Performance Based Learning and Assessment Task

Properties of Different Quadrilaterals

I. ASSESSSMENT TASK OVERVIEW & PURPOSE:

This activity will help students solidify the properties of quadrilaterals through a performance- based task

II. UNIT AUTHOR:

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III. COURSE:

Geometry

IV. CONTENT STRAND:

Geometry

V. OBJECTIVES:

Students will show mastery of understanding the properties of quadrilaterals

VI. REFERENCE/RESOURCE MATERIALS:

Students will use a worksheet for the task.

VII. PRIMARY ASSESSMENT STRATEGIES:

Pre-assessment followed by group activity and assessment

VIII. EVALUATION CRITERIA:

Pre-Evaluation and teacher Assessment, Teacher Assessment Rubric

IX. INSTRUCTIONAL TIME:

One 45-minute class session.

Properties of Different Quadrilaterals

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Geometry

Mathematical Objective(s)

Students will: 1) explore a variety of sets of quadrilaterals to investigate the properties of them. 2) apply characteristics and properties or them throughout the lesson.

Related SOL

- G.1 (Use Venn diagrams to represent set relationships)
- G.9 (The student will verify characteristics of quadrilaterals and use properties of quadrilaterals)

NCTM Standards

- Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationship.
- Use visualization, spatial reasoning, and geometric modeling.

Materials/Resources

Students will need the Student Handout

Assumption of Prior Knowledge

- Students should have completed the unit which covers properties of parallelograms before attempting the worksheet.
- Students should be at a Van Hiele Level of either a one (Visualization) or 2 (Analysis) meaning that they should be able to name some of the properties associated with the different quadrilaterals but are still struggling relating the properties together
- Due to variations, students should use the following definiteions: 1)"a trapezoid is a quadrilateral with exactly one pair of parallel sides, called bases. The nonparallel sides are called legs." 2) "A kite is a quadrilateral with two pairs of adjacent, congruent sides and one pair of opposite angles congruent."

Introduction

- In this task/activity, you will investigate the relationship between all quadrilaterals and to be able to identify and explain their thinking for the different figures. This task should be completed in 45 minutes. The task will have students explain their thinking by looking at different groups of quadrilaterals and determining which shape does not belong with the others. Students should complete this in a Think/Pair/share activity. It is important for each student to have time to formulate their own ideas and then be able to express them.

Student Exploration

Individual Work

Students should individually examine the groups of quadrilaterals and determine the shape the does not belong. Correct answers are based on the students' answers and how they are able to support their thinking.

Whole Class Sharing/Discussion

Students should have to justify their answers in a whole group format.

Student/Teacher Actions

- Students should be investigating quadrilaterals and looking at common properties between the figures. They should come up with the shape that doesn't belong with the others. The key idea of this activity is that students are able to justify why they believe the shape does not actually fit with the others.
- The teacher should play the role of facilitator in making sure there is discussion between the students and overall whole class. The teacher should ask for students to support their classmates or offer counter statements if they disagree with a student.
- Students tend to confuse the properties of quadrilaterals so this activity will help to explain and solidify their knowledge

Monitoring Student Responses

Students should be communicating throughout this activity as they discuss the shapes within their groups. Based on their responses, the teacher should ask more leading questions if necessary. Students should be able to defend their answers and share with the class.
Students should first do the Pre-Assessment and the results should be discussed in a whole group discussion. Then students should be given the sets of quadrilaterals within their groups. Each group should come up with the one shape they would exclude from the others but more importantly be prepared to discuss their thinking.
After each group has doing the four provided sets, they should then try to make up their own and swap with another pair.
As a post assessment check, teacher could have students list out the properties associated with the different quadrilaterals in their own words.

Assessment List and Benchmarks

Preassessment: Allow students to answer the true/false questions on worksheet number 1.

Grouping Activity: Handout Attached. The discussion should be a key to assessing student understanding.

- Included is a key which should help the teacher guide students through the work.
- Sample Rubrics: http://www.rubrics4teachers.com/pdf/PerformanceTaskRubric.pdf

Pre-Assessment: Student Worksheet

Please note, the following definitions will be used in the instrument below:

A trapezoid is a quadrilateral with exactly one pair of parallel sides, called bases. The nonparallel sides are legs.

A kite is a quadrilateral with two pairs of adjacent, congruent sides and one pair of opposite angles congruent.

