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Contents

Chapter 1 : Whole Numbers, Real Numbers, and Integers.....	11
Rounding.....	13
Estimates	15
Whole Number Addition and Subtraction	17
Whole Number Multiplication.....	19
Whole Number Division	21
Adding and Subtracting Integers.....	23
Multiplying and Dividing Integers.....	25
Arrange, Order, and Comparing Integers.....	27
Compare Integer	29
Order of Operations	31
Integers and Absolute Value	33
Chapter 2 : Fractions and Decimals.....	35
Simplifying Fractions	37
Factoring Numbers	39
Greatest Common Factor (GCF)	41
Least Common Multiple (LCM)	43
Divisibility Rules.....	45
Adding and Subtracting Fractions.....	47
Multiplying and Dividing Fractions	49
Adding Mixed Numbers.....	51
Subtracting Mixed Numbers	53
Multiplying Mixed Numbers	55
Dividing Mixed Numbers.....	57
Comparing Decimals.....	59
Rounding Decimals.....	61
Adding and Subtracting Decimals	63
Multiplying Decimals	65
Dividing Decimals	67
Converting Between Fractions, Decimals and Mixed Numbers.....	69
Chapter 3 : Proportion, Ratio, Percent	71
Writing Ratios.....	73
Simplifying Ratios.....	75
Create a Proportion.....	77
Similar Figures	79
Ratio and Rates Word Problems	81
Percentage Calculations	83
Percent Problems	85
Markup, Discount, and Tax	87
Simple Interest	89
Converting Between Percent, Fractions, and Decimals	91
Chapter 4 : Exponents and Radicals	93
Multiplication Property of Exponents	95
Division Property of Exponents	97
Powers of Products and Quotients.....	99

Zero and Negative Exponents	101
Negative Exponents and Negative Bases	103
Writing Scientific Notation	105
Square Roots	107
Chapter 5 : Algebraic Expressions	109
Translate Phrases into an Algebraic Statement.....	111
The Distributive Property	113
Evaluating One Variable	115
Evaluating Two Variables.....	117
Expressions and Variables.....	119
Combining like Terms	121
Expressions	121
Simplifying Polynomial Expressions	123
Chapter 6 : Equations and Inequalities.....	125
One-Step Equations	127
Two-Step Equations	129
Multi-Step Equations.....	131
Graphing Single-Variable Inequalities	133
One-Step Inequalities	135
Two-Step Inequalities	137
Multi-Step Inequalities	139
Solving Systems of Equations by Substitution.....	141
Solving Systems of Equations by Elimination	143
Systems of Equations Word Problems	145
Linear Equations	147
Graphing Lines of Equations.....	149
Graphing Linear Inequalities.....	151
Finding Distance of Two Points	153
Chapter 7 : Polynomials	155
Classifying Polynomials.....	157
Adding and Subtracting Polynomials.....	159
Multiply and Divide Monomials	161
Multiplying Monomials.....	163
Multiply a Polynomial and a Monomial.....	165
Multiply Binomials.....	167
Factor Trinomials	169
Operations with Polynomials.....	171
Simplifying Polynomials	173
Chapter 8 : Functions	175
Relations and Functions	177
Rate of change	179
Slope	181
x and y intercept.....	183
Writing Linear Equations	185
Slope-intercept form	187
Point-slope form	189
Equation of Parallel or Perpendicular lines.....	191
Equation of Horizontal and Vertical Lines	193
Function Notation.....	195
Adding and Subtracting Functions.....	197

