Hiking Proportions

Shenandoah National Park Quarter

Grades Seven and Eight

OBJECTIVES

Students will compute unit rates and solve word problems associated with ratios of fractions, including ratios of lengths. Students will analyze proportional relationships and use them to solve real-world mathematical problems. Students will develop and produce creative or informational media messages using technology as a tool to research, organize, evaluate and communicate information.

MATERIALS

- 1 overhead projector or equivalent technology (optional)
- 1 overhead transparency (or photocopy) of each of the following:
  - "Shenandoah National Park Quarter" page
  - "Shenandoah Trails Chart"
- Copies of the following:
  - "Shenandoah Trails Chart"
  - "Shenandoah Trails Multimedia Rubric"
  - "Hiking Proportions" worksheet (2 pages)
  - "Hiking Proportions Video/Presentation Rubric"
- 1 class map of the United States
- Texts that contain information on hiking and Shenandoah National Park, such as:
  - *75 Hikes in Virginia's Shenandoah National Park* by Russ Manning
  - *101 Essential Tips: Hiking* by Hugh McManners
  - *Day and Overnight Hikes: Shenandoah National Park* by Johnny Molloy
  - *The Hiking Companion* by Michael Robbins
- Chart paper, whiteboard or interactive whiteboard
- Computers with Internet access and presentation software

PREPARATIONS

- Make an overhead transparency or equivalent of each of the following:
  - "Shenandoah National Park Quarter" page
  - "Shenandoah Trails Chart"
- Make copies of each of the following:
  - "Shenandoah Trails Chart" (½ sheet per student)
  - "Shenandoah Trails Multimedia Rubric" (½ sheet per student)

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  - "Hiking Proportions" worksheet (2 pages, 1 each per student)
  - "Hiking Proportions Video/Presentation Rubric" (1 per student)
- Locate texts that contain information on hiking and Shenandoah National Park (see examples under "Materials").
- Arrange to use the school computer lab for one or two sessions.
- Bookmark Internet sites that contain information about Shenandoah National Park and hiking, such as:
  - www.nps.gov/shen/index.htm
  - www.nps.gov/shen/planyourvisit/mapshiking.htm
  - www.nps.gov/isro/planyourvisit/upload/Safety%20Tips%20for%20Hiking-2.pdf
- Prepare a graphic organizer in the format of your choice on chart paper.
- Find the hiking map for the Overall Run Falls Trail in the Mathew Arm area. Display the map or make a copy for each student.
- Prepare a multimedia presentation template on the Overall Run Falls Trail that includes a slide for each of the following:
  - Introduction (area, name)
  - Information (trail length, circuit length)
  - Information (difficulty)
  - Summary (other interesting information)
  - Conclusion (why visit this site or trail)
- Grade the "Hiking Proportions" worksheets after Session 4.
- Find some examples of instructional videos for sessions 5 and 6.

GROUPINGS

- Whole group
- Small groups
- Individual work

CLASS TIME

Six 45- to 60-minute sessions, total 4 to 6 hours

CONNECTIONS

- Math
- Language Arts
- Technology

Hiking Proportions

NATIONAL STANDARDS/COMMON CORE

- Common Core State Standards (CCSS)
  - Math.Content.7.RP.A.1: Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.
  - Math.Content.7.RP.A.2c: Represent proportional relationships by equations.
  - ELA-Literacy.SL.7.5: Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.
  - ELA-Literacy.SL.8.5: Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
- National Council for Teachers of Mathematics (NCTM)
  - Understand and use ratios and proportions to represent quantitative relationships.
- International Society for Technology in Education (ISTE)
  - Students apply digital tools to gather, evaluate, and use information.

TERMS AND CONCEPTS

- Quarter
- Round trip trail
- Panorama
- Obverse (front)
- Pace
- Terrain
- Reverse (back)
- Strenuous
- Avid
- Circuit trail
- Ridge

BACKGROUND KNOWLEDGE

Students should have a basic knowledge of:

- Ratios
- Setting up and solving proportions
- Multimedia presentation software
- Hiking
- Conversion between miles and kilometers
- Conversion between minutes and hours
- Conversion between fractions and decimals

