \ominus\ominus\ominus$

So, $\boxed{x = -3}$

11. (12 points) Determine whether the following statements are *always, sometimes,* or *never* true. **Explain your reasoning.**

(a) Two acute angles are supplementary.

Never. Adding two angles $<90^\circ$ will be $<180^\circ$.

(b) Opposite angles of a quadrilateral are congruent.

Sometimes. This is true for all parallelograms but not all trapezoids, e.g. 

(c) A rectangle is a right trapezoid.

Always. (Under inclusive defn.) A right trapezoid has at least 1 pair of parallel sides and 2 adjacent right angles, and all rectangles satisfy these requirements.

(d) Two sides of a right triangle are congruent.

Sometimes. This is true if and only if it is a 90°-45°-45° right triangle.

(e) A pentagon with all angles congruent is a regular pentagon.

Sometimes. Only if the sides are all congruent as well, see HW5.

(f) Two lines that are parallel intersect at exactly one point.

Never. By definition parallel lines do not meet.