_____ 1. A rhombus is a quadrilateral.

_____ 2. If a quadrilateral is a square then it is also a rectangle.

_____ 3. If a quadrilateral is a trapezoid then it is also a parallelogram.

_____ 4. If a quadrilateral is a rectangle then it is also a square.

_____ 5. If a quadrilateral is a rhombus then it is also a square.

_____ 6. If a quadrilateral is a parallelogram then it is also a rhombus.

_____ 7. If a quadrilateral is a square then it is also a parallelogram.

_____ 8. An isosceles trapezoid is a parallelogram.

_____ 9. A rectangle is an isosceles trapezoid.

_____ 10. A quadrilateral with four congruent sides is a square.

_____ 11. A quadrilateral with four right angles is a rectangle.

_____ 12. A trapezoid has two pairs of parallel sides.

_____ 13. A rectangle has congruent opposite sides.

_____ 14. A parallelogram has one pair of parallel sides.

_____ 15. A parallelogram always has four congruent sides.

_____ 16. A kite has perpendicular diagonals.

STUDENT HANDOUT Name _____

Please note, the following definitions will be used in the instrument below:

A trapezoid is a quadrilateral with exactly one pair of parallel sides, called bases. The nonparallel sides are legs.

A kite is a quadrilateral with two pairs of adjacent, congruent sides and one pair of opposite angles congruent.

1) With a partner, create a venn diagram or a tree diagram which relates all quadrilaterals.

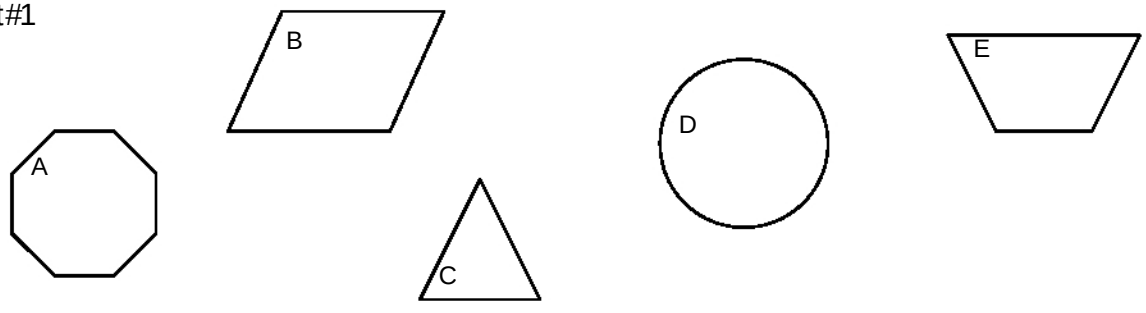
Kites, Trapezoids, Rectangles, Rhombi, Squares, Parallelograms

2) Take time to review your pretest based on the diagram you created above. If there is an answer you change please provide an explanation as to why you have changed your answer.

3) Grouping activity:

Directions: Look at each set of figures. Which shape(s) would you exclude from the rest? You must justify why you believe your answer to be correct. There may be more than one correct answer so your justification is what will provide you with points. Assume all figures are not drawn to scale so look at the markings on the figure to help you. Be as detailed and specific as possible.

Set #1



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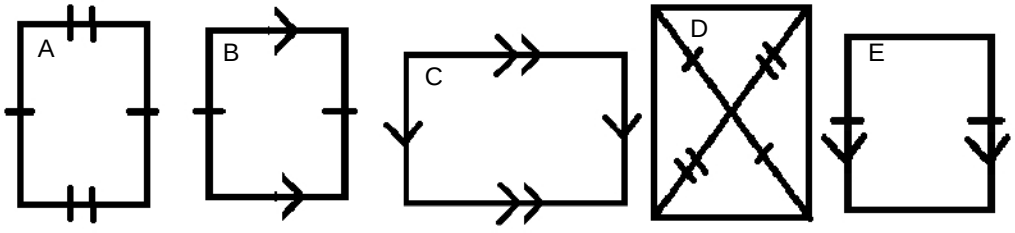

