Exam 2 | TMath 344 | Spring 2019

Show all your work. Reasonable supporting work must be shown to earn credit.

1. [8] Let A and B be points with coordinates a and b respectively. Let l and m be lines and ϕ a fold. Determine if the following make sense/*could* be true and be sure to justify your answer:

   (a) $A < B$

   (b) $l(A) = B$

   (c) $\phi(A) \in l$

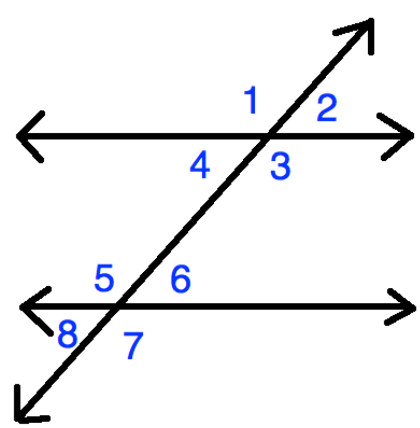
   (d) $\phi = A$

2. Use the figure on the right to answer the following.

   (a) [1] Identify a transversal line.

   (b) [2] Identify a pair of angles in the figure that are non-alternating interior angles.

   (c) [2] Give a condition on the angles that will guarantee two of the lines shown are parallel.



3. Fold a line and use a ruler to mark points A, B, C, and D with coordinates 0, 1, 3 and 4 units respectively.

   (a) [3] (Practice 4.12) Determine if there exists a fold ϕ such that $\phi(A) = D$ and $\phi(B) = C$. If ϕ exists, define it clearly. If ϕ does not exist, explain why not.

   (b) [3] Determine if there exists a fold θ such that $\theta(A) = B$ and $\theta(B) = C$. If θ exists, define it clearly. If θ does not exist, explain why not.

   (c) [4] (2D congruence Activity #4) Determine if there exists an isometry τ such that $\overline{AB}$ is translated to $\overline{CD}$. If τ exists, define it clearly. If τ does not exist, explain why not.

   (d) [4] (HW5 5.3) For each fold or isometry above that exists, find the inverse. That is, if ϕ exists, find ϕ^{-1}; if θ exists, find θ^{-1}; and if τ exists, find τ^{-1}.

4. [5] (Suggested 6.29) Below are definitions for a few other special quadrilaterals. Explain the relation between them.

   Definition 1. *A quadrilateral is* convex *provided that both diagonals are contained in the interior of their respective angles. An* isosceles trapezoid *is a trapezoid whose legs are congruent. A quadrilateral $ABCD$ is a* dart *provided that $AB = BC$ and $CD = AD$. A convex dart is called a* kite

5. (2DInteresting Activity) Let us redefine "point" to mean what you would usually call a line through the origin in $\mathbb{R}^3$.

   (a) [2] How would "lines" be defined in this space?

   (b) [3] Do parallel lines in this geometry satisfy the parallel postulate? Recall the parallel postulate: If two parallel lines are cut by a transversal, then alternate interior angles are congruent.

6. [4] (HW5 5.15) Consider the conjecture below. If it is true, provide a proof, if it is false, provide a counter example.

   Conjecture 1. *Given four distinct points A, B, C, and D and an isometry σ such that $\sigma(B) = B$, $\sigma(C) = C$ and $\sigma(D) = D$, than $\sigma(A) = A$.*

7. [2] (5/7 Lecture) Identify a geometry that has the sum of angles in a triangle adding up to more than π radians.

8. [5] (HW4 #4.59) Let A, B, and C be points, and let ϕ a fold such that $\phi(A) = C$, $\phi(C) = B$ and $\phi(B) = A$. Prove that $A = C$.

9. [2] What concept did you study well and not see on the exam?