GMAS Math Prep Grade 8

Multiplying and Dividing Functions	199
Composition of Functions	201
Solve a Quadratic Equation	203
Chapter 9 : Geometry	205
The Pythagorean Theorem.....	207
Angles	209
Area of Triangles.....	211
Area of Trapezoids	213
Area and Perimeter of Polygons.....	215
Area and Circumference of Circles	217
Volume of Cubes.....	219
Volume of Rectangle Prisms.....	221
Surface Area of Cubes.....	223
Surface Area of a Rectangle Prism.....	225
Volume of a Cylinder.....	227
Surface Area of a Cylinder.....	229
Chapter 10 : Statistics	231
Mean and Median	233
Mode and Range	235
Times Series	237
Box and Whisker Plot.....	239
Bar Graph	241
Dot plots.....	243
Scatter Plots	245
Stem-And-Leaf Plot	247
The Pie Graph or Circle Graph.....	249
Probability of Simple Events.....	251
Chapter 11 : Georgia Milestones Math Practice Tests	253
GMAS Grade 8 Mathematics Reference Materials	255
Georgia Milestones Assessment System Practice Test 1	257
Session 1	257
Session 2	261
Georgia Milestones Assessment System Practice Test 2	267
Session 1	267
Session 2	271
Chapter 12 : Answers and Explanations.....	275
Answer Key.....	275
Practice Test 1	277
Practice Test 2	281

Chapter 3 : Proportion, Ratio, Percent

Topics that you'll learn in this chapter:

- Writing and Simplifying Ratios
- Create a Proportion
- Similar Figures
- Simple Interest
- Ratio and Rates Word Problems
- Percentage Calculations
- Converting Between Percent, Fractions, and Decimals
- Percent Problems
- Markup, Discount, and Tax

*“Do not worry about your difficulties in mathematics. I can assure you mine are still greater.” –
Albert Einstein*

Name:

Writing Ratios

✓ A ratio is a comparison of two numbers, and it can be written as a division.

EXAMPLE:

3: 5 =?

Both numbers 3 and 5 are divisible by 8 , $\Rightarrow 3 \div 8 = \frac{3}{8}, 5 \div 8 = \frac{5}{8}$,

Then: $3: 5 = \frac{3}{8}$ and $\frac{5}{8}$.

PRACTICES:

Express each ratio as a rate and unite rate.	Express each ratio as a fraction in the simplest form
1) 80 dollars for 4 chairs.	2) 13 cups to 39 cups.
3) 125miles on 25 gallons of gas.	4) 17 cakes out of 51 cakes
5) 147 miles on 7 hours.	6) 35 red desks out of 125 desks
7) 12 inches of snow in 24 hours.	8) 8 story books out of 32 books
9) 14 dimes to 112 dimes.	10) 12 gallons to 20 gallons

Score:

Answer Key

1) $\frac{80 \text{ dollars}}{4 \text{ books}}$, 20.00 dollars per chair	2) $\frac{1}{3}$
3) $\frac{125 \text{ miles}}{25 \text{ gallons}}$, 5 miles per gallon	4) $\frac{1}{3}$
5) $\frac{147 \text{ miles}}{7 \text{ hours}}$, 21 miles per hour	6) $\frac{7}{25}$
7) $\frac{12" \text{ of snow}}{24 \text{ hours}}$, 0.5 inches of snow per hour	8) $\frac{1}{4}$
9) $\frac{14 \text{ dimes}}{112 \text{ dimes}}$, $\frac{1}{8}$ per dime	10) $\frac{3}{5}$

Name:

Simplifying Ratios

- ✓ Ratios are used to compare two numbers.
- ✓ Ratios can be written as a fraction, using colon or the word "to".
- ✓ You can calculate identical ratios by multiplying or dividing both sides of the ratio by the same number.

EXAMPLE:

Simplify. $8:4 =$

Both numbers 8 and 4 are divisible by 4 , $\Rightarrow 8 \div 4 = 2, 4 \div 4 = 1,$

Then: $8:4 = 2:1$

PRACTICES:

Reduce each ratio.

1) $49:14$

2) $22:55$

3) $35:25$

4) $18:99$

5) $16:36$

6) $64:72$

7) $4:60$

8) $70:40$

9) $8:64$

10) $16:24$

Score:

Answer Key

1) 7: 2	2) 2: 5
3) 7: 5	4) 2: 11
5) 4: 9	6) 8: 9
7) 1: 15	8) 7: 4
9) 1: 8	10) 2: 3

Name:

Create a Proportion

- ✓ A proportion carries two equal fractions! A proportion means equality of two fractions.
- ✓ If you want to create a proportion, simply find (or create) two equal fractions.