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STEPS

Sessions 1 and 2

1. Display and examine the "Shenandoah National Park Quarter" page. Locate this site on a class map. Note its position in relation to your school's location.
2. As background information, explain to the students that the United States Mint began to issue the quarters in the America the Beautiful Quarters® Program in 2010. By the time the program ends in 2021, there will be a total of 56 quarter designs. Each design will focus on a different national site—one from each state, territory and the District of Columbia.
3. Tell the students that the front of a coin is called the "obverse" and the back is called the "reverse." Have the students identify the images on the quarter's reverse. Tell the students that the image depicts a day hiker taking in the view from Little Stony Man summit. Skyline Drive is visible in the distance.
4. Have the students share what they know about Shenandoah National Park and hiking.
5. Display or have the students search the Shenandoah National Park Web site at www.nps.gov/shen/planyourvisit/mapshiking.htm. Find the hiking map for Overall Run Falls Trail in the Mathew Arm area. Display the map or give a copy to each student. Explain that this trail is being used as an example for their own work later.
6. Record facts about the Overall Run Falls Trail trail on a web, concept map or topic map on chart paper. Ask the students what they should consider and prepare for when planning to hike the trails in Shenandoah National Park. Some examples may include type of shoes, plant life to see and avoid, wildlife to look for and to avoid, water and food. Have them include the trail length, the distance and the difficulty of the hike.
7. Have the students visit bookmarked Web sites or use selected texts to find more information to add to the web or graphic organizer.
8. Have the students define the terms "ridge" (a long area of land on top of a mountain or hill), "panorama" (a full and wide view or something), "terrain" (the physical features of a tract of land) and "avid" (characterized by enthusiasm and vigorous pursuit) during their research and write the definitions on the graphic organizer, chart paper or note paper.
9. Distribute a copy of the "Shenandoah Trails Chart" to the students. Discuss the difference between a round trip hike and a circuit hike. Explain to the students that a round trip hike goes to a certain place and returns along the same trail. In a circuit hike, hikers begin and end at the same location but do not retrace their steps along the trail. Allow students time to complete the blank columns on the "Shenandoah Trails Chart" using the park Web site or selected texts.

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10. Review the students' research and be sure their figures match those on the "Shenandoah Trails Chart."
11. Using the prepared presentation template, demonstrate to the students how to set up a multimedia presentation about the Overall Run Falls Trail trail to encourage park visitors to hike the trail. Include information from the chart generated in Step 6, focusing the presentation on the trail length, the distance and the difficulty of the hike.
12. Have the students select a trail from the "Shenandoah Trails Chart" and research more information on the trail. Have the students work in groups of two or three to create some type of multimedia presentation on the trail, to include trail information (area, name, length, distance, difficulty), preparation, safety tips and persuasive reasons to hike the trail.
13. Distribute the "Shenandoah Trails Multimedia Rubric" and review it with the students.
14. Allow time for the students to research and put together their presentation.

Session 3

1. Have the students present their multimedia presentations to the class or set up a center in the room where students can watch the presentations.
2. Have the students complete the rubric for their presentation.

Session 4

1. Review the process of setting up and solving proportions with the class. Distribute a copy of the "Hiking Proportions" worksheet to each student.
2. Discuss the word "pace" with the students. Explain that it is a ratio of the distance hiked to the time it takes to hike.
3. Read the sample problem with the students. Have the students set up the proportion and solve it. Review the conversion of fractions to decimals, decimals to fractions, minutes to hours and hours to minutes.
4. Assign the problems on page 2 of the "Hiking Proportions" worksheet to the students. Have the students use the "Shenandoah Trails Chart" to complete the problems. Allow the students time to complete the worksheet.
5. Collect the "Hiking Proportions" worksheet.

Sessions 5 and 6

1. Return and review the graded "Hiking Proportions" worksheet with the students.
2. Tell the students that they will be working in groups of three and creating their own

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problem from the chart. They will create a one-minute instructional video, oral presentation or skit demonstrating the problem and how to solve it.

3. Distribute a copy of the "Hiking Proportions Video/Presentation Rubric" to the students. Review the rubric. Review and discuss tips for creating a video/presentation with the students. Show the students some examples of instructional videos.
4. Allow students time to create their problem and presentation of their choice.
5. Allow time for students to view the completed presentations.
6. Have students complete and hand in the rubric.

ASSESSMENTS

- Use the worksheets and rubrics to evaluate whether the students have met the lesson objectives.
- Use the "Hiking Proportions" worksheet (both pages) to assess the students' understanding of solving proportion problems.

ENRICHMENTS/EXTENSIONS

- Have the students interview someone who has hiked in a national park.
- Present the videos to the rest of the school in a gallery format.
- Have students use personal electronic devices for research.
- Have students complete a Web quest on hiking.
- Instead of having students make their presentations, have them let the class solve the problems before showing the instructional presentations.

