

# EISENHOWER PROFESSIONAL DEVELOPMENT PROGRAM

## Mathematics Within: Algebraic Patterns

### Lesson Plan

**Participant Name:** Barbara C. Anderson

**Broad Topic:** Algebra

**Subtopic:** Graphing equivalent fractions

#### Aim:

*Students will learn to graph families of equivalent fractions and to compare them by observing the slope of the line formed by each fraction family.*

#### Specific Objectives:

##### Students will learn to:

- o Find equivalent fractions for a given fraction (brief review)  $\frac{1}{4} (2) = \frac{2}{8}$
- o Plot a fraction on a grid, e.g.,  $\frac{1}{4} = \frac{y}{x} = \frac{\text{Rise}}{\text{Run}}$
- o Plot some equivalents for the initial fraction
- o Connect the points for a family of equivalent fractions by drawing a straight line that goes through the origin
- o Observe the slope of the line drawn
- o Place fractions in ascending order by comparing the slopes of each line (the greater the fraction, the steeper the slope) after several families of equivalent fractions have been graphed
- o Observe that fractions and their reciprocals will form lines equidistant from the line for 1 and that the angles formed will be the same.

#### Materials/Supplies:

##### Teacher:

- o Drawings or transparencies to review equivalent fractions, e.g., 1/4, 2/8, 4/16, 5/20, 6/24
- o Overhead projector
- o Overhead markers
- o Transparency of a grid
- o Transparency of answers for independent practice activity (grid and fractions in ascending order)
- o Ruler
- o Vocabulary list (fraction, equivalent fractions, slope, origin, ascending order, descending order, reciprocal fractions)

##### Students:

- o 2 grids per student
- o 1 ruler per student
- o Pencils and colored pencils

#### Lesson:

- o Time: approximately 40-45 minutes
- o Introduction: Review equivalent fractions
- o **Tell story of Cedric's birthday parties.** Class discussion will generate answers. When Cedric was 4, he invited 3 friends to his party, and they all came (total of 4 children present), so each child got  $\frac{1}{4}$  of cake. When he was 8, Cedric invited 7 friends, but only 3 came again because the rest were on vacation. He cut the cake into 8 pieces, but since there were only 4 at the party, each child got  $\frac{2}{8}$  or  $\frac{1}{4}$  of the cake. When he turned 12, he invited 11 friends, but again only 3 came! (Poor Cedric!) This time each child got  $\frac{3}{12}$  or  $\frac{1}{4}$  of the cake. He tried again when he was 16—same story, so each person got  $\frac{4}{16}$  or  $\frac{1}{4}$  of the cake. He tried again when he was 20, so each person got  $\frac{5}{20}$  or  $\frac{1}{4}$  of the cake. When he was 24, he decided to invite just 3 friends and they all came! (Each person got  $\frac{1}{4}$  of the cake, but if he had cut the cake into 24 pieces, each person would have gotten  $\frac{6}{24}$  of the cake.)

- o Review formation of equivalent fractions and concept of a fraction family  
 $\frac{1(2)}{4(2)} = \frac{2}{8}$      $\frac{1(3)}{4(3)} = \frac{3}{12}$      $\frac{1(4)}{4(4)} = \frac{4}{16}$      $\frac{1(5)}{4(5)} = \frac{5}{20}$      $\frac{1(6)}{4(6)} = \frac{6}{24}$
- o We can call a group of equivalent fractions a fraction family.