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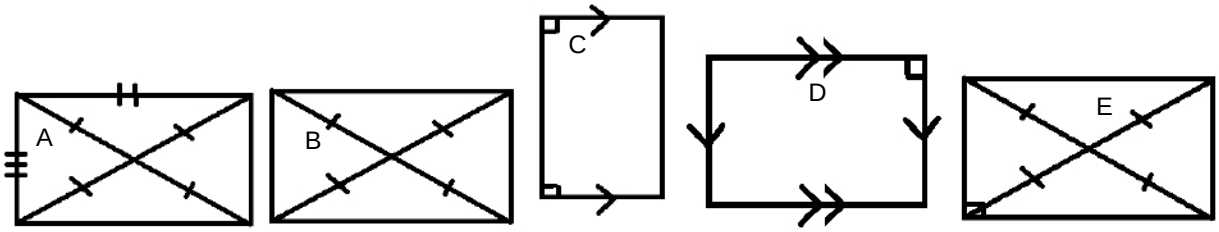
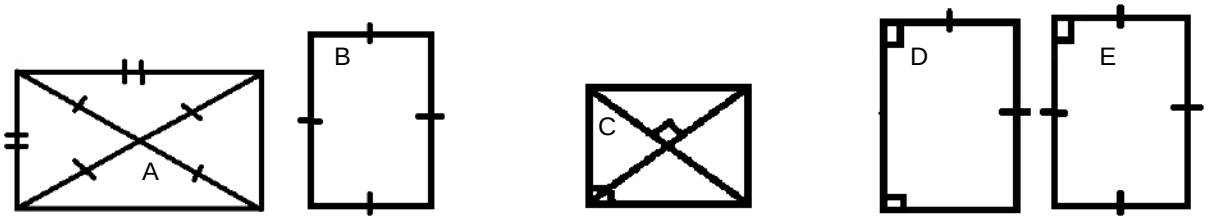


Set #4 - Assume all are parallelograms



Set # 5 and beyond: With a partner, make your own set of a group of 5 or more objects where one shape does not belong. Swap with another partner group and discuss. Does your answer match the other group? If no, are you both correct? Explain.

Extension Questions:

1) Draw as many different quadrilaterals that you can with the following properties

a) congruent diagonals.

b) perpendicular diagonals

c) exactly one pair of congruent sides

d) at least one pair of opposite angles congruent

e) at most one pair of opposite congruent sides

2) You have decided to make a rectangular picture frame with side lengths 20 in by 16 in. You hope that your frame is in the shape of a rectangle but you don't have a way to measure the angles.

a) You measure the diagonals of your frame and find that one diagonal measures 23 cm. Is your frame a rectangle? Explain why or why not. If not, explain what type of shape you have.

b) What other measurement(s) could you find in order to be sure your frame is rectangular?

3) At home activity: Find a trapezoid, rectangle, square, kite and parallelogram. Take a picture and then print it in order to bring to school tomorrow. Use your picture to do one last check of the properties that we reviewed/reinforced yesterday in class. How can you be sure your shape is what you think it is?

BENCHMARKS

Pre-Assessment:

TRUE_____ 1. A rhombus is a quadrilateral.

TRUE_____ 2. If a quadrilateral is a square then it is also a rectangle.

FALSE_____ 3. If a quadrilateral is a trapezoid then it is also a parallelogram.

FALSE_____ 4. If a quadrilateral is a rectangle then it is also a square.

FALSE_____ 5. If a quadrilateral is a rhombus then it is also a square.

FALSE_____ 6. If a quadrilateral is a parallelogram then it is also a rhombus.

TRUE_____ 7. If a quadrilateral is a square then it is also a parallelogram.

FALSE_____ 8. An isosceles trapezoid is a parallelogram.

FALSE_____ 9. A rectangle is an isosceles trapezoid.

FALSE_____ 10. A quadrilateral with four congruent sides is a square.

TRUE_____ 11. A quadrilateral with four right angles is a rectangle.

FALSE_____ 12. A trapezoid has two pairs of parallel sides.

TRUE_____ 13. A rectangle has congruent opposite sides.

FALSE_____ 14. A parallelogram has one pair of parallel sides.

FALSE_____ 15. A parallelogram always has four congruent sides.

TRUE_____ 16. A kite has perpendicular diagonals.