EXAMPLE:

Explain if these ratios form a proportion. $\frac{3}{5}$ and $\frac{24}{45}$

Use cross multiplication: $\frac{3}{5} = \frac{24}{45} \rightarrow 3 \times 45 = 5 \times 24 \rightarrow 135 = 120$, which is not correct.

Thus, this pair of ratios doesn't form a proportion.

PRACTICES:

Create proportion from the given set of numbers.

1) 3, 2, 9, 6	2) 4, 18, 12, 6
3) 5, 11, 25, 55	4) 24, 7, 21, 8
5) 49, 7, 12, 84	6) 15, 12, 30, 24
7) 20, 10, 200, 1	8) 9, 27, 81, 3
9) 4, 2, 16, 32	10) 9, 6, 27, 18

Score:

Answer Key

1) $2: 6 = 3: 9$	2) $4: 12 = 6: 18$
3) $5: 25 = 11: 55$	4) $8: 24 = 7: 21$
5) $7: 49 = 12: 84$	6) $12: 24 = 15: 30$
7) $1: 10 = 20: 200$	8) $3: 27 = 9: 81$
9) $2: 16 = 4: 32$	10) $6: 18 = 9: 27$

Name:

Similar Figures

✓ Two or more figures are equivalent if their corresponding angles are equal, and the corresponding sides are in proportion.

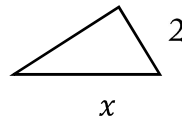
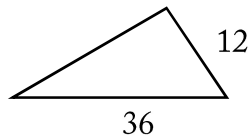
EXAMPLE:

4-5-6 triangle is like an 8-10-12 triangle.

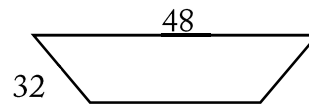
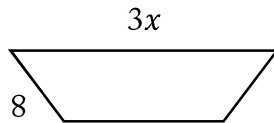
PRACTICES:

Each pair of figures is similar. Find the missing side.

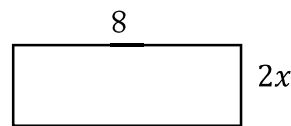
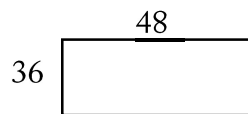
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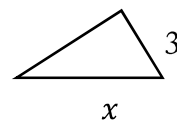
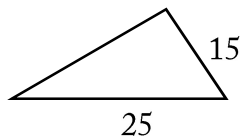
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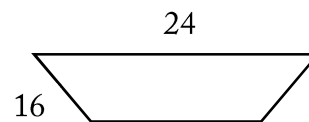
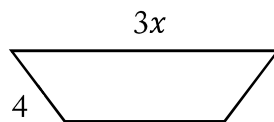
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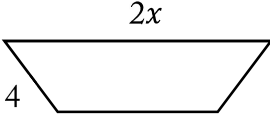
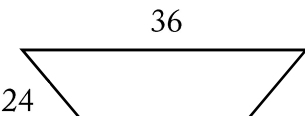
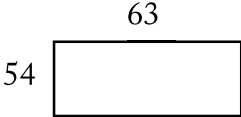
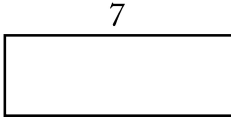
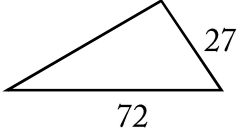
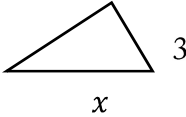
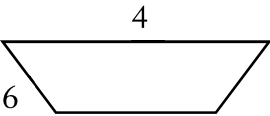
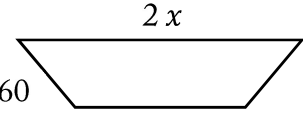
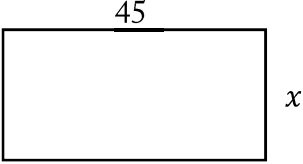
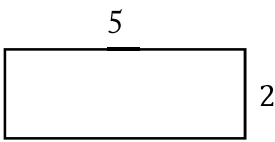
4)



5)



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6)		
7)		
8)		
9)		
10)		

Score:

Answer Key

1) 6	2) 4
3) 3	4) 5
5) 2	6) 3
7) 1	8) 8
9) 20	10) 18

Name:

Ratio and Rates Word Problems

✓ To solve a rate word problem or a ratio, create a proportion and then use cross multiplication method.