DIFFERENTIATED LEARNING OPTIONS

- Allow students to work in pairs or small groups on the research and on solving the problems on the worksheets.
- Simplify the measurements in the problems.
- Allow additional time for students to complete the problems.

Name _____

Shenandoah Trails Chart

Area	Name of Trail	Length		Round Trip or Circuit	Difficulty	Sites to See
		Miles	Kilometers			
Dickey Ridge	Fox Hollow					
Dickey Ridge	Snead Farm					
Mathew Arm	Overall Run Falls					
Panorama	Pass Mountain					
Skyland	Stony Man					
Skyland	Little Stony Man					
White Oak	Cedar Run/White Oak					
Old Rag	Old Rag					
Hawksbill Mountain	Upper Hawksbill					
Lewis Mountain	South River Falls					
Loft Mountain Area	Brown's Gap					
Riprap	Riprap					

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Name _____

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Name _____

Shenandoah Trails Chart
Key

Area	Name of Trail	Length		Round Trip or Circuit	Difficulty	Sites to See
		Miles	Kilometers			
Dickey Ridge	Fox Hollow	1.2	1.9	Circuit	Easy	
Dickey Ridge	Snead Farm	3	4.8	Circuit	Easy	
Mathew Arm	Overall Run Falls	4.7	7.6	Round trip	Moderate	Waterfall
Panorama	Pass Mountain	3.4	5.5	Circuit	Easy	
Skyland	Stony Man	1.6	2.6	Circuit	Easy	View
Skyland	Little Stony Man	0.9	1.4	Round trip	Easy	View
White Oak	Cedar Run/White Oak	8.2	13.2	Circuit	Strenuous	
Old Rag	Old Rag	8.8	14.16	Circuit	Strenuous	
Hawksbill Mountain	Upper Hawksbill	2.1	3.4	Round trip	Moderate	
Lewis Mountain	South River Falls	2.6	4.2	Round trip	Strenuous	
Loft Mountain Area	Brown's Gap	6.5	10.5	Circuit	Moderate	
Riprap	Riprap	3.4	5.5	Round trip	Moderate	

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Shenandoah Trails Chart
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Lewis Mountain	South River Falls	2.6	4.2	Round trip	Strenuous	
Loft Mountain Area	Brown's Gap	6.5	10.5	Circuit	Moderate	
Riprap	Riprap	3.4	5.5	Round trip	Moderate	

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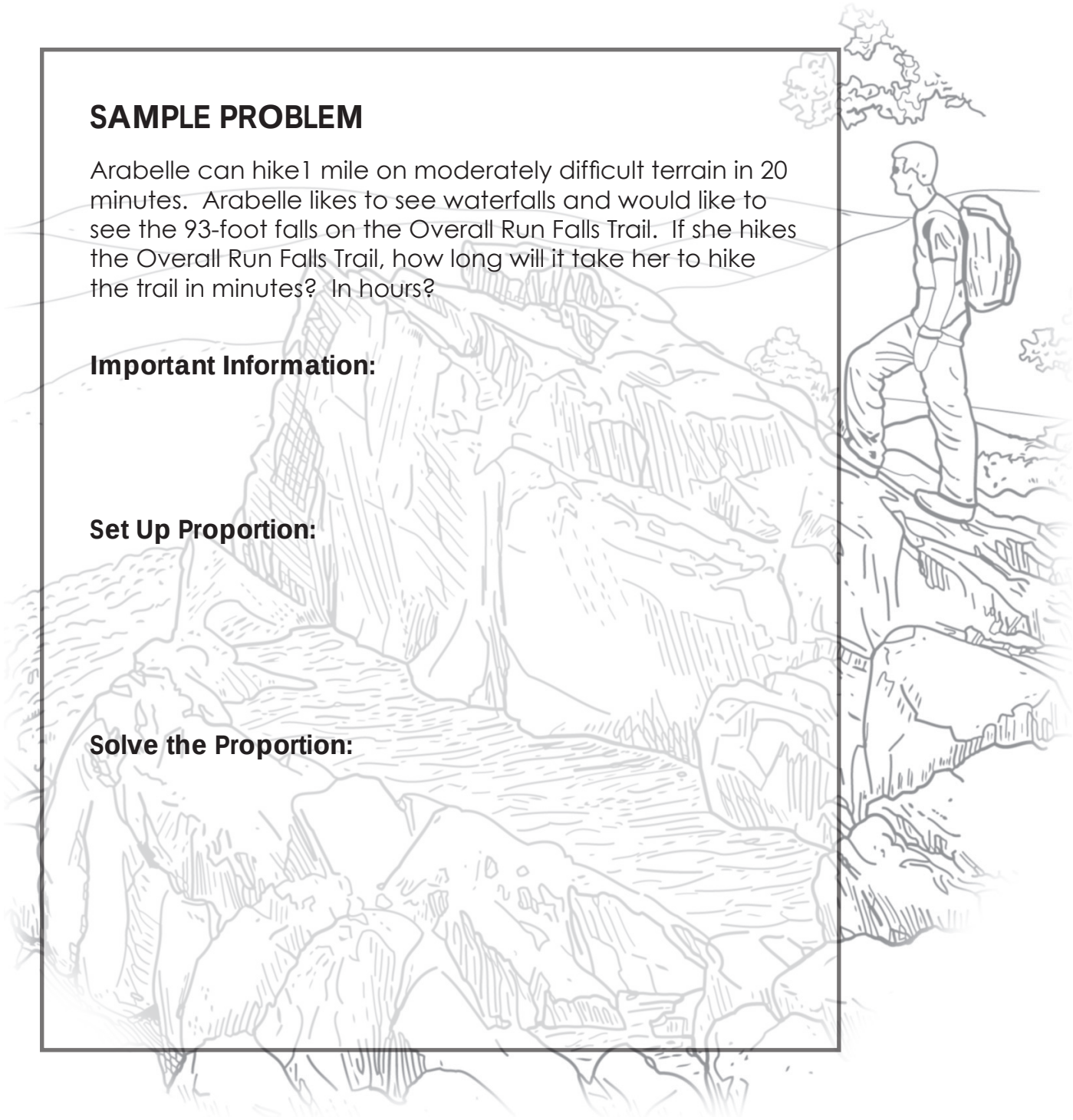
Hiking Proportions
Page 1