Please note, the following definitions will be used in the instrument below:

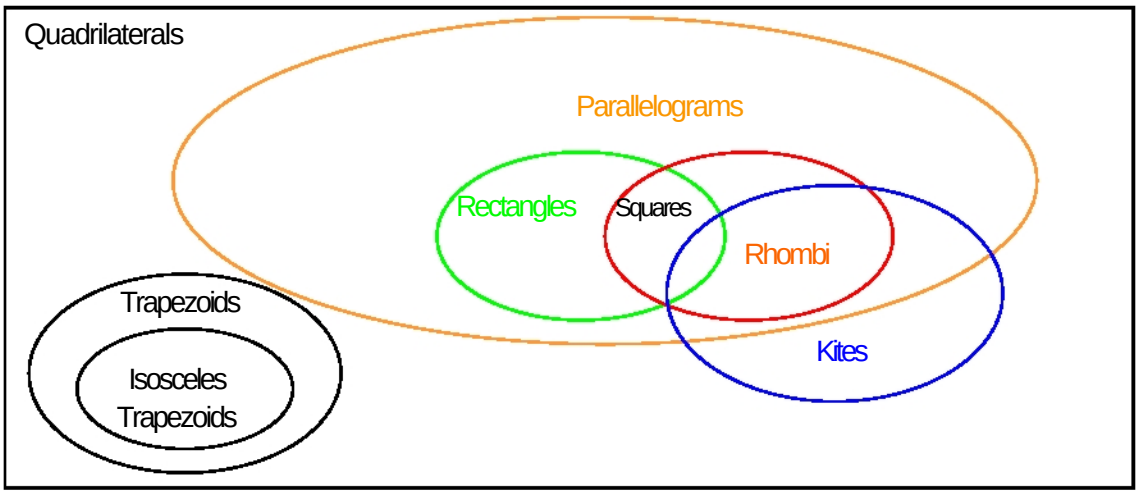
A trapezoid is a quadrilateral with exactly one pair of parallel sides, called bases. The nonparallel sides are legs.

A kite is a quadrilateral with two pairs of adjacent, congruent sides and one pair of opposite angles congruent.

1) With a partner, create a venn diagram or a tree diagram which relates all quadrilaterals.

Kites, Trapezoids, Rectangles, Rhombi, Squares, Parallelograms

Answers may vary in how the venn diagram is designed to fit rhombi and squares within kites. This is a simplistic model but there are others available on the internet which are more complex, that students would enjoy exploring.

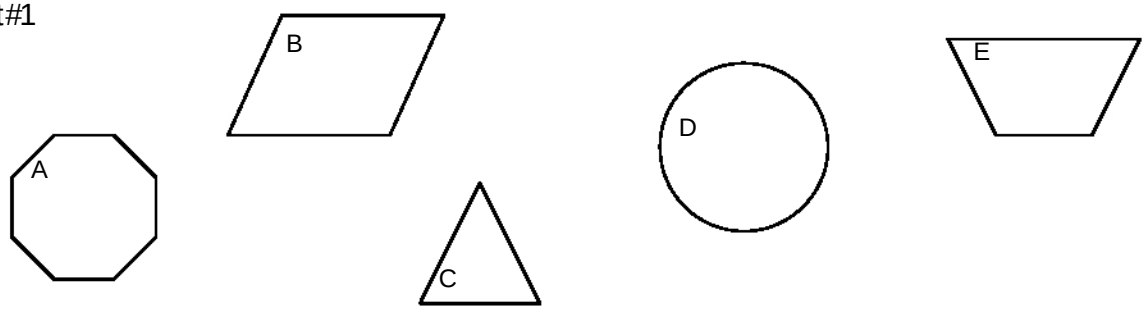


2) Take time to review your pretest based on the diagram you created above. If there is an answer you change please provide an explanation as to why you have changed your answer.

See above for the pre-test answers.

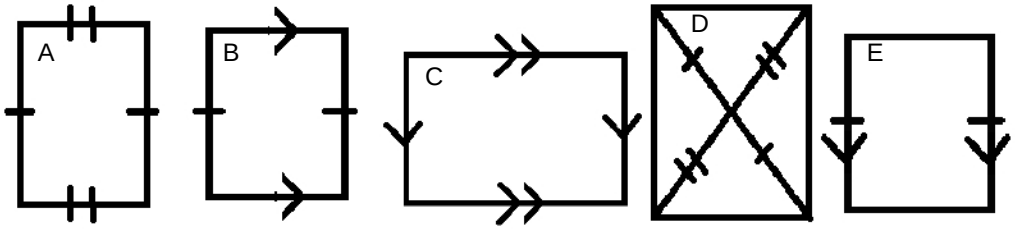
Grouping activity:

