

# AnimalWatch Vi Suite



## App User Guide



L. Penny Rosenblum, Project Director  
Version 1: November 2017  
©The University of Arizona  
AnimalWatch Vi Suite Project  
[www.awvis.org](http://www.awvis.org)

**The AnimalWatch Vi Suite app is available in the App Store by searching on APH or AnimalWatch Vi Suite.**

**Print and braille files to accompany the app are available for download from: <https://awvis.aphtech.org/>.**

---

## **Acknowledgement**

The *AnimalWatch-Vi Suite: A Comprehensive Program to Increase Access to Mathematics for Students with Visual Impairments* was supported by a grant from the U.S. Department of Education, Institute of Education Sciences (R324A120006). The views expressed are not necessarily those of the funding agency. We would like to thank the students and their teachers for their participation in developing the *AnimalWatch Vi Suite* materials. We wish to acknowledge the following individuals for their role in the project.

### **Staff:**

Dr. Carole R. Beal, Principal Investigator, University of Florida (2012-2014)  
Dr. Jane N. Erin, Principal Investigator, University of Arizona (2014-2016)  
Dr. L. Penny Rosenblum, Project Director, University of Arizona  
Mr. Thomas Hicks, Programmer, University of Arizona  
Ms. Pam de Steiguer, Project Coordinator, University of Arizona

### **Consultants:**

Ms. Susan Osterhaus, Texas School for the Blind and Visually Impaired  
Dr. Derrick Smith, The University of Alabama in Huntsville

### **Advisory Board Members:**

Dr. Jim Allan, Texas School for the Blind and Visually Impaired  
Ms. Haylee Holland, Student  
Ms. Karen Hudak, Chandler Public Schools, Arizona  
Dr. Elizabeth Murray, CAST, Inc.

### **Vendors:**

Mrs. Cecelia Anczurowski of Tactile Vision  
Mrs. Diane Everhart of Books2Braille  
Ms. Lucia Hasty of Rocky Mountain Braille Associates

The American Printing House for the Blind has been instrumental in disseminating the materials developed under the project. We would especially like to acknowledge:

Dr. Ralph Bartley, Retired  
Ms. Kate Herndon, Director of Educational Product Research  
Ms. Rosanne Hoffman, STEM Project Leader  
Mr. Lawrence Lovelace, iOS App Developer  
Ms. Dorinda Rife, VP of Educational Services and Product Development

## TABLE OF CONTENTS

	Page
Section 1: What is the AnimalWatch Vi Suite.....	1
Premise .....	1
Earlier Work That Led to This App and Materials.....	1
The University of Arizona Team That Created the App and Materials ...	4
Section 2: Using the AnimalWatch Vi Suite App .....	6
Assumptions.....	6
iPad Settings .....	7
Step-By-Step Directions for Using the AWWiS App .....	7
Opening the App .....	7
Setting Up and Accessing User Accounts .....	8
How to Pages.....	10
Units Available on the Main Page.....	10
Unit Home Page .....	11
Settings .....	12
Introduction Pages .....	13
Problem Pages .....	16
Conclusion Page.....	20
Score Report .....	21

Section 3: Accessibility and iOS Devices .....	22
Invert Colors .....	22
Zoom.....	23
VoiceOver .....	24
Using VoiceOver with Gestures .....	26
Using VoiceOver with a Bluetooth Keyboard.....	28
Using VoiceOver with a Refreshable Braille Display .....	28
Appendix A: Learning Objectives/Common Core Mathematics Standards ...	31
Appendix B: Module 1 Math Problems .....	36
Appendix C: Module 2 Math Problems .....	46
Appendix D: Module 3 Math Problems .....	55

## Welcome

Congratulations on using the *AnimalWatch Vi Suite* app and materials developed by the University of Arizona.

This guide provides background information about the *AnimalWatch Vi Suite* research project, information about how to use the app, and an overview of accessibility features that can be used by those with visual impairments to access the app.

### Section 1: What is the AnimalWatch Vi Suite

The *AnimalWatch Vi Suite* is the result of a research project funded by the United States Department of Education's Institute of Education Sciences (R324A120006). The grant was awarded to the University of Arizona's Dr. Carole Beal and Dr. Jane Erin and began March 1, 2012. The project was granted a one-year no cost extension and ended February 28, 2016.

#### Premise

Youths who do not succeed in pre-algebra competence are less likely to go into the STEM (science, technology, engineering, and mathematics) fields. Connecting math with authentic science data engages students and exposes them to another STEM area. Since weak skills in math preclude individuals from entering STEM, in the late 1990s Dr. Beal recognized that students, especially girls, needed to build their math skills during middle school if they were to increase their potential to enter STEM fields.

#### Earlier Work That Led to This App and Materials

For over 20 years Dr. Beal has had a line of educational inquiry that set the stage for the app and materials you and your student(s) are using.

1997: WhaleWatch, a pre-Internet computer program, was developed targeting middle school girls. The content focused on the North Atlantic Right Whale. The project was funded by the National Science Foundation (HRD 9555737) and involved collaboration with whale experts at the New England Aquarium.

2001: AnimalWatch was born. AnimalWatch was a web-based mathematics tutoring system focused on word problem solving at the pre-algebra level.

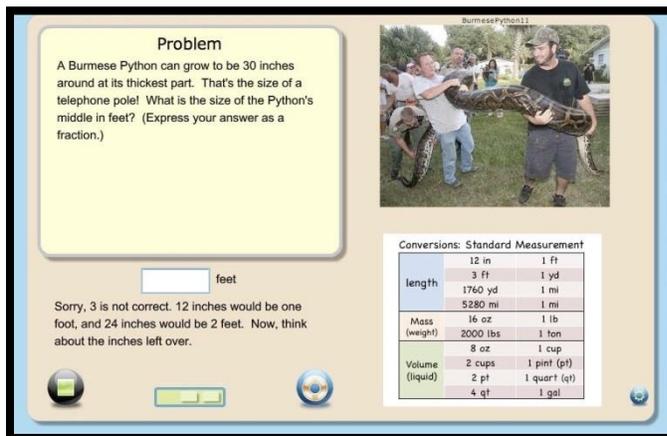
By using environmental science data about endangered species, it also exposed users to the general field of science. The project was funded by the National Science Foundation (HRD 9714757).

### Image 1.1: AnimalWatch Logo



2005: AnimalWatch was expanded with more units added through funding from the U.S. Department of Education's Institute of Education Sciences (R305K05086). Though AnimalWatch was used successfully to increase the math competence of students in California and Massachusetts, it was not accessible for those with visual impairments who were unable to access information presented on screen by the Animal Watch Tutoring System.

### Image 1.2: AnimalWatch Screenshot



Specifically, AnimalWatch did not:

- Allow access with screen reading software.
- Allow the screen to be altered for those with low vision.
- Provide audio descriptions of graphics needed to solve the math problems nor graphics in hard copy.
- Provide audio descriptions of images of animals.

2009: Another grant from the U.S. Department of Education's Institute of Education Sciences (R305A090197) continued the expansion of AnimalWatch

and evaluated its use by middle school students. Over the course of the grant, more than 850,000 word problems were solved. A related project allowed the team to study how word problems were solved by students who were English Language Learners (National Science Foundation, DRL 0903441).

2009: Dr. Beal received a small grant from the National Science Foundation to make AnimalWatch accessible for students who are blind (HRD 0940201). Through this grant AnimalWatchVI Beta was born. This was a self-voicing program that used keyboard commands for users to navigate. The product was field tested in Arizona. An article by Beal and Shaw (2009) describes the beginning work on the AnimalWatch VI Beta project. An article by Beal, Rosenblum, and Smith (2011) details the work of this project in Arizona.

2012: The AnimalWatch Vi Suite project was funded and began on March 1, 2012. This U.S. Department of Education Institute of Education Science's project built on Dr. Beal's previous work with two primary goals:

Goal 1: To develop a fully accessible version of AnimalWatch that allows all youths with visual impairments to customize their work environment, access graphics in their preferred literacy medium, and use "Help" items that are accessible.

Goal 2: To provide youth with visual impairments with the skills needed to succeed in algebra, better positioning them to develop an interest and foundation to succeed in STEM careers.

**Image 1.3: AnimalWatch Vi Suite Banner**



When the University of Arizona project began the intention was to adapt the computer version of AnimalWatch applying principles of universal design. Specifically, the team wanted to make the images, help videos, and all text accessible to those with vision loss. At the same time, they were learning

more about how iDevices, specifically the iPad, were being used in K-12 classrooms. After two brief surveys of the field the University of Arizona team made the decision in August 2012 to move forward with development of an iPad app.

### **The University of Arizona Team That Created the App and Materials**

Dr. Carole Beal: Co-PI, Dr. Beal was a Professor in the School of Information: Science, Technology, and Arts. Her training is in the area of cognitive psychology. Her initial desire to help middle school girls succeed in math laid the foundation for AnimalWatch Vi Suite. In August 2014 Dr. Beal accepted an appointment at the University of Florida, but continued to consult on the project until its end.

Dr. Jane Erin: Co-PI, Dr. Erin is a Professor Emeritus in the Department of Disability and Psychoeducational Studies. Dr Erin has vast experience in the field of visual impairment that allowed her to bring a wealth of knowledge to the project. She was a teacher of students with visual impairments and a supervisor at Western Pennsylvania School for Blind Children prior to joining the faculty at the University of Texas at Austin and later the University of Arizona.

Dr. L. Penny Rosenblum: Project Director, Dr. Rosenblum has been a teacher of students with visual impairments in Pennsylvania, South Carolina, and Arizona and a faculty member at Florida State University and the University of Arizona. She was able to pull from these experiences as she coordinated the day-to-day activities of the project.

Tom Hicks: Senior Research Programmer, Mr. Hicks has more than 30 years of experience in the field. The AnimalWatch Vi Suite project gave him the opportunity to develop skills programming in the iOS environment with a focus on accessibility. Tom rose to the challenge and increased his understanding of the needs of people who have disabilities, especially those with visual impairments.

Pamela de Steiguer: Project Coordinator, Mrs. de Steiguer was an active member of the project team; she developed a web site ([www.awvis.org](http://www.awvis.org)), assured that our bills were paid, and worked behind the scenes to keep the project moving smoothly.

Our project had many partners including:

- Derrick Smith: University of Alabama in Huntsville, associate professor, Certified Secondary Mathematics Teacher, and Teacher of Students with Visual Impairments
- Susan Osterhaus: Texas School for the Blind and Visually Impaired, Certified Secondary Mathematics Teacher, Teacher of Students with Visual Impairments, and Outreach Consultant
- Cecelia Anczurowski, Tactile Vision Inc. of Toronto, Canada (retired, company sold)
- Lucia Hasty, Rocky Mountain Braille Associates
- Diane Everhart, certified braille transcriber and teacher of students with visual impairments
- Danielle Cummings, videographer, teacher of students with visual impairments and certified mathematics teacher, for the North Central Regional Cooperative of Arizona State Schools for the Deaf and Blind

The remainder of this manual focuses on the *AnimalWatch Vi Suite* iPad app and the accompanying materials. A detailed description of the features of the app is provided. You will also find information on accessibility built into the iOS environment including Zoom, VoiceOver, and Invert Colors along with some general guidelines about using a Bluetooth keyboard or refreshable braille display with the app.

## Section 2: Using the AnimalWatch Vi Suite App

This section contains detailed instructions for using the *AnimalWatch Vi Suite* app referred to as “the app” throughout this section.

### Assumptions

We assume that the user can:

- Navigate to apps, open apps, and navigate within apps using buttons and pop-up menus to make selections
- Swipe left and right, tap, double tap, and triple tap
- Use 3-finger Zoom if the user has low vision and prefers magnification
- Use VoiceOver if the user is blind and uses the iPad's built-in screen reader
- Use a Bluetooth® keyboard or refreshable braille display if these are preferred access methods

Many users who have low vision or are blind can be more efficient with a Bluetooth keyboard. Learning the Bluetooth keyboard commands can allow for powerful navigation. Similarly, access through a refreshable braille display can increase efficiency and also provide the user with braille input and output so the user is not relying solely on listening in order to access information. See Section 3, page 23, for more information on accessibility with the AnimalWatch Vi Suite app.

### Image 2.1: User with iPad and Refreshable Braille Display



## **iPad Settings**

One factor that make the iPad powerful for users with visual impairments is the ability to adjust both general and accessibility settings. Depending on the user's specific needs, use of VoiceOver, Zoom and/or Invert Colors can be helpful.

To use the app you *cannot* have Mute selected.

- Access the Control Center with a one-finger swipe up on the home screen and select the bell symbol changing it from gray to white or with VoiceOver on changing Mute from on to off.
- If "Mute" is selected then you must position the side switch so the bell symbol without the line through it appears.

To adjust the volume, use a one-finger swipe up to open the Control Center and use the slider to adjust the volume.