EXAMPLE:

A tree 32 feet tall has a shadow 12 feet long. Jack is 6 feet tall. How long is Jack's shadow?

To solve for the missing number, write in a proportion.

$$\frac{32}{12} = \frac{6}{x} \rightarrow 32x = 6 \times 12 = 72$$

$$32x = 72 \rightarrow x = \frac{72}{32} = 2.25$$

PRACTICES:

Solve.

- 1) In a party, 8 soft drinks are required for every 35 guests. If there are 560 guests, how many soft drinks is required?
- 2) You can buy 6 cans of green beans at a supermarket for \$3.50. How much does it cost to buy 42 cans of green beans?
- 3) The price of 5 bananas at the first Market is \$1.05. The price of 7 of the same bananas at second Market is \$1.07. Which place is the better buy?
- 4) In Peter's class, 21 of the students are tall and 9 are short. In Elise's class 56 students are tall and 24 students are short. Which class has a higher ratio of tall to short students?
- 5) The bakers at a Bakery can make 110 bagels in 4 hours. How many bagels can they bake in 6 hours? What is that rate per hour?
- 6) A certain sweet recipe calls for 3 kg of sugar for every 6 kg of flour. If 63 kg of this sweet must be prepared, how much sugar is required?

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7) In a mixture of 45 liters, the ratio of sugar solution to salt solution is 1:2. What is the amount of sugar solution to be added if the ratio must be 2:1?
8) In a bag of red and green sweets, the ratio of red sweets to green sweets is 3:4. If the bag contains 120 green sweets, how many red sweets are there?
9) If the ratio of chocolates to ice-cream cones in a box is 5:8 and the number of chocolates is 30, find the number of ice-cream cones.
10) In a group, the ratio of doctors to lawyers is 5:4. If the total number of people in the group is 72, what is the number of lawyers in the group?

Score:

Answer Key

1) 128	2) \$24.5
3) The price at the second Market is a better buy.	4) The ratio for both classes equal 7 to 3.
5) 165, the rate is 27.5 per hour.	6) 21 kg ($3+6=9$, $\frac{63}{9} = 7$. Therefore, $3:6=21:42$)
7) 45	8) 90
9) 48	10) 32

Name:

Percentage Calculations

✓ Percent is called the ratio of a number and 100. It always possesses the same denominator, 100. The symbol used for percent is %.

✓ Percent is another method to write decimals or fractions. For example:

$$40\% = 0.40 = \frac{40}{100} = \frac{2}{5}$$

✓ Use the given formula to find part, whole, or percent:

$$\text{part} = \frac{\text{percent}}{100} \times \text{whole}$$

EXAMPLE:

What is 10% of 45?

Use this formula: $\text{part} = \frac{\text{percent}}{100} \times \text{whole}$

$$\text{part} = \frac{10}{100} \times 45 \rightarrow \text{part} = \frac{1}{10} \times 45 \rightarrow \text{part} = \frac{45}{10} \rightarrow \text{part} = 4.5$$

PRACTICES:

Calculate the percentages.

1) 75% of 45

2) 50% of 66

3) 90% of 58

4) 25% of 88

5) 5% of 100

6) 80% of 60

Solve.

7) What percentage of 60 is 6

8) 6.76 is what percentage of 52?

9) 17 is what percentage of 85?

10) Find what percentage of 96 is 24.