Set #1



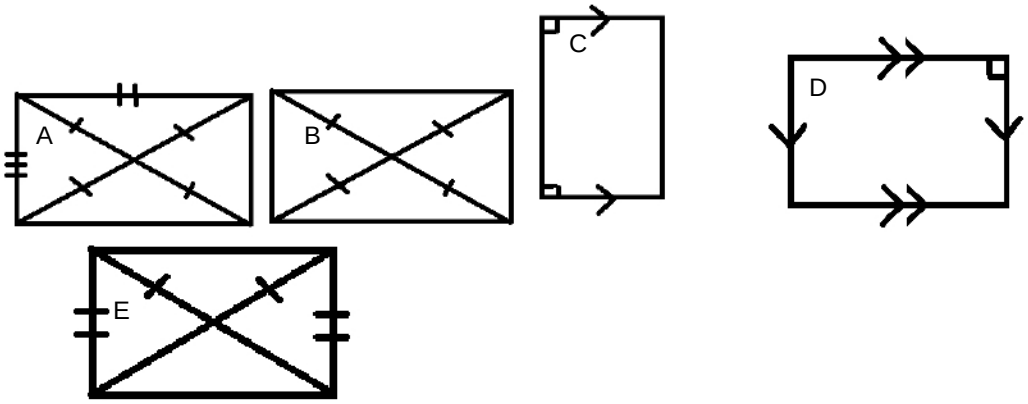
SET 1 TEACHER NOTES - Shape D should be excluded since it has rounded edges thus not a polygon. AGAIN ANSWERS MAY VARY SO LISTEN TO YOUR STUDENTS AS THEY DISCUSS

Set #2



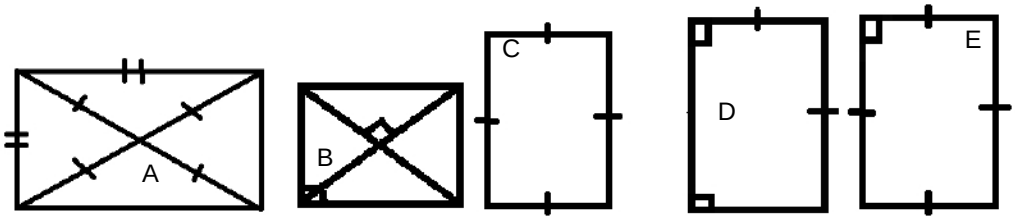
SET 2 TEACHER NOTES - Shape B should be excluded since it is not necessarily a parallelogram. Since we are using the definition of a trapezoid which is provided above, B could be a parallelogram but it could also be a trapezoid. All of the others fit the properties of a parallelogram. AGAIN ANSWERS MAY VARY SO LISTEN TO YOUR STUDENTS AS THEY DISCUSS

Set #3



SET 3 TEACHER NOTES - Shape E should be excluded since it is not necessarily a rectangle. AGAIN ANSWERS MAY VARY SO LISTEN TO YOUR STUDENTS AS THEY DISCUSS

Set #4 - Assume all are parallelograms



SET 4 TEACHER NOTES - Shape C should be excluded since it is not necessarily a square. AGAIN ANSWERS MAY VARY SO LISTEN TO YOUR STUDENTS AS THEY DISCUSS

Set # 5 and beyond: With a partner, make your own set of a group of 5 or more objects where one shape does not belong. Swap with another partner group and discuss. Does your answer match the other group? If no, are you both correct? Explain.

Extension Questions:

1) Draw as many different quadrilaterals that you can with the following properties

a) congruent diagonals. (Rectangle, Square, Isosceles Trapezoid, some kites)

b) perpendicular diagonals (Rhombus, Square, Kite)

c) exactly one pair of congruent sides (Isosceles Trapezoid)

d) at least one pair of opposite angles congruent (Kite, Rhombus, Parallelogram, Square, Rectangle)

e) at most one pair of opposite congruent sides (Trapezoid, Isosceles Trapezoid)

2) You have decided to make a rectangular picture frame with side lengths 20 in by 16 in. You hope that your frame is in the shape of a rectangle but you don't have a way to measure the angles.

a) You measure the diagonals of your frame and find that one diagonal measures 23 cm. Is your frame a rectangle? Explain why or why not. If not, explain what type of shape you have. This shape is not a rectangle since the diagonals would have to measure 25.6 in order to make a rectangle. Based on the following measurement, all you can assume is that your shape is a parallelogram.

b) What other measurement(s) could you find in order to be sure your frame is rectangular? The diagonals would have to be congruent.