## **Step-By-Step Directions for Using the AWWiS App**

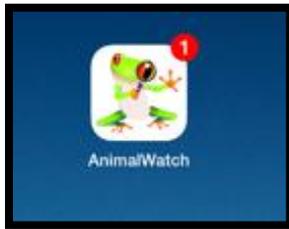
The directions below are not given for VoiceOver gestures or VoiceOver with a Bluetooth keyboard or refreshable braille display. However, with few exceptions, everything described in this section can be accomplished with these options. See Section 3 on page 23 for detailed information on accessibility options and tools.

### **Opening the App**

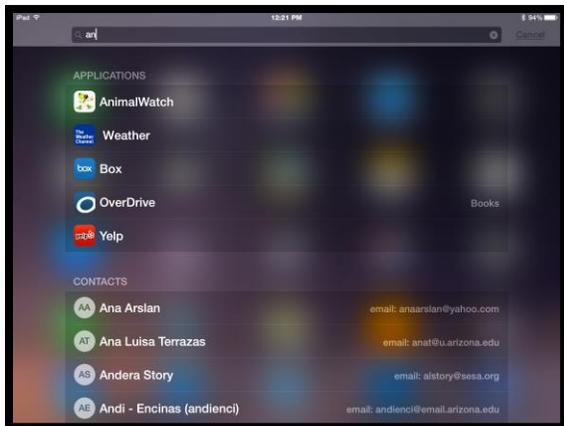
To open the app, find it on the Home screen using one of two methods:

- Swiping through the Home screens until the icon for the app is located and tapping on it to open. (See Image 2.2.)
- Accessing the Search screen by swiping down from any screen and typing "Animal..." in the search field. The app will appear on a list of items starting with "A." (See Image 2.3.)

**Image 2.2: AnimalWatch Vi Suite App Icon**



**Image 2.3: Search Screen**



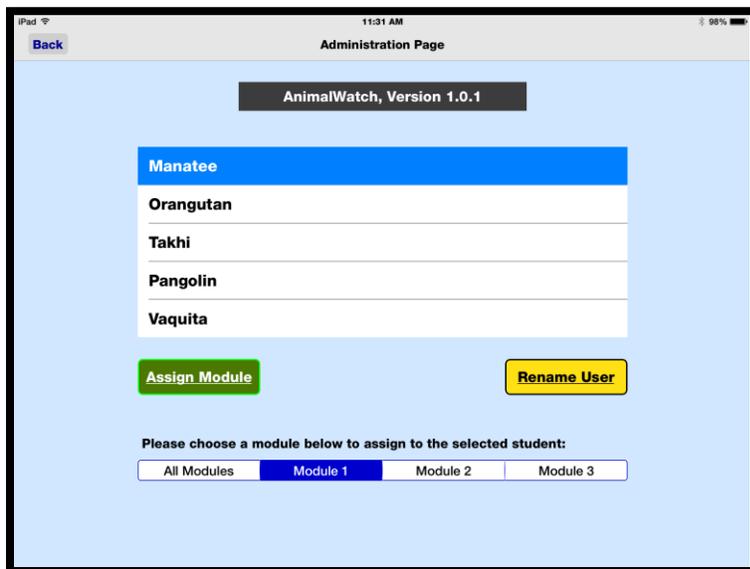
## **Setting Up and Accessing User Accounts**

Multiple users can access the app through individual accounts. On the app's Login Page, the user should select one of the default accounts or tap Administration and change the name of one of the default accounts to her own. To make this change, the user taps the yellow button labeled Rename User and follows the prompts to enter her name. (See Images 2.4 and 2.5.)

**Image 2.4: Login Page**



**Image 2.5: Administration Page**



On the Administration Page the user can tap the green Assign Module button to assign a user to all the modules or to one of the three modules. Appendices B, C, and D provide the problems and answers for all the units in each module.

It is important that a user only work in her account. Individual settings will be stored for each user, and the app will remember where the user left off at the end of the previous session. Each user will also be able to access a Score Report showing progress for the unit.

Once a user's account has been renamed if desired and modules have been assigned, the user can access her account from the Login Page.

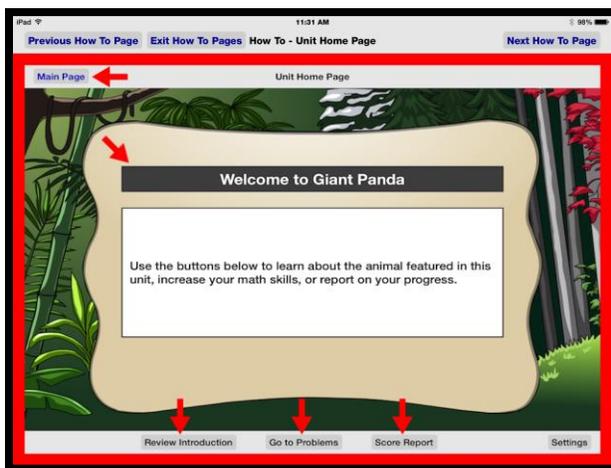
## How to Pages

From the Login Page the user can access the How to Pages and move through a series of screens that explain each button and feature of the app. (See Images 2.6 and 2.7.) Each item on a page is shown with a red arrow. Users can tap on the red arrow to view a dialog box that explains the item.

### Image 2.6 How to Page



### Image 2.7: How to Page



## Units Available on the Main Page

Once the user has selected her account, a list of math units available to the user will be visible on the Main Page. (See Image 2.8.) The user selects a

unit by tapping on the name of the unit. Units that have not been started have a picture of an animal next to their title. Units in progress have a "man working" sign and those that are completed have a check mark.

## Image 2.8: Units Available on the Main Page



## Unit Home Page

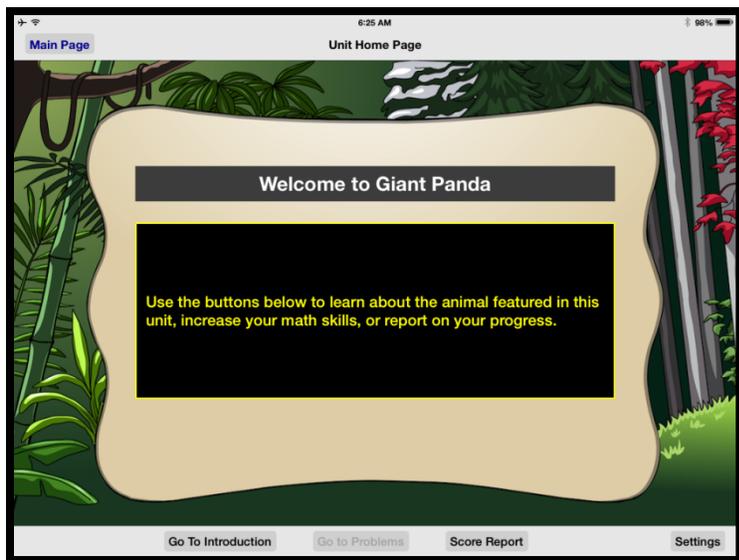
Each unit begins with a Unit Home Page. (See Image 2.9.) Text in the center of the screen tells the options available in the unit. The navigation bar at the top of the screen contains a button to return the user to the Main Page and has the title "Unit Home Page."

The toolbar located at the bottom of the screen contains four buttons:

- Go to Introduction: Tapping this button brings up the first introduction screen. If a user has previously read the introduction, the label for this button will read "Review Introduction."
- Go to Problems: The first time a user starts the unit this button will be grayed out. Users must move through the four introduction pages before they can access the problems. If the user has previously read the introduction pages, then the user can move to the Problem Page from the Unit Home Page.
- Score Report: The user may tap this button to be taken directly to the Score Report Page.
- Settings: The user can tap this button to move to a page where the app's settings can be customized based on the user's preferences.

**IMPORTANT NOTE:** When VoiceOver is *not* activated, the user may use the two-finger single tap to activate the app's internal speech for text or images appearing in boxes throughout the app.

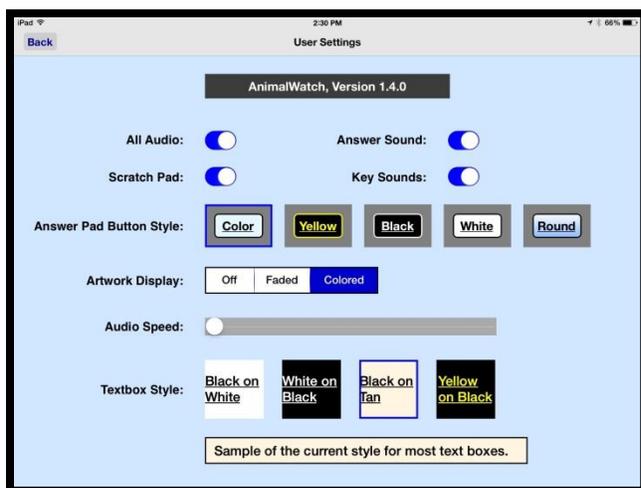
## Image 2.9: Unit Home Page



## Settings

The Settings Page allows the user to customize the app to maximize the user's functional vision if she has low vision. (See Image 2.10.) It also allows the user to turn built-in audio features of the app on and off. The navigation bar at the top of the screen contains a button to return the user Back to the previous page and the title "User Settings."

## Image 2.10: User Settings Page



The following are available on the Settings page:

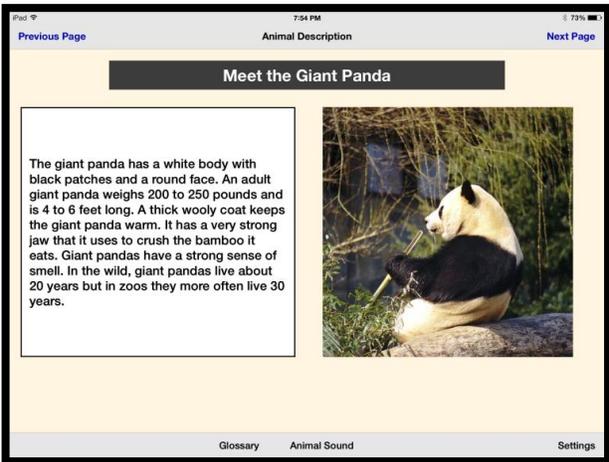
- All Audio: The user can turn all the app's audio on or off including key click sounds and sounds for correct and incorrect answers. Selecting off does not disable the ability to two-finger single tap to hear information in text boxes.
- Scratch Pad: The user can turn the app's internal scratch pad on or off.
- Answer Sound: The user can turn the sounds the app makes for correct and incorrect answers on or off.
- Key Sounds: The user can turn the clicking sound that keys make when pressed on the answer pad on or off.
- Answer Pad Button Style: The user can select from five background color and font color combinations for the answer pad buttons.
- Artwork Display: The user can select from three options for viewing artwork on screens used throughout the app.
- Audio Speed: The audio speed refers to the app's internal audio speed, not the audio speed for VoiceOver. The user can move the slider to hear different speech rates available in the app from 70% normal speed to twice normal speed.
- Textbox Style: The user can select from four color options for viewing text that appears in textboxes within the units. An example of the selected textbox style appears under the four options.

## **Introduction Pages**

There are four introduction pages for each unit. Each page has an identical format with a textbox on the left and an image on the right. (See Image 2.11.) A user may move between the pages using a one-finger swipe to the right or left or by tapping the navigation buttons on the navigation bar at the top of the screen.

The user may listen to the text in the textbox or a description of the image by using a two-finger single tap on the textbox or image to stop or start the audio.

## Image 2.11: Introduction Page



The titles of the four introduction pages and their content are:

- Meet the Animal: Overview information about the animal is provided, such as height, weight, and color.
- What the Animal Looks Like: This page is accompanied by a graphic (large print or tactile) of the animal (See Image 2.12.). The text on this page guides the user in exploring the graphic. Users are encouraged to take time to explore the graphic and to read or listen to the description to better understand the features of the animal.

## Image 2.12: Graphic Image



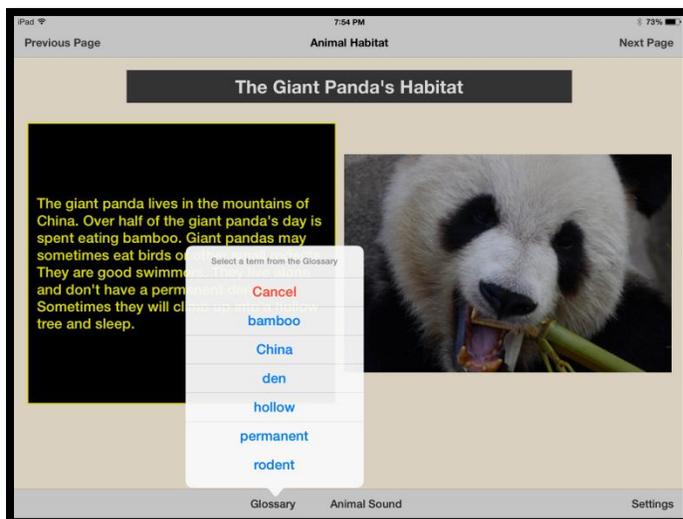
- The Animal's Habitat: Information about the animal's habitat is provided, such as where it lives in the world, what it eats, and how it raises its young.