### Activities:

- o Class learns to plot a fraction on a grid through teacher demonstration/explanation:  
 $\frac{1}{4} = \frac{y}{x} = \frac{\text{Rise}}{\text{Run}}$   
 Teacher (using overhead) and class work together to plot the fraction equivalents for  $\frac{1}{4}$  that were introduced in the story ( $\frac{2}{8}, \frac{3}{12}, \frac{4}{16}, \frac{5}{20}, \frac{6}{24}$ ) and to connect the points with a line through the **origin**.
- o Guided practice  
 Students generate some equivalents for  $\frac{1}{2}$  (e.g.,  $\frac{2}{4}, \frac{3}{6}, \frac{4}{8}, \frac{6}{12}$ ) and then they graph them (along with teacher at overhead projector). They do the same for  $\frac{3}{4}$  (e.g.,  $\frac{6}{8}, \frac{9}{12}, \frac{12}{16}, \frac{15}{20}$ ), and 1 ( $\frac{1}{1}, \frac{2}{2}, \frac{3}{3}, \frac{4}{4}, \frac{5}{5}$ ). Teacher introduces concept of **reciprocal fractions**, and they graph reciprocals for fraction family of  $\frac{1}{4}$  ( $\frac{4}{1}, \frac{8}{2}, \frac{12}{3}, \frac{16}{4}, \frac{20}{5}$ ). Use page 4.  
 Class discussion to answer the question, "If we did not know the value of these fractions, how could we use the graph we made to put the fractions in ascending (growing larger) or descending (growing smaller) order? (Fractions get larger as line gets closer to the y axis.) Fractions are then listed in ascending order. Review slope and then continue the discussion to answer the question, "When we compare the slopes of the lines formed by several different sets or families of fractions, what is the relationship between the slope and the size of the fractions? (The steeper the slope, the larger the fraction.) Finally, students will look at the angle formed by the line for the family of fractions representing  $\frac{1}{4}$  and  $\frac{1}{1}$  and compare it to the angle formed by the family of fractions representing  $\frac{4}{1}$ . (Angles are the same.) See page 5.
- o Independent practice (This could be done the next day.)  
 Students are given a list of fractions to plot on a grid ( $\frac{5}{6}, \frac{3}{9}, \frac{27}{9}, \frac{10}{10}, \frac{18}{6}, \frac{9}{27}, \frac{6}{18}, \frac{20}{24}, \frac{14}{14}, \frac{10}{12}, \frac{9}{3}, \frac{28}{28}$ ). Students must connect points to draw lines through the origin. Hint: They will need to draw 4 different lines. Finally, they will list the fractions in ascending order. (Note: It is important the grid be large enough and the fractions be far enough apart in size to allow the students to easily connect the points to draw lines through the origin. In addition, at this stage it is helpful to use fractions that are simple enough so that students could determine which ones are equivalent even without the graph.) Use pages 4 and 6
- o Follow-up  
 Students correct their answers with the graph that is on an overhead transparency. Review of questions asked previously during guided practice.
- o Extension  
 Give students a graph with lines already drawn and ask them to list equivalent fractions (in ascending or descending order) based on the graph. Use page 5 and 7.

Name \_\_\_\_\_

Date \_\_\_\_\_

### Activity: Graphing Equivalent Fractions

1. Plot the following fractions on a grid:

$$\frac{5}{6} \quad \frac{3}{9} \quad \frac{27}{9} \quad \frac{10}{10} \quad \frac{18}{6} \quad \frac{9}{27} \quad \frac{6}{18} \quad \frac{20}{24} \quad \frac{14}{14} \quad \frac{10}{12} \quad \frac{9}{3} \quad \frac{28}{28}$$