3) At home activity: Find a trapezoid, rectangle, square, and parallelogram. Take a picture and then print it in order to bring to school tomorrow. Use your picture to do one last check of the properties that we reviewed/reinforced yesterday in class. How can you be sure your shape is what you think it is? Answer may vary.

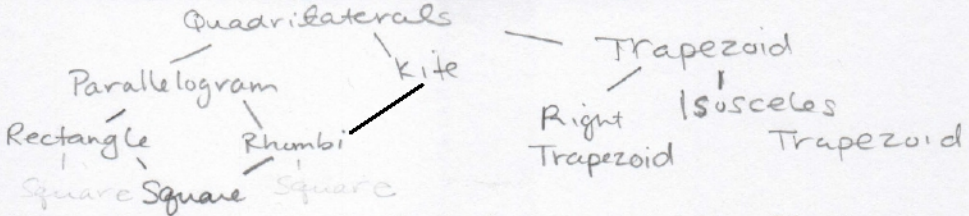
3) Have students go home and find a trapezoid, rectangle, square, and parallelogram. Have students take and then print out a picture and bring it in the following day. Use the pictures they took to do one last check of the properties they should worked on the prior day.

STUDENT HANDOUT Name _____

Please note, the following definitions will be used in the instrument below:

- A trapezoid is a quadrilateral with exactly one pair of parallel sides, called bases. The nonparallel sides are legs.
- A kite is a quadrilateral that has two pairs of consecutive congruent sides, but in which opposite sides are not congruent.

1) With a partner, create a venn diagram or a tree diagram which relates all quadrilaterals.
Kites, Trapezoids, Rectangles, Rhombi, Squares, Parallelograms

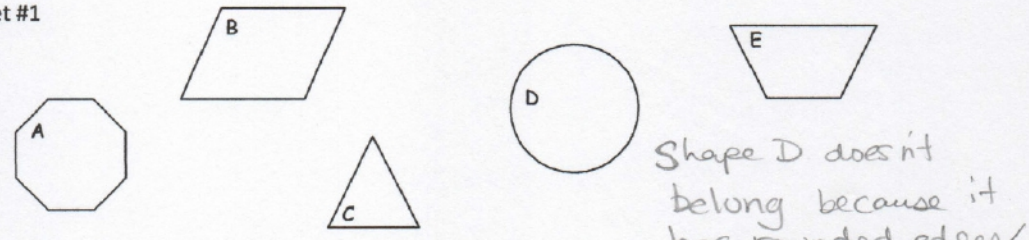


2) Take time to review your pretest based on the diagram you created above. If there is an answer you change please provide an explanation as to why you have changed your answer.

3)
Grouping activity:

Directions: Look at each set of figures. Which shape would you exclude from the rest? You must justify why you believe your answer to be correct. There may be more than one correct answer so your justification is what will provide you with points. Assume all figures are not drawn to scale so look at the markings on the figure to help you. Be as detailed and specific as possible.

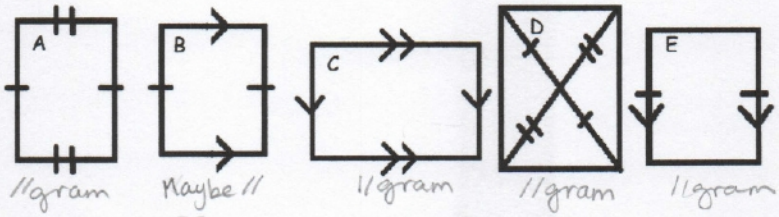
Set #1



Shape D doesn't belong because it has rounded edges/ not a polygon.

5

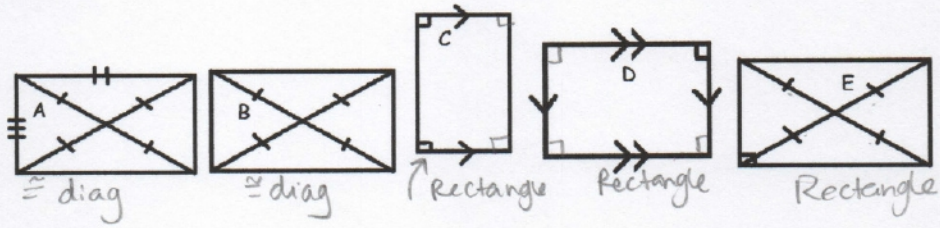
Set #2



//gram Maybe // or Trapezoid //gram //gram //gram

Shape B is the only shape that could be a trapezoid instead of a //gram.