- Animal Unit Math Skills: A brief synopsis of the math skills covered in the unit is provided.

There are three buttons on the toolbar at the bottom of the screen:

- Glossary: Tapping the Glossary button pops up a list of glossary terms for the current page. (See Image 2.13.) Tapping on Cancel hides the pop-up.
  - The user may tap on a term, and the definition will be displayed in an information box at the bottom of the screen. To hear the definition, the user performs a two-finger single tap.
  - **NOTE:** The glossary term will remain visible in the information box until it is replaced by another item that shares this space.
- Animal Sound: The user may tap the Animal Sound button to play a sound of the animal if available. Tapping the button a second time stops the audio. If there is not a sound available, as in the case of the White Shark, the user will hear "This animal does not make a sound people can hear."
- Settings: The user can move to the Settings page by tapping this button.

**Image 2.13: Glossary Pop-Up**



## Problem Pages

The Problem pages have a similar layout to the Introduction pages with a few notable differences:

- There are seven buttons available to users on the toolbar at the bottom of the screen as described below: Enter Answer, Scratch, Glossary, Hint 1, Hint 2, Give Up, and Settings.
- Hint 1 does not become available until the user gets a wrong answer on the first try. Hint 2 does not become available until the user gets a wrong answer on the second try.
- The user cannot move to the next page until a problem is completed. A problem is completed when the user enters the correct answer, enters three wrong answers, or gives up on the problem.
- Once the correct answer has been entered, three wrong answers have been entered, or the user gives up, the Enter Answer button and Glossary buttons are no longer visible, and in their place is an Answer button. Tapping this button provides the correct answer for the problem. The hints are also available.
- Once a problem is complete the user may not return to it. To move to the next problem select the Next Problem button on the navigation bar at the top of the screen or swipe left.

The text of the word problem that the user is to solve is in the left textbox. The user may listen to the problem, read by the app, by using a two-finger single tap to toggle audio on and off. Glossary terms in the problem text are available by tapping the Glossary button on the toolbar at the bottom of the screen. (See Image 2.13.)

Each problem has an image on the right side of the screen. The user can perform a two-finger single tap on the image to hear an audio description. The audio may be toggled on and off with the same gesture. For problems 2 and 5 of each unit the image box contains a graphic needed to solve the problem. Graphics include bar graphs, line graphs, circle graphs, maps, tables, and number lines. These graphics are available on the web site in either PDF format for printing or fusing (with braille text).

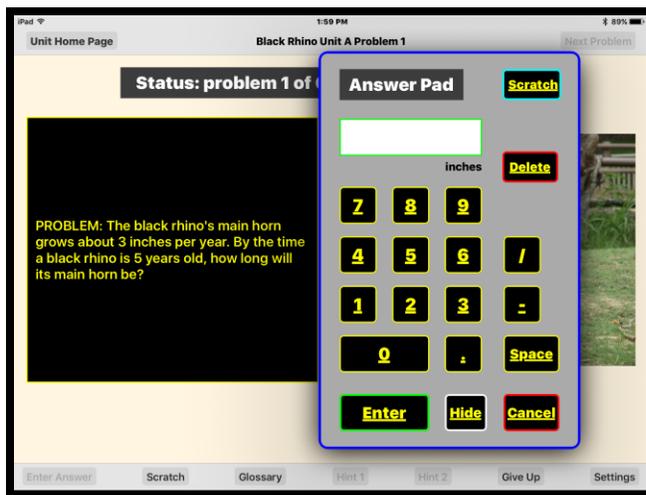
The following buttons are located on the toolbar at the bottom of the screen when the user is working the problem:

- Enter Answer: Tapping Enter Answer brings up the Answer Pad, a window that allows the user to enter her answer to the problem and to access the Scratch Pad (see below). In addition to the 10 digits, slash, period, and hyphen, the Answer Pad has buttons for the scratch pad, delete, enter, hide, and cancel functions. (See Image 2.14.)

**IMPORTANT NOTE:** When entering a mixed number such as  $1\frac{3}{4}$ , the user must enter the whole number followed by a space, then the numerator, a forward slash, and the denominator. Answers must be entered as a fraction rather than a decimal:  $1\frac{3}{4}$  rather than 1.75. Fractions must be entered with a forward slash unless the decimal form is specified within a unit.

**NOTE:** The user can turn the clicking sound of the keys on or off by tapping the radio button for key sounds on the Settings page.

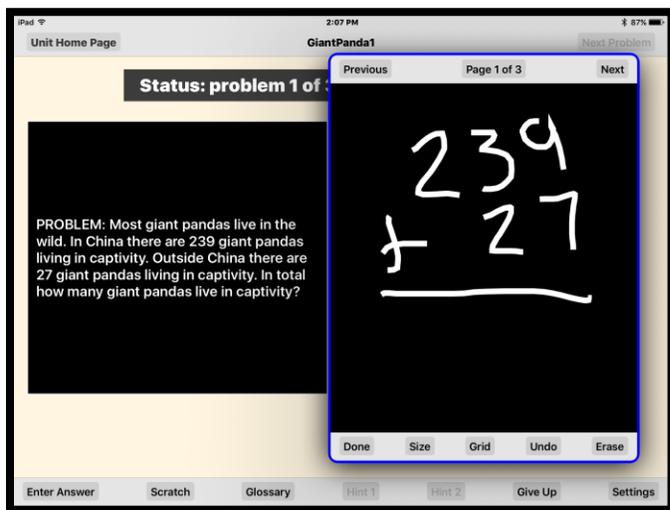
**Image 2.14: Enter Answer Pad**



- Scratch: Tapping Scratch on the toolbar brings up the Scratch Pad, a scratch pad window in the same background color as the textbox displaying the problem. (See Image 2.15.) The user can position the Scratch Pad by repeatedly tapping the Scratch button, which toggles between three options: right, left, and off. The user can use her finger or a stylus to write on the Scratch Pad.
- Two buttons on the navigation bar at the top of the Scratch Pad allow the user to move through three scratch pages. This gives the user more space in which to do calculations.
- Five buttons on the toolbar at the bottom of the Scratch Pad allow the user to:
  - Done: Tap Done to hide the Scratch Pad. Anything written on the Scratch Pad will stay on the Scratch Pad until the user moves to the next problem.
  - Size: Select from four thicknesses of line by tapping the Size button to toggle among choices.

- **NOTE:** To see the size choices at least one mark must be drawn on the Scratch Pad.
- Grid: Tap Grid to turn grid lines on or off the current scratch page. Grid lines can help a student align numbers.
- Undo: Removes the last pen stroke entered on the current page of the Scratch Pad.
- Erase: Clears the current page of the Scratch Pad.

**Image 2.15: Scratch Pad**



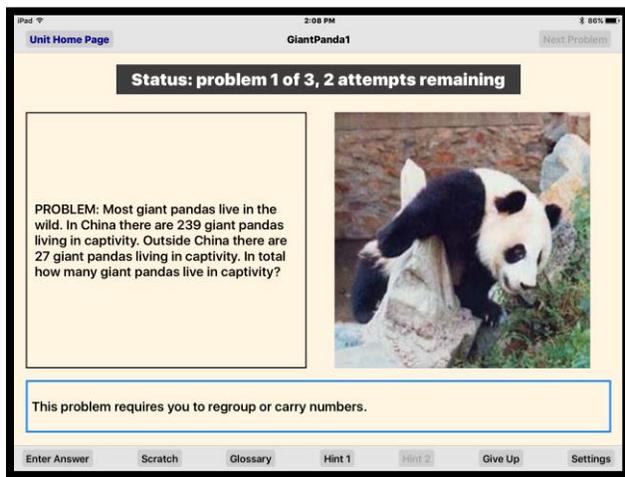
- Glossary: Tapping the Glossary button pops up a list of glossary terms for the current page. (See Image 2.13.) The user may tap on a term and the definition will be displayed in an information box at the bottom of the screen. To hear the definition the user can use a two-finger single tap.
- Hint 1: The user may view a hint to assist in solving the word problem. The hint is displayed in the information box. (See Image 2.16.) To hear the hint the user performs a two-finger single tap. Hint 1 does not become available until the user has either (a) entered an incorrect answer, (b) given up on the problem, or (c) arrived at the wrong answer three times.
- Hint 2: The user may view a second hint to assist in solving the word problem. Hint 2 is accessed in the same way as Hint 1. It does not become available until the user has either (a) entered an incorrect answer two times, (b) given up on the problem, or (c) arrived at the wrong answer three times.

**IMPORTANT NOTE FOR BRAILLE USERS:** Braille files for the TEXT for each unit are available for the braille reader. These are produced as .brf files and can be downloaded unit by unit, as a module (8 units), or as all

units. Box lines are used to cue the braille reader to stop after reading the problem, and to not immediately read Hint 1. Hint 2 is also separated by box lines. The intent is for students to try to solve the problem before reading Hint 1, try a second time before reading Hint 2, and to read both hints if giving up on the problem or getting it wrong three times.

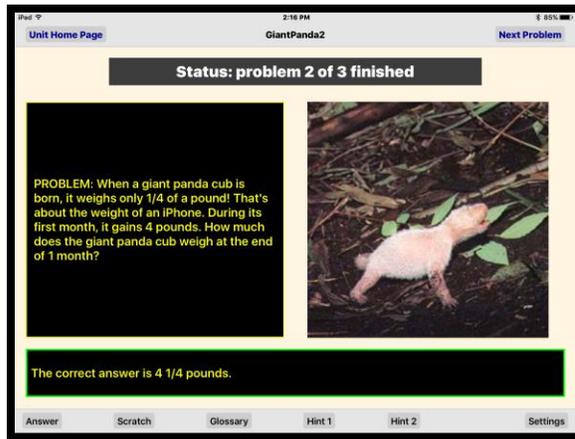
The GRAPHICS for each unit need to be downloaded as PDF files and run through a fuser to make them accessible for a braille reader. To save fuser paper, graphics that are tables are .brf files.

## Image 2.16: Hint



- Give Up: The user has three opportunities to solve the problem. At any time, the user may tap Give Up and then choose Yes. After the user gives up, all buttons on the bottom toolbar are enabled and the Enter Answer button changes to Answer. Tapping the Answer button displays the correct answer. (See Image (2.17.) To move to the next problem the user taps the Next Problem button on the navigation bar at the top of the screen or swipes left. If the user is on the last problem of the unit, the button states Go to Conclusion.

## Image 2.17: Answer box display

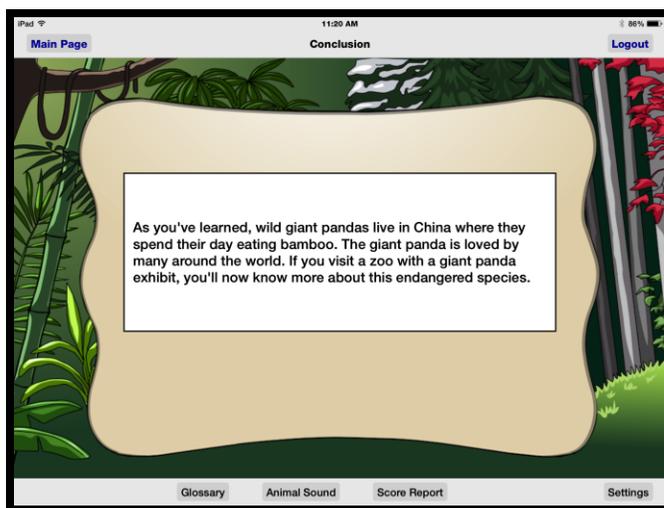


- Settings: The user can move to the Settings page by tapping this button. (See page 7 for an explanation of Settings options.)

## Conclusion Page

The Conclusion Page has the same layout as the Unit Home Page. (See Image 2.18.) The user can read and listen to the text or use the four buttons on the bottom toolbar to access Glossary terms, hear the Animal Sound, view a Score Report, or access the Settings page. Tapping the Main Menu button on the navigation bar at the top of the screen, or swiping right, will return the user to the Main Page where the user may select another math unit. If the user does not wish to work on another math unit, tapping the Logout button on the navigation bar at the top right of the screen, or swiping left, will allow the user to log out immediately.