2. Draw lines to connect points with the origin. (Hint: 4 lines in all.)

3. List families of equivalent fractions in ascending order.

#### Answers:

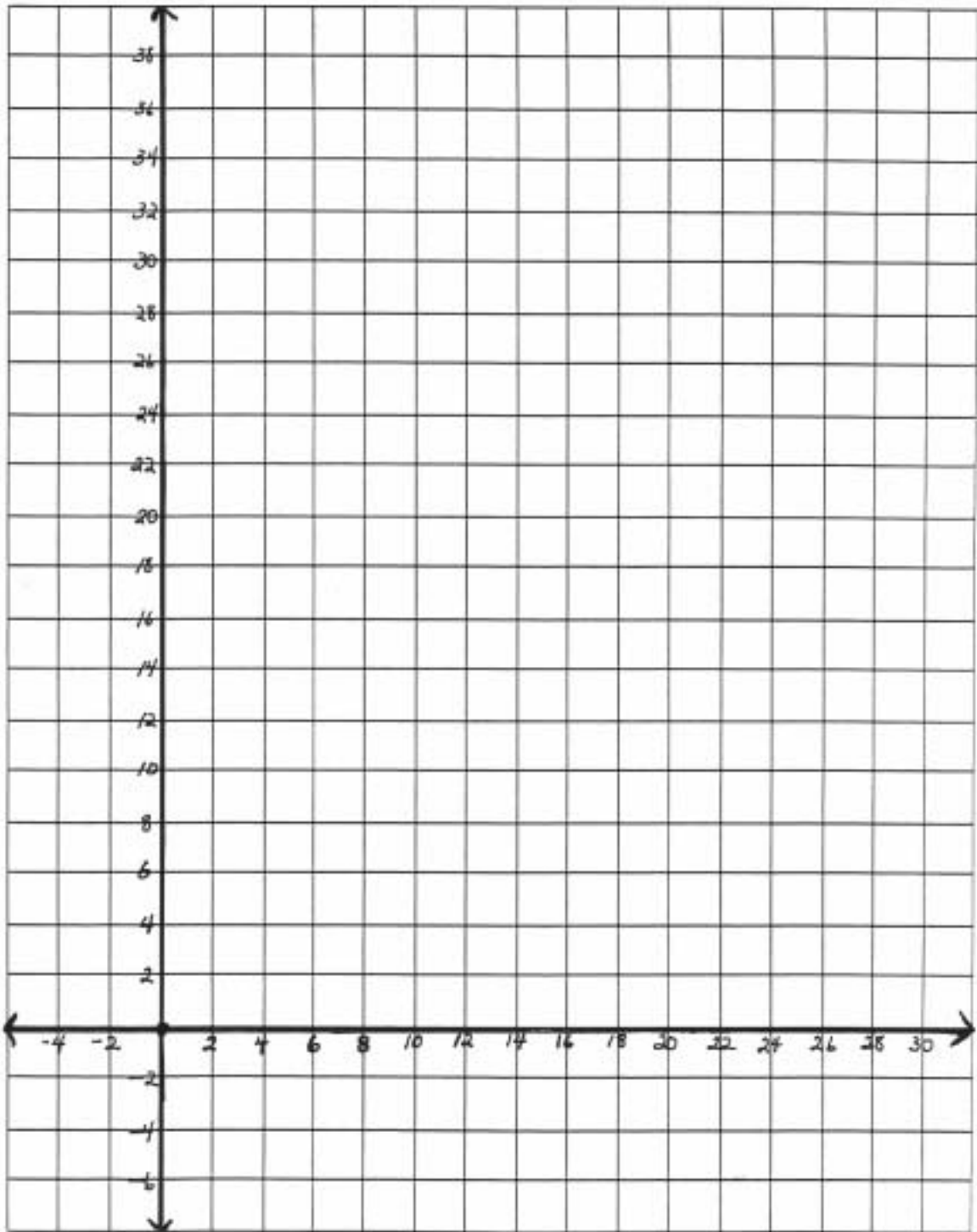
A.  $\frac{3}{9}$     $\frac{6}{18}$     $\frac{9}{27}$