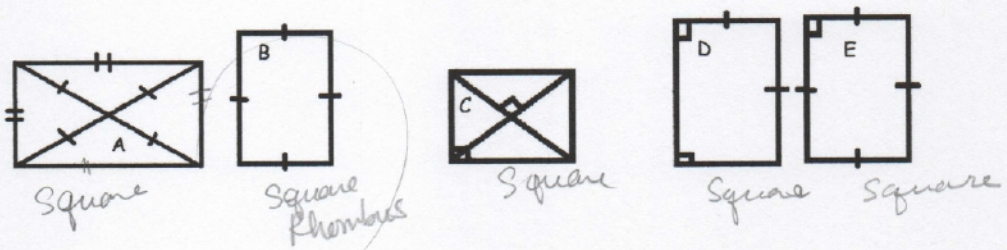
Set #3



≅ diag ≅ diag Rectangle Rectangle Rectangle

Shapes A & B should be grouped differently from the others since they are both not necessarily rectangles but might be isosceles trapezoids instead

Set #4 – Assume all are parallelograms



Square Square Rhombus Square Square Square

B should be excluded since the other shapes are squares instead of

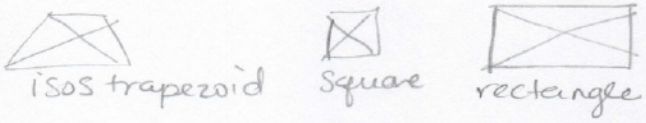
6

Set # 5 and beyond: With a partner, make your own set of a group of 5 or more objects where one shape does not belong. Swap with another partner group and discuss. Does your answer match the other group? If no, are you both correct? Explain.

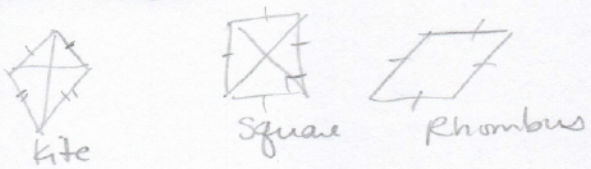
Extension Questions:

1) Draw as many different quadrilaterals that you can with the following properties

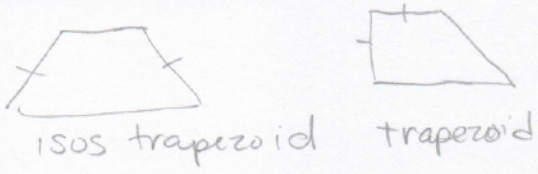
a) congruent diagonals.



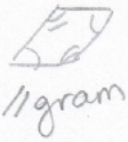
b) perpendicular diagonals



c) exactly one pair of congruent sides



d) at least one pair of opposite angles congruent



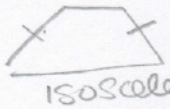
//gram

All //grams (square, Rectangle, Rhombus)

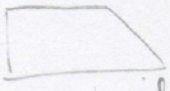
e)

e) at most one pair of ≅ sides

Kite



isosceles Trap

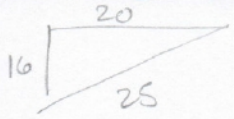


Trapezoid

18

2) You have decided to make a rectangular picture frame with side lengths 20 in by 16 in. You hope that your frame is in the shape of a rectangle but you don't have a way to measure the angles.

a) You measure the diagonals of your frame and find that one diagonal measures 25 cm. Is your frame a rectangle? Explain why or why not. If not, explain what type of shape you have.



$16^2+20^2 \neq 25^2$

therefore this is not a right $\triangle$

b) What other measurement(s) could you find in order to be sure your frame is rectangular?

Show the diagonals are congruent

$16^2+20^2=c^2$

$c=\sqrt{25.6}$

3) At home activity: Find a trapezoid, rectangle, square, and parallelogram. Take a picture and then print it in order to bring to school tomorrow. Use your picture to do one last check of the properties that we reviewed/reinforced yesterday in class. How can you be sure your shape is what you think it is?