## Image 2.18: Conclusion Page



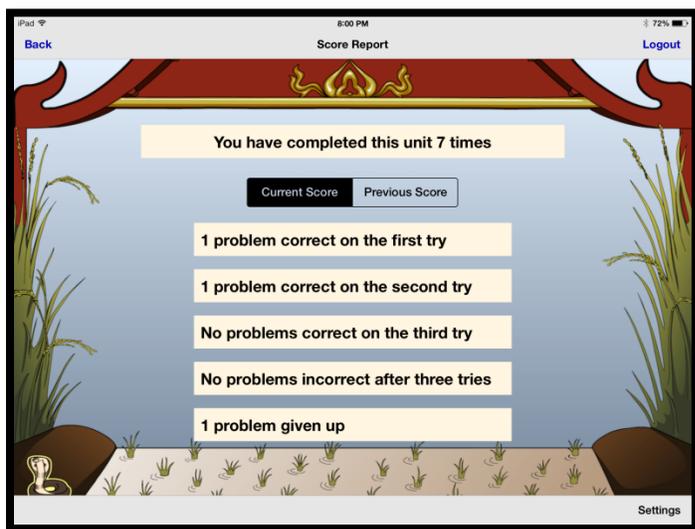
## Score Report

The user can access the Score Report Page (See Image 2.19.) from the Unit Home Page or the Conclusion Page. Two tabs at the top of the page allow the user to view the Current Score or the Previous Score, if the user has already completed the unit a previous time.

Each line of the Score Report provides the user with information about her performance related to the number of problems solved correctly on the first, second, or third try; the number of problems incorrect after three tries; and the number of problems the user gave up on.

The user can access the Back button on the navigation bar at the top of the screen, or swipe right, to return to the Conclusion Page. The user can access the Logout button on the navigation bar at the top of the screen, or swipe left, to log out immediately. On the toolbar at the bottom of the screen the user may access the Settings Page.

**Image 2.19: Score Report**



This completes the section that details the AnimalWatch Vi Suite app for those not using Zoom, VoiceOver or Invert Color. The next section of this User Guide discusses these options and the use of a Bluetooth keyboard or refreshable braille display.

## Section 3: Accessibility and iOS Devices

The AnimalWatch Vi Suite app is accessible with Zoom, the iOS built-in screen magnification feature; and VoiceOver, which is the iOS built-in screen reader. For some users with low vision, the accessibility feature Invert Colors can increase the contrast provided in an app by changing the background and font color combination. A user can navigate the app using a Bluetooth keyboard or refreshable braille display paired with the iPad and with VoiceOver activated.

**IMPORTANT NOTE:** When using a refreshable braille display, the user *will not* see numbers in Nemeth code. Numbers will be seen in Unified English Braille (UEB).

The User Guide is not intended to be a detailed tutorial on using accessibility options with iOS devices, rather it is an overview on how to specifically use the AnimalWatch Vi Suite app with Zoom, VoiceOver and, if desired, a Bluetooth keyboard or refreshable braille display. In this section, text appearing in all capitals and bolded refers to global iPad settings, not settings specific to the AnimalWatch Vi Suite app.

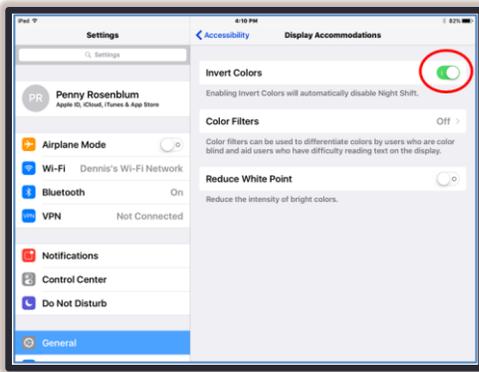
Some users with low vision may find the following settings under General > Accessibility helpful. Changing these settings is not necessary for use of the app.

- Large Text: The user can increase the size of the font by moving the slider.
- Bold Text: The user can increase the thickness of some text using this option.
- Increase Contrast: The user can provide higher contrast for some items viewed on the screen.
- Reduce Motion: The user can turn off the motion seen when moving between elements on the screen.

### Invert Colors

Users with low vision may find that Invert Colors provides a higher level of contrast than that provided within the Settings menu of the AnimalWatch Vi Suite app (referred to as the app for the rest of this section). To activate Invert Colors the user navigates to **GENERAL > ACCESSIBILITY > DISPLAY ACCOMMODATIONS > INVERT COLORS** and turns **ON** the feature. See Image 3.1.

## Image 3.1: Invert Colors

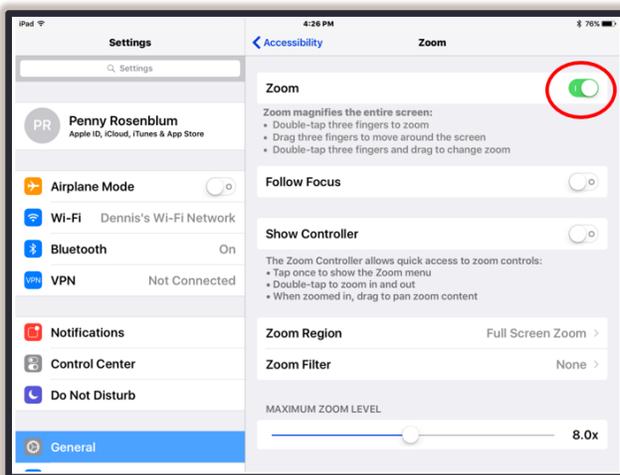


This feature can be added to the Accessibility Shortcut Menu. In Image 3.2, VoiceOver, Invert Colors, and Zoom have all been selected to be active in the Accessibility Shortcut menu when the Home button is clicked three times in rapid succession. Choose only the options that work best for your specific student.

## Zoom

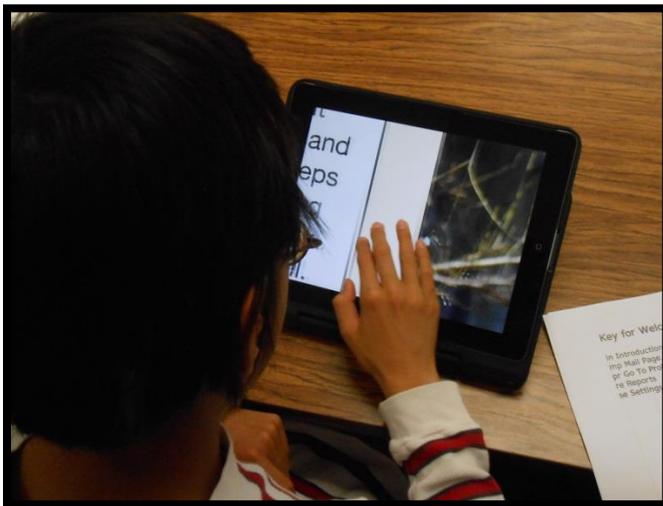
Zoom is the built-in screen magnification feature available in iOS devices. To activate Zoom the user navigates to **GENERAL > ACCESSIBILITY > ZOOM** and turns **ON** the feature. See Image 3.2.

## Image 3.2: Zoom



The level of magnification available when Zoom is activated can be adjusted by using a three-finger double tap and hold. To do this, tap three fingers on the screen twice and maintain contact with or “hold” all three fingers down on the screen. With three fingers still on the screen slide up or down on the screen to increase and decrease magnification. Once a Zoom magnification level is selected, the iOS device remembers this setting each time Zoom is activated. When Zoom is activated, the user can move around the screen by swiping left, right, up or down with three fingers. The student in Image 3.3 has adjusted Zoom to high magnification as he moves to explore the image of the animal on the right side of the screen.

### **Image 3.3: User with Zoom Activated**

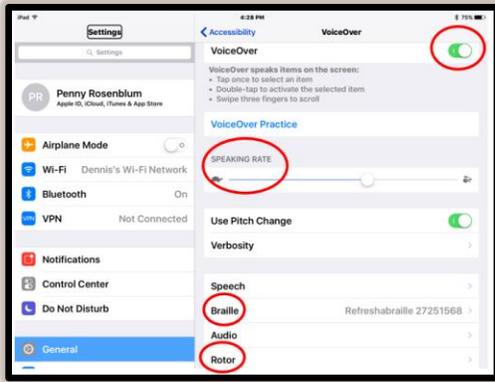


Pinch zoom does not work in the app. Users who try this option will find the app is not responsive.

### **VoiceOver**

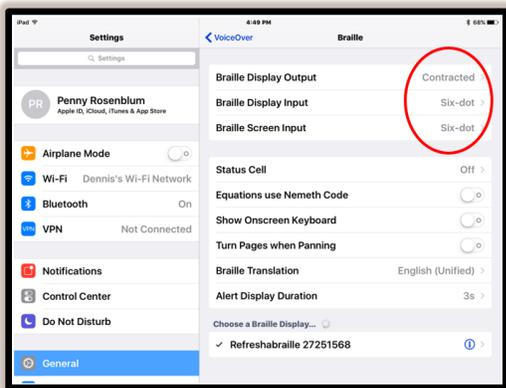
VoiceOver (VO) is the iOS screen reading option that works with all elements of the app. To activate VO, the user navigates to **GENERAL > ACCESSIBILITY > VOICEOVER** and turns **ON** the feature. In setting up VoiceOver, the user has many choices including Speaking Rate, Braille, and Rotor. See image 3.4.

### Image 3.4: VoiceOver



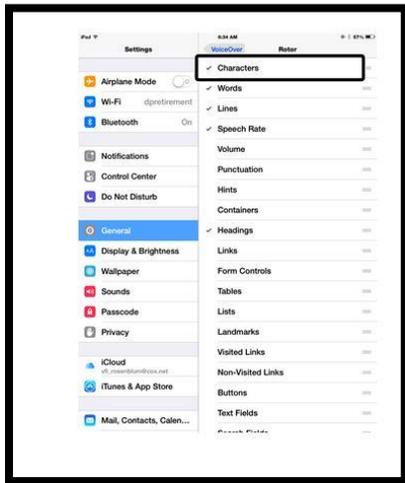
When Braille is selected, the user moves to another Menu as shown in Image 3.5. Contracted braille and Six-dot Braille should be turned on. Note that there is a menu choice for Equations Use Nemeth Code. This setting does not apply to the app, so numbers in the app will appear in Unified English Braille (UEB).

### Image 3.5: Braille



The Rotor allows for ease of navigation when using VO. To select Rotor settings the user navigates to **GENERAL > ACCESSIBILITY > VOICEOVER > ROTOR**, and a list of options is displayed. When using the app, characters, words, and speech rate should be selected. See Image 3.6.

## Image 3.6: Rotor

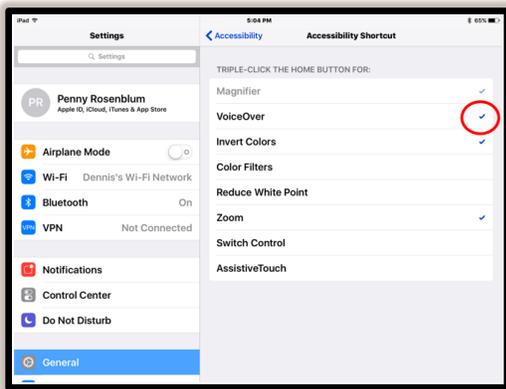


## Using VoiceOver with Gestures

For a detailed document explaining VO and a list of gestures see <http://support.sas.com/misc/accessibility/education/ios/quickref.html>. This document also provides commands for Bluetooth keyboards and refreshable braille displays. A second resource is the *iPad User's Guide* that has an Appendix listing VO gestures. Go to <https://www.apple.com/> and type "iPad User Guide" in the search form to locate the user guide for your specific operating system.

VO can be added to the Accessibility Shortcut Menu (See Image 3.7.). It also can be turned on and off with Siri.

## Image 3.7: Accessibility Shortcut Menu



The user should be familiar with and efficient in using these gestures with the app:

- One-finger single tap: select an item.

- One-finger double tap: activate the selected item.
- One-finger swipe left/right: move focus from item to item (e.g., buttons, text, image).
- Two-finger single tap: pause reading, and two-finger single tap again resumes reading where VO left off.
- Two-finger swipe up: move to the first button at the top of the page and read everything on the page (buttons, text, image description).
- Two-finger swipe down: read everything on the page (buttons, text, image description) beginning from where the VO cursor is focused.
- Four-finger single tap: when done at the top of the screen, it brings the VO cursor's focus to the top of the screen; when done at the bottom of the screen, it brings the VO cursor's focus to the bottom of the screen.
- Three-finger swipe right: move to the previous page when in the Introduction screens.
- Three-finger swipe left: move to the next page when in the Introduction screens.

Double tapping can be difficult for some users, especially if they have difficulty with fine motor control. If the user slides the pointer finger on the screen and hears VO announce a desired button or other item, the user can activate the item by leaving the pointer finger on that item and tapping on the screen once with the middle finger or thumb on the same hand or the other hand. These actions function as a double tap and assures that the user activates the item just heard.