SAMPLE PROBLEM

Arabelle can hike1 mile on moderately difficult terrain in 20 minutes. Arabelle likes to see waterfalls and would like to see the 93-foot falls on the Overall Run Falls Trail. If she hikes the Overall Run Falls Trail, how long will it take her to hike the trail in minutes? In hours?

Important Information:

Set Up Proportion:

Solve the Proportion:

Name _____

Hiking Proportions

Page 2

Directions: Solve the following problems. Use your "Shenandoah Trails Chart" to find the length of the trails. Be sure to show your work.

1. Justin can hike a moderately easy trail at 1 mile every 15 minutes. If he hikes the Pass Mountain trail to look for birds, how long will it take him to make the circuit?

2. Ivy wants to hike to the view shown on the Shenandoah National Park quarter (Little Stony Man Trail) after she first hikes the Stony Man trail. If she takes her time to enjoy the views, she will cover about a half mile every 15 minutes. How long will it take her to hike both trails in minutes? In hours?

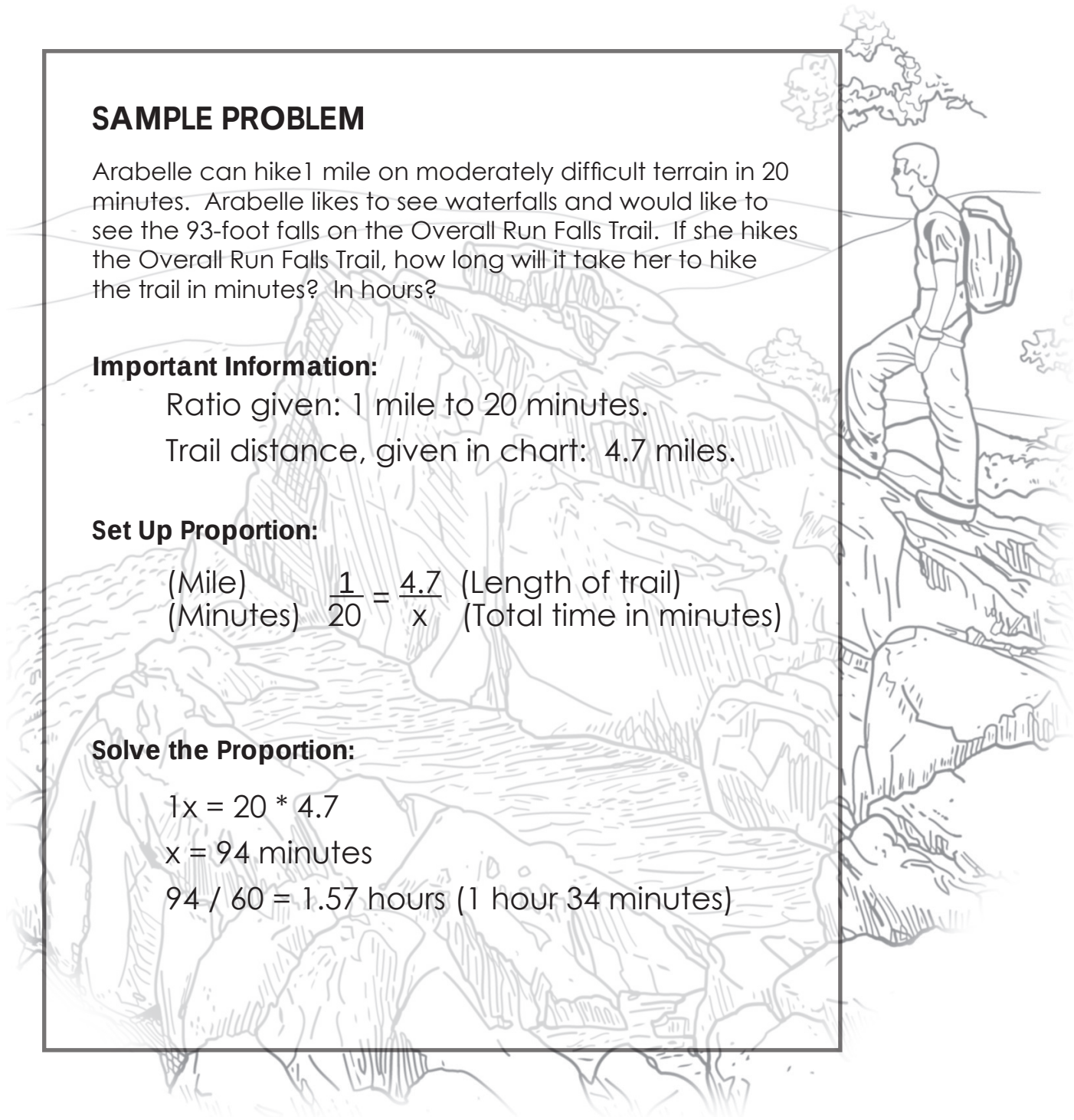
3. Adam considers himself to be an avid hiker and plans on hiking the Cedar Run/White Oak circuit trail to see the different waterfalls and cascades. Although he knows the hike is very strenuous, he can probably go 5/10 of a mile every 1/5 of an hour. How many minutes will it take him to hike the trail? How many hours?