B.  $\frac{5}{6}$     $\frac{10}{12}$     $\frac{20}{24}$

C.  $\frac{10}{10}$     $\frac{14}{14}$     $\frac{28}{28}$

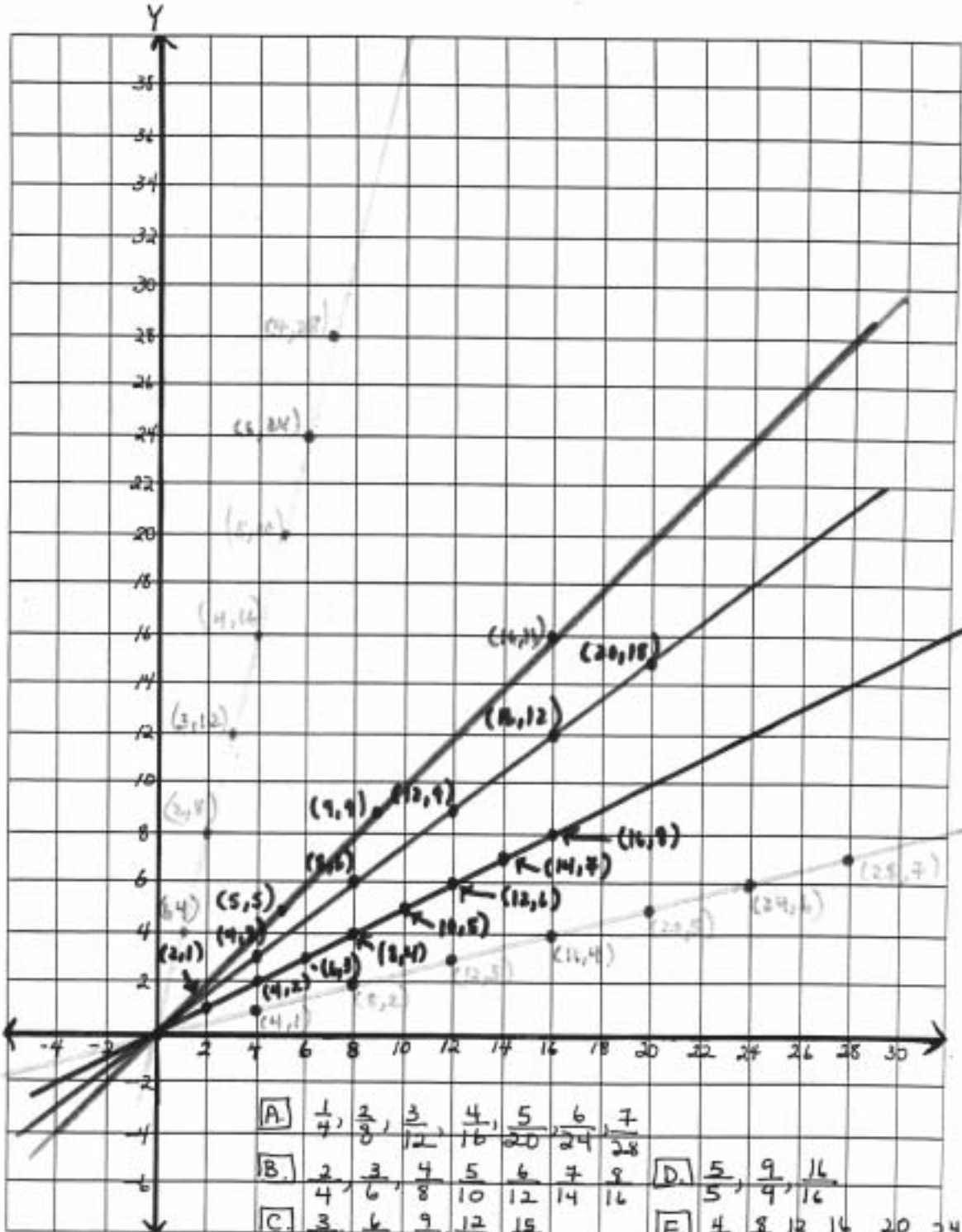
D.  $\frac{9}{3}$     $\frac{18}{6}$     $\frac{27}{9}$

Name \_\_\_\_\_



Guided Practice

Name Madame Anderson



**A.**  $\frac{1}{4}, \frac{2}{8}, \frac{3}{12}, \frac{4}{16}, \frac{5}{20}, \frac{6}{24}, \frac{7}{28}$

**B.**  $\frac{2}{4}, \frac{3}{6}, \frac{4}{8}, \frac{5}{10}, \frac{6}{12}, \frac{7}{14}, \frac{8}{16}$

**C.**  $\frac{3}{4}, \frac{6}{8}, \frac{9}{12}, \frac{12}{16}, \frac{15}{20}$

**D.**  $\frac{5}{5}, \frac{9}{9}, \frac{16}{16}$

**E.**  $\frac{4}{1}, \frac{8}{2}, \frac{12}{3}, \frac{16}{4}, \frac{20}{5}, \frac{24}{6}, \frac{28}{7}$

Independent Practice

Name Madame Anderson