**NOTE:** Some users may prefer the approach just described, especially when entering answers in the app.

The Rotor allows the user to manipulate what is heard when using the app. The Rotor is activated by turning two fingers on the screen as if turning a knob. The following Rotor settings work in the app:

- Characters: Setting the Rotor to characters and flicking down will read the word letter by letter moving from left to right. Flicking up will read the word letter by backwards from right to left.
- Words: Setting the Rotor to words and flicking down will read the text word by word moving from left to right. Flicking up will read the text word by word moving from right to left.
- Speech rate: Setting the Rotor to speech rate and flicking down will decrease the VO speech rate. Flicking up will increase the VO speech rate.

## Using VoiceOver with a Bluetooth Keyboard

A Bluetooth keyboard that has arrow keys allows a VO user to navigate an iOS device without needing to touch the screen. **In order for the Bluetooth keyboard to work with the app, the Bluetooth keyboard must be paired with the iPad and VO must be turned on. Quick nav must also be activated.** To toggle quick nav on and off, press the left and right arrow keys simultaneously until "Quick nav on" is heard.

On most Bluetooth keyboards pressing CONTROL and OPTION keys simultaneously is necessary to activate the VO commands. These two keys in combination will be abbreviated VO. Therefore VO+B means the user presses CONTROL-OPTION-B (VO+B) all at the same time. Users with Windows keyboards replace CONTROL and OPTION with ALT and WINDOWS.

The following commands are used in the app:

- Right arrow: move forward one item to the right
- Left arrow: move backward one item to the left
- Up+down arrow simultaneously: select item
- VO+B: read everything on the page beginning at the top of the screen
- VO+A: read everything from current VO cursor position
- Control: Pause or Resume VoiceOver.

The user can access the Rotor with the Bluetooth keyboard by pressing the right arrow and up arrow simultaneously. Pressing the two arrows simultaneously multiple times moves through the Rotor settings. The user can stop when the desired Rotor setting is heard.

Once the Rotor setting is chosen (e.g., characters, words, speech rate) the user taps the up or down arrow keys to perform the function (e.g., read character by character).

## Using VoiceOver with a Refreshable Braille Display

A refreshable braille display (RBD) can be a stand-alone device such as the Refreshabraille 18 from the American Printing House for the Blind (APH®) or the braille display on a portable notetaker such as the BrailleNote Apex by Humanware™. The information below is based on the Refreshabraille 18 as this device is available with APH federal quota funds and often used by students in K-12 classrooms. Consult the manufacturer's information for specifics on other devices.

**IMPORTANT NOTE:** When using an RBD, the user *will not* see numbers in Nemeth code. Numbers will appear in the Unified English Braille code.

**In order for the RBD to work with the app, the RBD must be paired with the iPad, and VO must be turned on.** The following commands are used to navigate through the app with the RBD with chords (space bar pressed simultaneously with the dot(s) specified):

- 4+Space: move forward one item to the right
- 1+Space: move backwards one item to the left
- 3+Space: select item
- 1-2-3+Space: move to first item on screen
- 4-5-6+Space: move to last item on screen
- 1-3-5+Space: move to next page (This will only work in the Introduction pages and on problem pages once the user has entered the correct answer or given up. The user must be below the top navigation bar.)
- 2-4-6+Space: move to the previous page (This command will only work in the introduction pages and the user must be below the top navigation bar. If used on a problem page, this command will take the user back to the Unit Home Page.)
- 2-4-5-6+Space: read everything on the page beginning at the top of the screen
- 1-2-3-4+Space: pause reading (Chord 1-2-3-4 a second time resumes reading)
- 1-2-3-5+Space: read everything from current VO cursor position
- 1-3-4+Space: mute VoiceOver (1-3-4+Space a second time turns speech back on)

Muting VoiceOver allows the student to read the braille on the RBD without the use of the screen reader.

The user can also use the joystick for navigation with the RBD. Available options include:

- Joystick-right: moves forward one item to the right
- Joystick-left: moves backwards one item to the left
- Joystick-press in: select item
- Joystick-up or Joystick-down (rotor commands)

As the user works with the app it will be necessary to pan left and right to review all material using the braille display.

The user can access the Rotor with the Space+5-6 to activate the Rotor. Pressing Space+5-6 moves through the Rotor settings. Once the Rotor

setting is chosen (e.g., characters, words, speech rate) the user chooses the up or down motion on the joystick to perform the function (e.g., read character by character). Alternatively, 3+Space moves to the next item based on the rotor setting; 6+Space moves to previous item based on the rotor setting.

This section has provided information on using iOS accessibility options with the AnimalWatch Vi Suite app.

## Appendix A: Learning Objectives and Common Core Mathematics Standards

<b>Learning Objective:</b>	<b>Topic:</b>	<b>CCMS Domain:</b>	<b>CCM Standard:</b>
Group 1 Units			
Polar Bear A	Addition and subtraction of positive integers	Number System Mathematical Practice	6.NS.5 MP.1
Polar Bear B	Addition and subtraction of positive and negative integers	Number System Mathematical Practice	6.NS.5 MP.1
Black Rhino A	Multiplication and division	Number System Mathematical Practice	6.NS.2 6.ND.3 MP.1
Black Rhino B	Multiplication and division	Number System Mathematical Practice	6.NS.2 6.ND.3 MP.1
Sea Turtle A	Forming fractions	Ratios & Proportional Reasoning Number System Mathematical Practice	6.RP.1 6.NS.3 MP.1
Sea Turtle B	Using fractions to solve problems	Ratios & Proportional Reasoning Number System Mathematical Practice	6.RP.1 6.NS.3 MP.1

<b>Learning Objective:</b>	<b>Topic:</b>	<b>CCMS Domain:</b>	<b>CCM Standard:</b>
Poison Frog A	Operations with like-denominator fractions	Ratios & Proportional Reasoning Number System Mathematical Practice	6.RP.3 6.NS.3 MP.1
Poison Frog B	Like-denominator fractions and mixed numbers	Ratios & Proportional Reasoning Number System Mathematical Practice	6.RP.1 6.NS.3 6.NS.4 MP.1
Group 2			
Snow Leopard A	Operations with unlike-denominator fractions	Ratios & Proportional Reasoning Number System	6.RP.3 6.NS.3 6.NS.4
Snow Leopard B	Unlike-denominator fractions and mixed numbers	Ratios & Proportional Reasoning Number System Mathematical Practice	6.RP.3 6.NS.3 6.NS.4 MP.1
Cheetah A	Percentages and fractions	Ratios & Proportional Reasoning Mathematical Practice	6.RP.2 6.RP.3 MP.1

<b>Learning Objective:</b>	<b>Topic:</b>	<b>CCMS Domain:</b>	<b>CCM Standard:</b>
Cheetah B	Speed, time and distance	Ratios & Proportional Reasoning Mathematical Practice	6.RP.3 MP.1
White Shark A	Fraction multiplication and division	Ratios & Proportional Reasoning Mathematical Practice	6.RP.3 6.NS.1 6.NS.2
White Shark B	Fraction multiplication and division	Ratios & Proportional Reasoning Number System Mathematical Practice	6.RP.3 6.NS.1 6.NS.2 MP.1
Burmese Python A	Convert units of measurement	Ratios & Proportional Reasoning Mathematical Practice	6.RP.3.d 6.RP.3.b MP.1
Burmese Python B	Convert units of measurement	Ratios & Proportional Reasoning Mathematical Practice	6.RP.3.d 6.RP.3.b MP.1

Group 3			
<b>Learning Objective:</b>	<b>Topic:</b>	<b>CCMS Domain:</b>	<b>CCM Standard:</b>
Gray Wolf A	Geometry: Angles, area, perimeter	Geometry	6.G.1 6.G.2 6.G.3 6.G.4
Gray Wolf B	Geometry: Volume, circumference	Geometry Mathematical Practice	6.G.2 6.G.3 7.G.4 7.G.5 MP.1
Honeybee A	Probability and data analysis	Statistics & Probability Mathematical Practice	6.SP.5.a 6.SP.5.c MP.1
Honeybee B	Probability and data analysis: Interpret data and find probability equivalent	Statistics & Probability	6.SP.4 6.SP.1
California Condor A	Statistics & averages: Mean, median, mode	Statistics & Probability	6.SP.2 6.SP.3 6.SP.5.c
California Condor B	Statistics & averages: Measures of central tendency and range	Statistics & Probability	6.SP.5.c

<b>Learning Objective:</b>	<b>Topic:</b>	<b>CCMS Domain:</b>	<b>CCM Standard:</b>
Hippo A	Variables and expressions	Expressions & Equations	6.EE.A.1 6.EE.B.6 6.EE.C.9
Hippo B	Variables and expressions	Expressions & Equations	6.EE.A.1 6.EE.B.6 6.EE.C.9

## Appendix B: Module 1 Math Problems

### Giant Panda Training Unit

1. Most giant pandas live in the wild. In China there are 239 giant pandas living in captivity. Outside China there are 27 giant pandas living in captivity. In total how many giant pandas live in captivity?

Answer: 266 pandas

2. When a giant panda cub is born, it weighs only  $\frac{1}{4}$  of a pound! That's about the weight of an iPhone. During its first month, it gains 4 pounds. How much does the giant panda cub weigh at the end of 1 month?

Answer: 4  $\frac{1}{4}$  pounds

3. The bar graph shows how many pounds of bamboo three giant pandas living in the wild eat over a one-week period. Altogether, how much bamboo did giant panda A and giant panda C eat?

Answer: 392 pounds

### Session 1 Polar Bear Unit A

1. Scientists capture polar bears to monitor their body weight. The bears are released after they are weighed. In October, a 7-year-old polar bear weighed 177 kilograms (kg). Two months later, she had gained 49 kilograms (kg). How much did she weigh?

Answer: 226 kilograms

2. The table shows the weights of four types of bears including the polar bear, Kodiak brown bear, panda, and black bear. The weights are shown in kilograms (kg). How many more kilograms does a male polar bear weigh compared to a male black bear?

Answer: 495 kilograms

3. Polar bears are one of the largest land carnivores. Male polar bears can weigh more than 1600 pounds (lbs). If one polar bear weighs 1350 pounds and another polar bear weighs 1220 pounds, how heavy are these two bears together?

Answer: 2570 pounds

4. Scientists have placed radio transmitters on polar bears to track their movements in the Arctic. A 7-year-old female polar bear was tracked from August to October. She swam in the open sea for 687 kilometers (km), and then walked on the ice for another 1812 kilometers. How many kilometers did she travel in all?

Answer: 2499 kilometers

5. The map shows the number of polar bears in three nations committed to helping preserve these animals. Polar bears in the United States live in Alaska which is northwest of Canada. Polar bears in Canada live on islands in the ocean northeast of the mainland. How many more polar bears are in Canada than in Greenland?

Answer: 13100 polar bears

6. The average male polar bear weighs 1500 pounds. The largest polar bear ever recorded weighed 2200 pounds. What is the difference between the average weight and the biggest recorded weight?

Answer: 700 pounds

### Session 2 Polar Bear Unit B

1. Polar bears can dive deep into the Arctic waters to hunt their prey. A polar bear dives to -13 feet (ft) and then spots a seal above her. She swims up 7 feet to catch the seal. What's her new depth in the water?

Answer: -6 feet

2. The bar graph shows the freezing point of three types of water, including plain water, ocean water and brine. Plain water freezes at 0 degrees Celsius (C). When salt is added to water it is harder for ice crystals to form, so it has to get even colder before the water will freeze. What is the difference in degrees between the freezing point of ocean water and brine?

Answer: 8 degrees

3. Polar bears are mammals and can keep their body temperature constant at 98.6 degrees Fahrenheit (F). That's the same body temperature you have! A polar bear mother goes through a type of hibernation while she gives birth to and cares for her young. When she gives birth her body temperature falls by -1.5 degrees F. After a few weeks, her body temperature falls another -1.6 degrees F. What is the total change in her body temperature? Your answer will be a negative number.

Answer: -3.1 degrees

4. A U.S. Navy submarine collects data on water and climate for scientists. The submarine just came to the surface of the Arctic Ocean from a depth of -252 feet (ft). If it then returns to a depth of -384 feet, how much deeper will it be than its original depth?

Answer: 132 feet

5. The line graph shows how the amount of sea ice in the Arctic Ocean changes with the seasons, from winter to spring to summer and fall. There are two lines. One shows the amount of sea ice from 40 years ago. The other line shows the amount of ice observed now. What is the difference between the amount of ice in the summer in the past, compared to now?

Answer: 4 tons of ice

6. Polar bears usually swim 3 feet under the ocean surface. Marine biologists recorded one polar bear that dived down another 17 feet. What was its final depth?

Answer: -20 feet

### Session 3 Black Rhino Unit A

1. The black rhino's main horn grows about 3 inches per year. By the time a black rhino is 5 years old, how long will its main horn be?

Answer: 15 inches

2. The table shows the weight in pounds of black rhino horns discovered by police in an illegal market. Horn D weighs twice as much as Horn B. How much does Horn D weigh?