4. The Old Rag Mountain circuit hike is a very challenging hike for even the most avid hiker. Elijah does not consider himself an avid hiker. Elijah wants to hike the trail with his cousin Julian and return before dark. If they leave by 8 a.m. and travel ¼ mile every 10 minutes, will they be back by 6 p.m.?

5. Mark and Allen have enjoyed hiking in Shenandoah National Park for several years. They are planning to hike the Riprap trail to see Chimney Rock. It is a moderately difficult trail, but they know they can keep up a pace of about ¾ mile every $\frac{6}{10}$ of an hour. How long will it take them to hike the trail in minutes? In hours?

Name _____

Hiking Proportions
Page 1, Key



SAMPLE PROBLEM

Arabelle can hike1 mile on moderately difficult terrain in 20 minutes. Arabelle likes to see waterfalls and would like to see the 93-foot falls on the Overall Run Falls Trail. If she hikes the Overall Run Falls Trail, how long will it take her to hike the trail in minutes? In hours?

Important Information:

Ratio given: 1 mile to 20 minutes.

Trail distance, given in chart: 4.7 miles.

Set Up Proportion:

(Mile) $\frac{1}{20} = \frac{4.7}{x}$ (Length of trail)
(Minutes) (Total time in minutes)

Solve the Proportion:

$1x = 20 * 4.7$

$x = 94$ minutes

$94 / 60 = 1.57$ hours (1 hour 34 minutes)

Name _____

Hiking Proportions

Page 2, Key

Directions: Solve the following problems. Use your "Shenandoah Trails Chart" to find the length of the trails. Be sure to show your work.

1. Justin can hike a moderately easy trail at 1 mile every 15 minutes. If he hikes the Pass Mountain trail to look for birds, how long will it take him to make the circuit?