Score:

Answer Key

1) 33.75	2) 33
3) 52.2	4) 22
5) 5	6) 48
7) 10%	8) 13%
9) 20%	10) 25%

Name:

Percent Problems

- ✓ In each percent question, we are finding the base, or part or the percent.
- ✓ Use the following equations to find each missing portion.
 - $\text{Base} = \text{Part} \div \text{Percent}$
 - $\text{Part} = \text{Percent} \times \text{Base}$
 - $\text{Percent} = \text{Part} \div \text{Base}$

EXAMPLE:

20 is 5% of what number?

Use the formula: $\text{Base} = \text{Part} \div \text{Percent} \rightarrow \text{Base} = 20 \div 0.05 = 400$

20 is 5% of 400

PRACTICES:

Solve each problem.

1) 52% of what number is 13?

2) What is 15% of 9 inches?

3) What percent of 185.6 is 23.2?

4) 24 is 72% of what?

5) 35 is what percent of 70?

6) 10 is 200% of what?

7) 14 is what percent of 70?

8) 26% of 100 is what number?

9) Mia requires 50% to pass. If she gets 250 marks and falls short by 90 marks, what were the maximum marks she could have got?

10) Jack scored 14 out of 70 marks in mathematics, 9 out of 10 marks in history and 56 out of 100 marks in science. In which subject his percentage of marks is the best?

Score:

Answer Key

1) 25	2) 1.35
3) 12.5	4) 33.33
5) 50%	6) 5
7) 20%	8) 26
9) 680	10) History

Name:

Rate of change

- ✓ Slope can be described as "rate of change".
- ✓ Rate of change is a ratio between a change in one variable comparing to a corresponding change in another variable. Rate of change = $\frac{\text{change in output } (y)}{\text{change in input } (x)}$
- ✓ Rates of change can be positive, negative, or zero.

EXAMPLE:

The table shows the amount of money SB carwash made washing car. Find the rate of change in dollar per car?

SB Carwash	Number	4	8	12	16
	Money (\$)	32	56	80	104

$$\text{Rate of change} = \frac{\text{change in output } (y)}{\text{change in input } (x)} = \frac{\text{Change in money}}{\text{Change in car}} = \frac{56-32}{8-4} = \frac{24}{4} = \frac{6}{1}, \text{ or } \$6 \text{ per car}$$

PRACTICES:

What is the average rate of change of the function?

1)	<table border="1"> <tr><td>Gallons</td><td>3</td><td>5</td><td>7</td><td>9</td></tr> <tr><td>Miles</td><td>81</td><td>135</td><td>189</td><td>243</td></tr> </table>	Gallons	3	5	7	9	Miles	81	135	189	243	2)	<table border="1"> <tr><td>Products</td><td>145</td><td>159</td><td>173</td><td>187</td></tr> <tr><td>Costs</td><td>761</td><td>719</td><td>677</td><td>635</td></tr> </table>	Products	145	159	173	187	Costs	761	719	677	635
Gallons	3	5	7	9																			
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Costs	761	719	677	635																			
3)	<table border="1"> <tr><td>x</td><td>4.5</td><td>6</td><td>7.5</td><td>9</td></tr> <tr><td>y</td><td>6</td><td>15</td><td>24</td><td>33</td></tr> </table>	x	4.5	6	7.5	9	y	6	15	24	33	4)	<table border="1"> <tr><td>x</td><td>41</td><td>47</td><td>53</td><td>59</td></tr> <tr><td>y</td><td>67</td><td>52</td><td>37</td><td>22</td></tr> </table>	x	41	47	53	59	y	67	52	37	22
x	4.5	6	7.5	9																			
y	6	15	24	33																			
x	41	47	53	59																			
y	67	52	37	22																			
5) $f(x) = -2x + 4$, from $x = -1$ to $x = 4$?		6) $f(x) = x - 6$, from $x = -5$ to $x = 1$?																					
7) $f(x) = -4$, from $x = 3$ to $x = -2$?		8) $f(x) = 3x^2 + 5$, from $x = 3$ to $x = 6$?																					
9) $f(x) = -2x^2 - 4$, from $x = 2$ to $x = 4$?		10) $f(x) = x^3 + 3$, from $x = 1$ to $x = 2$?																					