Answer: 6 pounds

3. The longest black rhino horn ever recorded was 60 inches! If the main horn grows 3 inches a year, how old was the black rhino?

Answer: 20 years old

4. When it is first born, a baby black rhino, called a calf, weighs between 50 and 100 pounds. It will gain 30 pounds a week drinking its mother's rich milk. How much weight will it gain in 3 weeks?

Answer: 90 pounds

5. The bar graph shows the number of rhinos killed illegally for their horns in one area. In the year 2010, four times as many were killed compared to 2000. How many were killed in 2000?

Answer: 20 rhinos

6. Black rhinos will travel long distances to find water in the dry grasslands. If a black rhino mother and her calf traveled 6 miles a day for 3 days to find a watering hole, how far did they travel in all?

Answer: 18 miles

### Session 4 Black Rhino Unit B

1. Black rhinos are large herbivores. One adult rhino eats 49 pounds of vegetation in 1 day. How many pounds will the rhino eat in 2 weeks?

Answer: 686 pounds

2. The map shows the average yearly rainfall in four countries in Africa where most of the black rhinos live. If a black rhino in the country of South Africa lives to be 32 years old, how many inches of rain will it experience in its lifetime?

Answer: 576 inches of rain

3. It is illegal to sell black rhino horns but there is still great demand for them. The rhino is large and dangerous so poachers kill the animal before taking its horns. In 2011, poachers killed 448 black rhinos in South Africa. If the horns from each animal weighed 6 pounds, how many pounds of horn is that in total?

Answer: 2688 pounds

4. Black rhinos are being moved to preserves where they can be protected. Each rhino needs at least 4 square miles of grassland to provide enough vegetation for it to eat. If a preserve has 232 square miles available, how many black rhinos can it support?

Answer: 58 black rhinos

5. The table shows the weights of black rhinos moved to a preserve by helicopter. The black rhino is tranquilized and lifted into the air with ropes tied around its feet. A helicopter is faster and safer than moving a black rhino in a truck. Rhino D is 2 times the weight of Rhino B. How much does Rhino D weigh?

Answer: 3172 pounds

6. Black rhino horn is worth \$1600 per ounce, whereas gold is worth \$1200 per ounce. There are 16 ounces in one pound. If someone sold a pound of rhino horn instead of gold, how much more money would he make?

Answer: 6400 dollars

## Session 5 California Condor Unit A

1. California condors are the largest bird species alive today. Their wingspan is wider than even the tallest human basketball player's arm span. The wingspans for four condors were 8, 8, 9 and 7 feet. What is the mean wingspan for these four birds?

Answer: 8 feet

2. The map shows three distances that a California condor was recorded flying from the visitor's center in Grand Canyon National Park. What was the condor's mean flight distance?

Answer: 50 miles

3. California condor chicks stay in the nest and rely on their parents to care for them for several months before they can fly. One season, one chick started flying when it was 154 days old. A second chick flew at 180 days old, and a third flew when it was 165 days old. What is the range for the number of days for these three chicks to start flying?

Answer: 26 days is the range

4. California condors usually lay one egg every other year. To increase the population, rangers will remove the egg and raise the chick by hand. The mother condor will then lay another egg in the same year. Records for five condor mothers showed that they laid 4, 3, 0, 1 and 2 eggs during one year. What is the median number of eggs for these five mothers?

Answer: 2 is the median

5. The bar graph shows the weights of eight different condors. What weight is the mode of this group of birds?

Answer: 20 is the mode

6. In the wild, California condors usually lay one egg at a time. Parents take turns sitting on the egg to keep it warm during the incubation period until the egg hatches. Scientists recorded the incubation periods for five eggs, which were 54 days, 55 days, 65 days, 63 days and 60 days. Which incubation period was the median for this set?

Answer: 60 days is the median

## Session 6 California Condor Unit B

1. To help save the California condor species, zoos set up programs to raise birds and then release them into the wild. One zoo program released 2 birds one year, 8 birds the next year, 6 birds the following year and then 12 birds in the fourth year. What was the mean number of birds released per year?

Answer: 7 birds per year

2. The bar graph shows the flight altitude for two bird and three human activities. What is the range between the highest and lowest flight altitudes? Do not include a comma in your answer.

Answer: 25000 feet

3. The mean weight for three California condors is 17 pounds. If condor 1 weighs 15 pounds, and condor 2 weighs 16 pounds, what is the weight of the third condor?

Answer: 20 pounds

4. California condors lay one or two eggs at a time. A condor egg is about four times larger than a chicken egg. Find the median weight of these six condor eggs: 10 ounces, 7.5 ounces, 9 ounces, 8 ounces, 9.5 ounces and 7 ounces. Enter your answer in decimal form.

Answer: 8.5 ounces

5. The table shows the activities of a California condor for three days. Find the mean number of hours per day that the condor spends grooming.

Answer: 4 hours per day

6. There are now three groups of California condors. One group is in California and includes 130 birds. A second group is in captivity and includes 144 birds. A third group is in the southwestern United States. The goal is to have a mean of 150 birds per group. How many birds need to be in the southwestern United States group so that the mean is 150 birds?

Answer: 176 birds

## Session 7 Sea Turtle Unit A

1. There are seven species of sea turtles that live around the world. Six of the species can be found in the waters around the United States. Form a fraction to show the number of species out of seven that are found in United States waters.

Answer:  $\frac{6}{7}$  of the species

2. The circle graph with sections shows the causes of death for a group of sea turtles. Scientists studied this group to find out what had caused them to die. Some sea turtles died from a virus, others died because they ate plastic floating in the ocean, and others died from unknown causes. What fraction of the sea turtles died because they had eaten plastic?

Answer:  $\frac{1}{3}$  of the turtles

3. Sea turtles reproduce by laying eggs. The female turtle climbs onto the beach, uses her flippers to dig a hole in the sand, and lays her eggs in the sand. The nest contains about 100 eggs. However, only one will survive into adulthood. Form a fraction to show the number of eggs that will not survive into adulthood.

Answer:  $\frac{99}{100}$  of the eggs

4. When a female sea turtle digs a hole and lays her eggs in the sand, it is called nesting. One female created three nests. There were 35 eggs in the first nest, 45 eggs in the second nest, and 57 eggs in the third nest. Form a fraction representing the number of eggs out of the whole that were laid in the third nest.

Answer:  $\frac{57}{137}$  of the eggs

5. The picture shows a group of sea turtles that were studied by scientists. Some of the sea turtles had tumors caused by a virus. The tumors grow on the sea turtle's head and can make it hard for the sea turtle to see its food. Form a fraction to represent the number of sea turtles in the group that had the virus.

Answer:  $\frac{2}{7}$  of the group

6. When female sea turtles climb up on the beach to nest, they are vulnerable to predators like the jaguar. In one preserve, scientists recorded that 676 turtles were killed by jaguars over a five year period. One turtle was a leatherback, and the rest were green sea turtles. What fraction of the turtles killed by jaguars were green turtles?

Answer:  $\frac{675}{676}$  of the turtles

### Session 8 Sea Turtle Unit B

1. The largest sea turtle species is the leatherback. A fully-grown leatherback has a shell that is 6 feet long. In comparison, the shell of the green sea turtle is  $\frac{1}{2}$  that long. How long is the green turtle's shell?

Answer: 3 feet

2. The circle graph with sections shows how one sea turtle spent its time. It is divided into equal sections. Scientists tracked the turtle using a radio transmitter placed on its shell with a special suction cup. The turtle spent 4 hours swimming in the open ocean. How many hours in all was it tracked?

Answer: 12 hours

3. Most countries now have laws to protect sea turtles and their eggs. But in some areas, people are so poor that they collect the eggs and sell them. Taking the eggs illegally is called poaching. One female sea turtle laid 60 eggs, but  $\frac{1}{2}$  were taken by poachers. How many eggs were left?

Answer: 30 eggs

4. Sea turtles are reptiles. They can't control their body temperature the way that mammals do. If the ocean water gets too cold, the turtles can't move. They just float on the water or lie on the sand, where they are vulnerable to predators. Scientists try to help stranded turtles by putting them in warm water until they can move again. One winter, scientists found 400 cold turtles. They were able to rescue  $\frac{3}{4}$  of them. How many turtles did they save?

Answer: 300 turtles

5. The line graph shows how the sex of sea turtle hatchlings depends on the temperature of the sand nest. Warmer sand means that more hatchlings will be female, and cooler sand means that more will be male. Use the graph to

find the temperature at which half of the hatchlings in a nest of 100 eggs will be female and half will be male.

Answer: 85 degrees

6. The sea turtle breathes air. If it is caught in a fishing net and cannot get to the ocean surface, it can drown. To help sea turtles, fishermen have started to add special openings to their nets that let the sea turtles escape. Marine biologists found that  $\frac{4}{5}$  of the sea turtles caught in one net were able to escape using the openings, but 12 turtles were not. How many turtles in all were caught in the net?

Answer: 60 sea turtles

## Appendix C: Module 2 Math Problems

### Giant Panda Training Unit

1. Most giant pandas live in the wild. In China there are 239 giant pandas living in captivity. Outside China there are 27 giant pandas living in captivity. In total how many giant pandas live in captivity?

Answer: 266 pandas

2. When a giant panda cub is born, it weighs only  $\frac{1}{4}$  of a pound! That's about the weight of an iPhone. During its first month, it gains 4 pounds. How much does the giant panda cub weigh at the end of 1 month?

Answer:  $4\frac{1}{4}$  pounds

3. The bar graph shows how many pounds of bamboo three giant pandas living in the wild eat over a one-week period. Altogether, how much bamboo did giant panda A and giant panda C eat?

Answer: 392 pounds

### Session 1 Poison Frog Unit A

1. The golden poison frog has enough poison to kill 10 adult humans! The frogs make the poison from chemicals in the insects they eat. About  $\frac{5}{8}$  of the frog's diet is ants,  $\frac{2}{8}$  is termites and  $\frac{1}{8}$  is other insects. What fraction of the diet is ants and termites together?

Answer:  $\frac{7}{8}$  of the diet

2. The map shows the fraction of poison frogs in four Central American countries that were infected with the chytrid (kit-rid) fungus. The fungus causes the frog's skin to grow thick, making it hard for the frog to breathe. What is the difference between the fraction of infected frogs in Honduras compared to Costa Rica?

Answer:  $\frac{1}{5}$  of the species

3. The Harlequin poison frog must feed its tadpoles eggs while they grow. A mother frog deposits or leaves eggs for her tadpoles. Three of the tadpoles get  $\frac{5}{7}$  of the eggs and another two tadpoles get  $\frac{1}{7}$  of the eggs. What fraction of eggs was left for the last three tadpoles?

Answer:  $\frac{1}{7}$  of the eggs

4. Golden poison frogs lose their toxicity when in captivity because they are fed a diet of crickets and flies, which lack the poison chemicals. After three weeks in captivity, the frogs are  $\frac{3}{8}$  less toxic. After two years, they are  $\frac{7}{8}$  less toxic. What is the difference between the two toxicity levels?

Answer:  $\frac{1}{2}$  less toxic

5. The table shows the fraction of poison frog species around the world that are in danger of extinction due to loss of habitat and the fungus. What is the difference between the fraction of endangered species in South America compared to North America?

Answer:  $\frac{1}{5}$  of the species

6. Scientists are interested in the toxic substance on the poison frog's skin because it could help with heart disease, weight loss, or pain management. The frogs are so small that it can be difficult to collect the toxin from their tiny bodies. In one study,  $\frac{3}{6}$  of the frogs had enough toxin to extract, and another  $\frac{1}{6}$  had the toxin but were too small for samples to be taken, and the rest did not have any toxin. What fraction of the frogs did not have any toxin?

Answer:  $\frac{1}{3}$  of the frogs

### Session 2 Poison Frog Unit B

1. Poison frogs are so tiny that they do not weigh very much. One poison frog weighed  $1\frac{1}{3}$  grams, and another weighed  $\frac{1}{3}$  gram more. How much did the larger frog weigh?

Answer:  $1\frac{2}{3}$  grams

2. The number line shows blue poison frog development. These frogs spend a short period developing in the egg. Then they hatch and live as tadpoles before reaching adulthood. Use the number line to determine what fraction of a year these frogs spend developing into adults. Remember there are 12 months in one year.

Answer:  $\frac{1}{4}$  of a year

3. Poison frog tadpoles hatch from tiny eggs. One egg is  $2\frac{3}{8}$  millimeters (mm) long. Twelve days later, when the tadpole comes out of the egg, it is  $8\frac{5}{8}$  mm long. How much longer is the tadpole compared to the egg?

Answer:  $6 \frac{1}{4}$  mm

4. Some poison frog species are only  $\frac{2}{5}$  of an inch long. One frog could fit on your thumbnail! Some of the largest species can be  $2 \frac{1}{5}$  inches long, which is about the length of a human adult's thumb. How much longer is the largest species compared to the smallest species?