   $\frac{1}{15} = \frac{3.4}{x}$ 1x = 15 * 3.4 x = 51 min (51 / 60 = .85 hour)

2. Ivy wants to hike to the view shown on the Shenandoah National Park quarter (Little Stony Man Trail) after she first hikes the Stony Man trail. If she takes her time to enjoy the views, she will cover about a half mile every 15 minutes. How long will it take her to hike both trails in minutes? In hours?

   1.6 + .9 = 2.5 combined trails 15 min. * 4 = 1 hour .5 miles * 4 = 2 miles per hour

   $\frac{1}{2} = \frac{15}{x}$ 1 * x = 15 * 2 x = 30 minutes per mile

   1x = 30 * 2.5 = 75 min (75 / 60 = 1.25 hours or 1 hour 15 min or 1¼ hours)

3. Adam considers himself to be an avid hiker and plans on hiking the Cedar Run/White Oak circuit trail to see the different waterfalls and cascades. Although he knows the hike is very strenuous, he can probably go 5/10 of a mile every 1/5 of an hour. How many minutes will it take him to hike the trail? How many hours?

   $\frac{1}{5} = \frac{1}{x}$ 1 * x = 5 * 1 x = 5 5/10 * 5 = 25/10 = 2.5 miles per hour

   $\frac{2.5}{1} = \frac{8.2}{x}$ 2.5 * x = 1 * 8.2 x = 8.2 / 2.5 = 3.28 hours

   3.28 hours (3.28 * 60 = 196.8 min or 3 hours 16.8 min.)

4. The Old Rag Mountain circuit hike is a very challenging hike for even the most avid hiker. Elijah does not consider himself an avid hiker. Elijah wants to hike the trail with his cousin Julian and return before dark. If they leave by 8 a.m. and travel ¼ mile every 10 minutes, will they be back by 6 p.m.?

   10 min. * 6 = 1 hour 1/4 mile * 6 = 1.5 miles per hour

   $\frac{1.5}{1} = \frac{8.8}{x}$ 1.5 * x = 1 * 8.8 x = 8.8 / 1.5 = 5.87 hours

   5.87 hours (5.87 * 60 = 352.2 min or 5 hours 52 minutes) so yes...they should arrive at 1:52 p.m.

5. Mark and Allen have enjoyed hiking in Shenandoah National Park for several years. They are planning to hike the Riprap trail to see Chimney Rock. It is a moderately difficult trail, but they know they can keep up a pace of about ¾ mile every 6/10 of an hour. How long will it take them to hike the trail in minutes? In hours?

   ¾ = .75 mile

   $\frac{.75}{.6} = \frac{3.4}{x}$ .75 * x = .6 * 3.4 .75x = 2.04 x = 2.04 / .75 x = 2.72 hours

   2.72 hours (2 hours 43.2 minutes or 163.2 minutes)

   .6 hour = 36 minutes $\frac{.75}{36} = \frac{3.4}{x}$ .75 * x = 36 * 3.4 .75x = 122.4 x = 122.4 / .75 x = 163.2 minutes

Name _____

Shenandoah Trails
Multimedia Rubric

CATEGORY	4	3	2	1	Self	Teacher
Content	Knowledge is excellent; information is very accurate.	Knowledge is good. Information is accurate.	Knowledge is good. Information is not entirely accurate.	Content is lacking or there are many factual errors.		
Originality	Presentation is very original and creative.	Presentation is original and creative.	Presentation is somewhat original.	Presentation shows little originality.		
Mechanics	All words are spelled correctly and there are no grammatical errors.	Most words are spelled correctly or there are 1 or 2 grammatical errors.	Many words are spelled correctly or there are 3 or 4 grammatical errors.	Few words are spelled correctly or there are many grammatical errors.		
Trail Info, Safety Tips, Preparation	All requirements are included.	Most requirements are included.	Some requirements are included.	Few requirements are included.		
Presentation	Very persuasive and informative; everything flows and fits together.	Persuasive and informative; generally flows and fits together	Mostly persuasive; flow is sporadic.	Somewhat persuasive but doesn't flow smoothly.		
Total points						
Student Reflection						
Teacher Comments						

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Name _____

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Hiking Proportions
Video/Presentation Rubric

CATEGORY	4	3	2	1	Self	Teacher
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Interview and Video/ Presentation	Very interesting and informative; everything flows and fits together.	Interesting and informative; generally flows and fits together	Mostly informative; flow is sporadic.	Somewhat informative but doesn't flow smoothly.		
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Shenandoah National Park Quarter

The United States of America