Ratios, Rates, and Proportions

Ratio
→ a relationship between two quantities usually expressed as a fraction

Looks Like

words	symbol	fraction
7 to 8	or 7:8	or $\frac{7}{8}$

dogs cats

must know
If 3:1 = $\frac{3}{1}$ must keep the one in the denominator or the relationship is lost

Application
* can be simplified
$\frac{12}{3} = \frac{4}{1}$ ← 4 cups flour
← 1 cup sugar
* can be expanded
$\frac{3}{2} \overset{\times 2}{=} \frac{6}{4}$ ← part juice concentrate
double ← part water

Rates
→ a ratio using two different units of measure

units

Looks Like

$\frac{23 \text{ miles}}{1 \text{ gallon}} = 23 \text{ mpg}$

miles per gallon

$ per weight $\frac{\$2.99}{1 \text{ pound}} = \$2.99/\text{lb}$

Rate Table

Cost of oranges

# of oranges	10	5	1	20
cost	$2	$1	$0.20	$4.

Application
A black racer snake can travel 4.6 km in 2 hr. What it sits rate, or speed in kilometers per hr?

$\frac{4.6 \text{ km}}{2 \text{ hr}} = 2.3 \text{ km/hr}$

We know...	Inquire: Ratios, Rates & Proportions	We want to learn...

Proportions
→ when two ratios (relationships) can be said to be equal
* used to find an unknown (algebra)

Looks Like

$\frac{9 \text{ dogs}}{8 \text{ cats}} = \frac{180 \text{ dogs}}{x \text{ cats}}$ ← total dogs; How many?

→ ratio of invariance

① Scale

$\frac{9}{8} \times \frac{20}{20} = \frac{180}{160}$ → 160 cats

② Cross products

$\frac{9}{8} = \frac{180}{x}$ → $9x = 180(8)$

$\frac{9x}{9} = \frac{1440}{9}$

$x = 160$

Application
Jogging 5 miles burns about 500 Calories. How many miles will you have to run to burn off 1,200-Calorie lunch of a Big Mac, fries, and a soda?

$\frac{5 \text{ miles}}{500 \text{ calories}} \overset{\text{like to like}}{=} \frac{x \text{ miles}}{1200 \text{ Calories}}$ ← like to like

$5(1200) = 500x$

$6000 = 500x$

$12 = x$

12 miles

Standards
- We will solve problems using scale factors, ratios, and proportions.
- We will compute unit rates associated with ratios of fractions.
- We will use proportional relationships to solve multistep ratio problems.

NMSS: • solve problems involving scale factors, rations, & proportions
• use measures expressed as rates
• choose appropriate units of measure and ratios to solve problems

M4S³ ™

UNIT PLANNING TOOL (CCSSM) • Compute unit rates assoc. with ratios of fractions

Unit CMP : Comparing & Scaling

Unit Goals: • use ratios, fractions, differences & % to form comparison statements • apply proportional reasoning to solve for the unknown part when one part of 2 equal ratios are unknown

Standards: • recognize & represent proportional relationships between quantities • use proportional relationships to solve multistep ratio & % problems

Key Concepts

Ratios - relationship between two things

Rates - a ratio using two different measures

Proportions - when two ratios can be said to be equal

Visual Models of Concepts

6 to 2
6 : 2
$\frac{6}{2}$

$2.99 per pound

23 miles per hour

cost of oranges		
# of oranges	10	5
cost	$2	$1

indirect measurement

Algorithms/Diagrams

$\frac{9}{8} = \frac{180}{x}$

$\frac{9 \times 20}{8 \times 20} = \frac{180}{160}$

$x = 160$

9 lbs cost $4.99
cost per lb?
$\frac{4.99}{5} = 99.8¢/lb$

unit rates

$\frac{4.6 km}{2h} = 2.3 km/hr$

$\frac{x}{3} = \frac{4}{6}$

$3(4) = 6x$

$12 = 6x$

$2 = x$

Connections (Real World Applications)

- recipes
- sculptures
- video games
- architects
- sales $ - taxes, - commission
- cost

Language Functions/Structures

Predicting
If predict ___ because ___.

Compare and Contrast
The ratio ___ is equivalent to the ratio ___ because ___.
A ratio is different than a rate because ___.

Explain
We use two ratios in proportion problems to find ___.

Vocabulary

rate
ratio
rate table
proportion
scale
scaling
unit rate
unit cost
equivalent fractions
proportional reasoning
cross-products
variables

Focus/Motivation

Brainpop - Scale Drawings
Proportions

StudyJams - Proportions
Ratio
Rate

Literature

"Fourscore and 7! Investigating Math in American History" by Betsy Franco
"Only One" by Marc Harshman
"Fraction Action" by Loreen Leedy
"Math Curse" by Jon Scieszka & Lane Smith

Activities

- Real life application problems
  - Predictions