Answer:  $1 \frac{4}{5}$  inches

5. The circle graph shows results from a frog species inventory. What fraction of the frog species has "poison" in their common name? Don't forget to reduce your answer to its simplest form.

Answer:  $\frac{1}{4}$  of the species

6. Female poison frogs are usually longer than males. A female measures  $4 \frac{7}{10}$  centimeter (cm), and a male measures  $3 \frac{9}{10}$  cm. How much longer is the female than the male?

Answer:  $\frac{4}{5}$  cm

### Session 3 Burmese Python Unit A

1. Burmese Pythons can grow to be very long. The longest one ever found was 27 feet when stretched out. How many yards long is that? Remember, there are 3 feet in one yard.

Answer: 9 yards

2. The graphic shows a python that has been stretched out to its full length next to a measuring tape that shows its length in yards. How long is the python in inches? Remember that 1 yard equals 36 inches.

Answer: 144 inches

3. Burmese pythons will eat whenever there is food available, even if they are not hungry. In captivity, they can get very large if their owner feeds them too much. The largest recorded weight of one was 403 pounds. How many ounces did it weigh? Remember that 1 pound equals 16 ounces. Do not include a comma in your answer.

Answer: 6448 ounces

4. Like many reptiles, pythons reproduce by laying eggs. When a baby python first hatches, it is 2 feet long. How many inches long is it?

Answer: 24 inches

5. The graphic shows how a wild python skin can be made into leather, and then into a very expensive purse. The value gets higher at each step. The first two steps are shown in dollars and euros. Euros are the currency of European countries where python purses are very popular. How much will a python purse cost in dollars?

Answer: 2000 dollars

6. Burmese pythons are not venomous. Instead, the python bites a prey animal and then wraps around the prey, squeezing until it suffocates. The python's teeth are sharp and curved backwards to help hold the prey animal. An adult python tooth is 1.25 centimeters long. If 1 centimeter is equal to 0.4 inches, how long is the tooth in inches? Report your answer in decimal form with a 0 to the left of the decimal point.

Answer: 0.5 inches

#### Session 4 Burmese Python Unit B

1. News stories about pythons becoming an invasive species have made people in Florida aware of the problem. One man was driving near the Everglades when he saw a very large python lying on the road. He called Animal Control officers who captured the snake. The snake was 5.6 meters long. If 1 meter equals 3.3 feet, how many feet long was the snake?

Answer: 18.48 feet

2. Pythons are large enough to be dangerous to humans. One python was discovered near homes in Fort Myers, Florida. It was captured and set loose in the Florida Everglades. Two months later, it was found back in Fort Myers. The map shows the distance the snake traveled in miles. One mile equals 1.6 kilometers. How many kilometers did the python travel back to Fort Myers?

Answer: 64 kilometers

3. One reason that Burmese Pythons have become a problem in the Everglades is that these large snakes kill native species such as the rare Florida Panther. One snake had the remains of a panther in its stomach. The average panther weighs 54 kilograms. One kilogram equals 2.2 pounds. How many pounds does the average panther weigh?

Answer: 118.8 pounds

4. One popular way to see wildlife in the Everglades is to ride in an airboat. The airboat has a flat bottom and a very large fan on the back, above the water. When the fan turns, the moving air pushes the boat forward. This way, the boat doesn't get stuck on grass growing in the water. The fan is covered by a metal cage to protect the blades. A typical fan would be 96 inches wide. How many feet wide is that?

Answer: 8 feet

5. The table shows the land speed of three dangerous species that are found in the Everglades, including the Burmese python, the alligator and the black mamba, a poisonous snake. What is the black mamba's speed in miles per hour?

Answer: 8 miles per hour

6. To try to reduce the number of pythons in the Everglades, park rangers hold a "Python Challenge Day" where hunters and scientists search for, capture and remove as many snakes as they can find. In the first challenge, 4.5 dozen snakes were captured and removed from the park. How many snakes were removed?

Answer: 54 snakes

### Session 5 Cheetah Unit A

1. Cheetahs stalk their prey. They hide in the grass and follow the animal until they get close enough to burst out running and attack. However, the cheetah cannot run at top speed for very long, so sometimes the prey will escape. Only  $\frac{1}{2}$  of the cheetah's hunts are successful. What is  $\frac{1}{2}$  in percent form?

Answer: 50%

2. The bar graph shows how cheetahs typically spend their time during a 24-hour day. What percentage of the cheetah's time is spent stalking its prey?

Answer: 25% of its day

3. One problem for the cheetah species is that only 5% of the cubs born in the wild survive to adulthood. Only adult cheetahs can reproduce cubs. The

mother must leave her cubs to hunt, leaving them at risk from predators like lions. In one preserve, scientists recorded 300 cubs born over a three-year period. How many cubs survived into adulthood?

Answer: 15 cubs

4. Scientists believe that the cheetah population has declined by 30% in the last 20 years. If the population was 9000 cheetahs then, what is it now?

Answer: 6300 cheetahs

5. The map shows the distances traveled by a mother cheetah from her cubs. She traveled to one prey animal, and then on to attack a second one before going on to a watering hole. She had gone 40% of the total distance when she attacked the second prey animal. How far did she travel from her cubs to the watering hole? Your answer will be a mixed number.

Answer: 7  $\frac{1}{2}$  miles

6. The cheetah is the world's fastest animal on land. Its top speed is 70 miles per hour. A gazelle's top speed is 49 miles per hour. Express the gazelle's top speed as a percentage of the cheetah's.

Answer: 70%

### Session 6 Cheetah Unit B

1. One cheetah cub gained 60 pounds in its first year. On average, how much weight did it gain per month?

Answer: 5 pounds

2. The line graph shows the number of cheetahs in the year 2000, and the number of cheetahs in 2010. If the decline in the population remains constant, how many cheetahs will there be in 2020?

Answer: 500 cheetahs

3. One cheetah was recorded running 330 feet in 6 seconds. Assume that it ran at a constant speed. How fast did the cheetah run per second?

Answer: 55 feet per second

4. One cheetah was recorded running 50 feet per second. If it ran 750 feet at a constant speed, how many seconds did it run?

Answer: 15 seconds

5. The table shows the distances run by three cheetahs in different amounts of time. What is the rate in feet per second of the fastest cheetah?

Answer: 50 feet per second

6. A mother cheetah must move her cubs every few days to keep them safe from predators like lions and hyenas. One mother traveled at 4 miles per hour for 90 minutes before she found a new hiding place for her three cubs. How far did she travel?

Answer: 6 miles

### Session 7 Hippo Unit A

1. Hippos are very large animals, but they are usually not very active. It does not take much energy to lie around in the mud. A hippo eats 80 pounds of grass in 4 hours. In the equation  $4x = 80$ ,  $x$  represents the number of pounds of grass the hippo eats per hour. Find the value of  $x$ .

Answer: 20 pounds of grass

2. The table shows the average weight in pounds for some of the largest animals alive today, including the elephant, the white shark, and the rhino. The average weight for the hippo is half the rhino's weight plus 500 pounds. What is the hippo's average weight?

Answer: 4000 pounds

3. Hippos are huge animals but their legs are quite short for their size. In fact, a hippo's body is usually 3 times as long as its height from its feet up to its shoulders. An adult male hippo is 5 feet tall. If  $x$  represents its height in the equation  $3x = \text{length}$ , how long is the male hippo?

Answer: 15 feet

4. One reason that hippos are dangerous is that they have four unusually long teeth: Two are in the upper jaw, and two in the bottom jaw. These teeth are used in fights with other hippos. Unlike human teeth, the hippo's teeth keep growing for its entire life. One year, a hippo's teeth were 15 inches long. The following year, the teeth were 16.2 inches long. Use the expression  $15 + x = 16.2$  to find the growth rate per year.

Answer: 1.2 inches per year

5. The circle graph shows the amount of time that hippos spend lying around, feeding and doing other things. Most of their time is spent lying around in the mud, trying to keep cool. Use the values in the graph to figure out how many hours a day hippos spend doing things other than lying around and feeding. Remember that a day is 24 hours.

Answer: 4 hours

6. Hippos are comfortable in the water. In fact, the name "hippo" comes from the Greek words for "river horse." A hippo can hold its breath underwater for five minutes. How many times does the hippo have to breathe in one hour? Remember there are 60 minutes in one hour. Use the equation  $5x = 60$ , where  $x$  represents the number of breaths.

Answer: 12 times

### Session 8 Hippo Unit B

1. Hippos are herbivores, meaning that they eat plants. Most of their food is grass but they also eat water plants, small shrubs and tree leaves. An adult hippo will eat 80 pounds of plants in a day. If one hippo ate 10 pounds of water plants and 5 pounds of shrubs in a day, how much grass did it eat?

Answer: 65 pounds of grass

2. The bar graph shows the number of hippos that were found living in a small private zoo in South America. Use the information in the graph to find the change in the number of hippos living there from 1980 to 1984. Assume that the rate of change is constant and predict the number of hippos that were in the zoo by 1988.

Answer: 64 hippos

3. The large side teeth of the hippo are longer in the male than in the female. On average, the male's teeth are 1.4 times longer. If a female hippo has side teeth that are 15 inches long, how long are the male's side teeth likely to be?

Answer: 21 inches

4. Hippos look clumsy out of the water but they can run fast for short distances. In fact, they can run 1.2 times faster than a human. If a human can run 15 miles per hour, how fast can the hippo run?

Answer: 18 miles per hour

5. The map shows three regions in Africa where hippos are found today. Scientists predict that the hippo population will decline, and that in 20 years it will be only 0.8 of its current population. Predict how many hippos there will be in the Southern Africa region in 20 years. Do not include a comma in your answer.

Answer: 48000 hippos

6. Hippos are social animals and usually stay in groups in the water. A group of hippos is called a pod. A pod will usually have 1 male and 12 females. If there are 4 pods, how many hippos are there in all?

Answer: 52 hippos

## Appendix D: Module 3 Math Problems

### Giant Panda Training Unit

1. Most giant pandas live in the wild. In China there are 239 giant pandas living in captivity. Outside China there are 27 giant pandas living in captivity. In total how many giant pandas live in captivity?

Answer: 266 pandas

2. When a giant panda cub is born, it weighs only  $\frac{1}{4}$  of a pound! That's about the weight of an iPhone. During its first month, it gains 4 pounds. How much does the giant panda cub weigh at the end of 1 month?

Answer:  $4\frac{1}{4}$  pounds

3. The bar graph shows how many pounds of bamboo three giant pandas living in the wild eat over a one-week period. Altogether, how much bamboo did giant panda A and giant panda C eat?

Answer: 392 pounds

### Session 1 Snow Leopard Unit A

1. Since the year 2000, the snow leopard population has declined by  $\frac{1}{5}$ . Scientists predict that in the next five years, the population will decline another  $\frac{1}{10}$ . What will the total decline in the population be 5 years from now?

Answer:  $\frac{3}{10}$  of the population

2. The map shows the fraction of the snow leopard's habitat by country. What is the difference between the fraction of habitat in China compared to India?

Answer:  $\frac{7}{12}$  of the habitat

3. One threat to the snow leopard is that people want its beautiful fur for hats, jackets and rugs, even though it is illegal to sell snow leopard pelts. Police discovered snow leopard pelts for sale in a market.  $\frac{1}{2}$  of the pelts were from one poacher, and  $\frac{1}{3}$  were from another poacher. What fraction of the pelts were from these two poachers together?

Answer:  $\frac{5}{6}$  of the pelts

4. The high mountain habitat where the snow leopard lives is very harsh. Snow leopard mothers have only one or two cubs each year. This means that the population does not increase very fast. Scientists estimate that  $\frac{1}{2}$  of the snow leopard population is mature adults that can reproduce, and another  $\frac{1}{6}$  are adolescents that will be able to reproduce within a year. What is the total population of snow leopards that will be able to reproduce in a year?

Answer:  $\frac{2}{3}$  of total population

5. The table shows what types of food one snow leopard ate in one year. The leopard lived in a preserve and scientists recorded what it ate. How much more of its diet was from wild sheep compared to domestic sheep?

Answer:  $\frac{9}{20}$  of the diet

6. Humans are moving into the habitat of the snow leopard. Humans raise sheep and cattle. Hungry snow leopards will sometimes kill and eat these domestic animals. One snow leopard killed  $\frac{2}{35}$  of the domestic animals while another snow leopard killed  $\frac{2}{70}$  of the domestic animals. Together what fraction of the domestic animals did the 2 snow leopards kill?

Answer:  $\frac{3}{35}$  of the animals

### Session 2 Snow Leopard Unit B

1. Snow leopards have very long tails. These are useful for two things: balance while leaping and climbing on the steep terrain and wrapping up to keep warm. One snow leopard's body measures  $1\frac{1}{10}$  meters (m) long not including its tail. Its tail measures  $\frac{4}{5}$  m. How long is the snow leopard from head to tail? When you enter your answer, put a space between the whole number and the fraction.

Answer:  $1\frac{9}{10}$  meters

2. The table shows the distances that three snow leopards could leap. How many yards farther was the longest leap compared to the shortest? Enter your answer as a mixed number.

Answer:  $2\frac{5}{12}$  yards

3. Most snow leopards have cloudy white and gray fur, which helps them blend in with the snow in the mountains. However, some have a darker yellow fur. One year in India  $\frac{2}{9}$  of the snow leopards had yellow fur, and in

Mongolia  $\frac{2}{27}$  of the snow leopards had yellow fur. What fraction of the snow leopards had yellow fur in these two countries?

Answer:  $\frac{8}{27}$  of the snow leopards

4. Snow leopard mothers can give birth to two cubs at one time. Cubs vary in size at birth. When two cubs were born, one weighed  $1\frac{1}{4}$  pounds (lbs), and the other weighed  $1\frac{3}{8}$  pounds. How much more did the bigger cub weigh? Reduce your answer if necessary.

Answer:  $\frac{1}{8}$  of a pound

5. The picture shows the weight in pounds for four snow leopards living in captivity in a zoo. In the snow leopard exhibit, a platform must support the weight of two of the snow leopards at the same time. Use the picture to find the minimum weight that the platform must support.

Answer: 196 pounds

6. In Central Asia, it is so cold that trees do not grow on the top of the high mountains where the snow leopard lives. As more snow falls, the snow leopard moves down the mountains into the trees. A snow leopard spends  $\frac{1}{3}$  of the year living above the tree line and  $\frac{1}{12}$  of a year traveling down the mountain to live below the tree line. What fraction of the year does the snow leopard spend living below the tree line?

Answer:  $\frac{7}{12}$  of a year

### Session 3 White Shark Unit A

1. Scientists estimate that an adult white shark will eat 11 tons of food in one year. How many tons of food would the shark eat in  $\frac{2}{5}$  of a year? Your answer will be a mixed number. When you enter your answer, put a space between the whole number and the fraction.

Answer:  $4\frac{2}{5}$  tons of food

2. The circle graph shows the types of food that the white shark eats.  $\frac{1}{3}$  of the diet is fish, rays and small prey. The other  $\frac{2}{3}$  is marine mammals. Use the circle graph to find the fraction of the total diet that is elephant seals.

Answer:  $\frac{2}{15}$  of the total diet

3. An adult white shark can swim 35 miles per hour. By comparison, an expert human swimmer can only swim  $\frac{1}{7}$  as fast. How many miles per hour can a human swim?

Answer: 5 miles per hour

4. White sharks are often found near the coast where large groups of seals live on the rocks and beaches. Sharks especially like to hunt for seal pups that are easy to catch. In the spring, about  $\frac{1}{3}$  of the seal population will be pups. If a shark catches  $\frac{1}{12}$  of the pups, what fraction of the total population of seals will be lost?

Answer:  $\frac{1}{36}$  of the population

5. The vertical number line shows how a shark traveled 20 feet up from the ocean floor to catch a seal.  $\frac{1}{4}$  of the shark's travel distance was up out of the water in the air. On its way up, the shark passed through seaweed. The seaweed grew  $\frac{1}{2}$  the distance from the ocean bottom to the surface. How many feet tall was the seaweed?

Answer: 7  $\frac{1}{2}$  feet tall

6. One white shark was tracked swimming from the coast of California toward the islands of Hawaii. It had traveled  $\frac{4}{5}$  of the distance between California and Hawaii when the signal from its radio transmitter was lost. Scientists looked at the radio signal and saw that at the  $\frac{1}{2}$  way point in the recording, the shark had a meal. What fraction of the total distance between California and Hawaii had the shark traveled when it had its meal?

Answer:  $\frac{2}{5}$  of the distance

#### Session 4 White Shark Unit B

1. A five-year-old white shark is  $\frac{2}{3}$  of its adult length. One year ago, it was  $\frac{1}{2}$  as long as it is now. What fraction of its adult length was it a year ago?

Answer:  $\frac{1}{3}$  its adult length

2. The table shows the fraction of shark attacks on people for different ocean activities in three areas of the world. How much more likely is it that a surfer in the United States will be attacked by a shark than a surfer in Australia? Your answer will be a mixed number.

Answer: 3  $\frac{1}{2}$  times more likely

3. Scientists who study white sharks use fish as bait to get a shark to approach the research boat so that a radio transmitter can be attached to the shark. One fish weighed  $6\frac{1}{3}$  pounds. If it is cut up into chunks each weighing  $\frac{1}{3}$  of a pound, how many pieces of bait will there be?

Answer: 19 pieces of fish bait

4. White Sharks are unusual fish because they can keep their blood warmer than the ocean water. A shark's body temperature can be  $1\frac{3}{7}$  times warmer than the ocean water. If a shark swims in water that is 56 degrees, what is the highest its body temperature could be?

Answer: 80 degrees

5. The bar graph shows the length in meters of five white sharks. How many times longer is the longest shark compared to the shortest? Report your answer as a mixed number.

Answer:  $2\frac{3}{5}$  times as long

6. A shark will often lose some teeth when it attacks prey, but the teeth are replaced by other teeth growing in its jaws. An adult shark has 52 teeth in all, and  $\frac{7}{13}$  are in its bottom jaw. How many teeth are in the shark's bottom jaw?

Answer: 28 teeth

### Session 5 Honeybee Unit A

1. Honeybees fly from the beehive to find flower nectar. One day, a beekeeper observed 100 bees leave the hive. Three-fourths of the bees flew toward a flower garden. The remaining  $\frac{1}{4}$  flew towards an orchard with flowering fruit trees. What is the probability that a bee returning to the hive has nectar from fruit tree flowers? Report your answer in decimal form, and include a zero before the decimal point.

Answer: 0.25 probability

2. The map shows how many honeybees traveled away from their beehive in search of nectar. Find the probability that a bee traveled 4 miles away from the hive. Enter your answer in decimal form. Include a zero to the left of the decimal point, and one digit to the right of the decimal point.

Answer: 0.1 probability

3. A beehive contains three types of honeybees. There is one queen, whose job is to lay eggs. Drones are males that are needed so that the queen will produce eggs. The rest are workers who obtain nectar, produce honey and care for the beehive. For every drone, there are 100 workers. A particular hive has 300 drones. How many workers does it contain? Your answer does not need a comma.

Answer: 30000 workers

4. There are 64 species of bees, but only 16 of these species are honeybees that produce honey. What is the probability that a bee species produces honey? Report your answer in decimal form with a zero before the decimal point.

Answer: 0.25 probability

5. The circle graph shows the different types of results from getting stung by a bee. Honeybees are not usually aggressive but they will sting if the hive is threatened. For most people the sting is not serious. For some people, the sting might lead to infection and the person would need to see a doctor. It happens rarely that some people die due to an allergic reaction to the venom in the sting. Use the data in the graph to find the probability that someone would die due to a bee sting. Report your answer as a decimal with a zero before the decimal point.

Answer: 0.015 probability

6. Almost all honeybees in a beehive are female, including the queen and the workers. In a particular hive with 500 bees, only 2 are male drones. What is the probability that a bee will be male? Enter your answer in decimal form, and include a zero before the decimal point.

Answer: 0.004 probability

### Session 6 Honeybee Unit B

1. People raise honeybees to help with pollination and also for honey. You want to buy a beehive so you can sell honey. Beekeeper 1 has five beehives that produce 300 pounds of honey per year. Beekeeper 2 has four hives that produce 280 pounds per year. Beekeeper 3 has six hives that produce 300 pounds per year. If you want the most production per year, which beekeeper should you buy a hive from? For your answer, enter the number of the beekeeper, not the pounds of honey.

Answer: 2 is most productive

2. The table shows how sweet three types of honey are. The amount of sweetness depends on the concentration. Concentration means the amount of honey relative to water. People were asked to rate how sweet the three types of honey were. Higher numbers mean more sweetness. At what concentration are the three types of honey rated as most different in sweetness? For your answer, enter the concentration, not the difference in sweetness. Use a zero before the decimal in your answer and report your answer to the first decimal place.

Answer: 0.5 concentration

3. Honeybees can become infected by a fly that lays eggs in the bee's body. This makes the bee act strangely. The infected bee will fly out of the hive at night and follow lights around. Beekeepers call these bees Zombees. In one beehive with 20000 bees, 20 were found to be infected with the Zombie fly. What is the probability of infection? Enter your answer in decimal form with a zero before the decimal point.

Answer: 0.001 probability

4. Keeping bees can be fun and profitable but beekeepers sometimes get stung by their bees when they are taking care of the beehives or harvesting honey. One beekeeper kept a journal and recorded that in one month, she was stung 15 times. Assuming that a month has 30 days, what is the probability of getting stung per day? Your answer will be in decimal form with a zero before the decimal point.

Answer: 0.5 probability

5. The line graph shows the amount of honey produced in three different beehives over three seasons. Which beehive is predicted to produce the most honey in the fourth season? Enter the number of the hive as your answer.

Answer: 2 is most productive

6. Some crops, like the almond tree, depend on honeybees for pollination. Economists estimate that for every dollar invested in a beehive, ten dollars will be earned from the almonds that are produced. Imagine that you spend

\$500 on a beehive and predict how much money you could earn from the almond trees pollinated by your bees.

Answer: 5000 dollars

### Session 7 Gray Wolf Unit A

1. Gray wolves are social animals. They usually live in packs consisting of a dominant adult male and female, several adolescent males, and younger wolves that are not ready to survive on their own. A pack needs a large territory to find enough prey for all its members. Scientists studied one pack that had a square territory that was 4 miles on each side. What is the perimeter of the territory?

Answer: 16 miles

2. The map shows the size of five states in the northwest United States that have gray wolf populations. One of the largest populations is in Wyoming. Use the map to find the area in square miles in Wyoming. Do not include a comma when you enter your answer.

Answer: 96250 square miles

3. A gray wolf was tracked by scientists as it traveled in a circle looking for prey. The circle had a radius of 1 mile. What was the circumference of the circle in miles? Use 3.14 for the value of pi.

Answer: 6.28 miles

4. Gray wolves sometimes need to be captured and moved to new areas where they are away from humans and livestock. Scientists and rangers use medicines to make the wolf sleep while it is being moved. The wolf is placed into a cage that is large enough for it to sleep but small enough so that it can't hurt itself. A cage is 4 feet long, 3 feet wide and 3 feet high. What is the volume of the cage in cubic feet?

Answer: 36 cubic feet

5. The map shows the location in miles between three wolves. Their locations are at the vertices of a right triangle. What is the area in square miles of the triangle? Use the formula  $\frac{1}{2}(\text{base})(\text{height})$ .

Answer: 9 square miles

6. Wolves communicate by howling together. Their calls can be heard over long distances. This helps a wolf pack control its territory. Imagine a wolf pack standing in the center of a circle. Their howls can be heard 4 miles away in any direction. Find the area of the circle across which the wolves can be heard. Remember, the formula for the area of a circle is pi times the radius squared. Use 3.14 as the value for pi.

Answer: 50.24 square miles

### Session 8 Gray Wolf Unit B

1. One gray wolf pack had a hunting territory that formed a circle. A road 20 miles long divided the circle in half. Hikers, hunters, and other humans were only permitted in the south half of the circle. How many square miles of territory were there in which both humans and wolves might be found? Remember that pi times the radius squared will give you the total area of the circle. Use 3.14 as the value of pi.

Answer: 157 square miles

2. The map shows an area in a national park where there are two gray wolf packs. The area forms a square with sides 12 miles long. A lake is located in the northwest corner of the square. Use the map to calculate the number of square miles in which the territories of the two packs overlap.

Answer: 36 square miles

3. Scientists and rangers sometimes move gray wolves to new areas where they will not harm livestock. Before the wolf is released, it is kept in a large wire pen until it has recovered from the trip. If a pen forms a circle with a circumference of 942 feet, what is its radius? Remember the formula for the circumference of a circle is pi times its diameter. Use 3.14 as the value for pi.

Answer: 150 feet

4. A gray wolf pack with five members will need 20 square miles of territory to have enough prey to survive. In a rectangular region that is 30 miles long and 10 miles wide, how many wolf packs could survive?

Answer: 15 packs

5. The map shows the territory of one gray wolf pack in Yellowstone National Park in Wyoming. The territory forms a right triangle measuring 40 square

miles. The distance from east to west forms the base of the triangle. Use the information in the map to find the territory distance from south to north. Remember that the area of a right triangle is one half its base times height.

Answer: 10 miles

6. When a female gray wolf is ready to give birth, she will look for a den where the cubs will be safe. One mother found a den that was 5 feet deep, 3 feet wide and 4 feet high. If each cub needs 10 cubic feet of space, how many cubs can fit into this den?

Answer: 6 cubs