

To the Teacher: The **Height Project** is most effective when it is initiated in early September and maintained throughout the school year.

HEIGHT

To the Student: This project will make you more knowledgeable about yourself, your classmates, and your surroundings. This project will also teach you about fractions, decimals, percent, averages, and long division. Measure and record the height of each of the following items in centimetres. Record your findings in the table below.

Things to Measure	September October	January	June	Special Instructions
your height				Make a tape of your height
a friend's height				
parent's or caregiver's height		NA	NA	
favourite pet's height or length				
desk height		NA	NA	
length of room		NA	NA	
width of room		NA	NA	
height of room		NA	NA	
circumference of a basketball or a pumpkin		NA	NA	

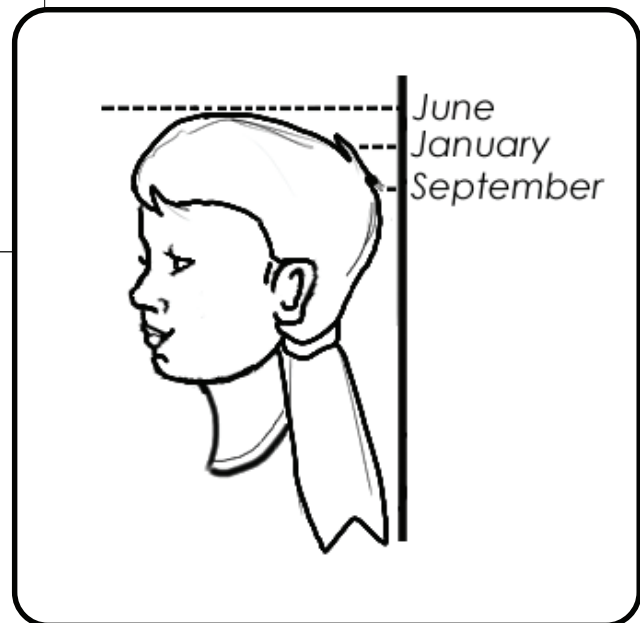
HEIGHT

A. Find the differences between:

- Your height in September, January, and June. How much had you grown each time that you measured?
- Your height and Vince Carter's of the Toronto Raptors basketball team. (Vince's height is **201 cm.**)
- Your height and your best friend's height.
- Your height and the height of the tallest or shortest person in your class.
- Your height and the height of the classroom door.
- Your height and the median (average) height of all your classmates.

B. Find the percentage differences between:

- Your height measurements in September, January, and the end of the school year.
- Your height and that of Vince Carter of the Toronto Raptors basketball team. (Vince's height is **201 cm.**)
- Your height and your best friend's height.
- The heights of the tallest and the shortest people in your class.



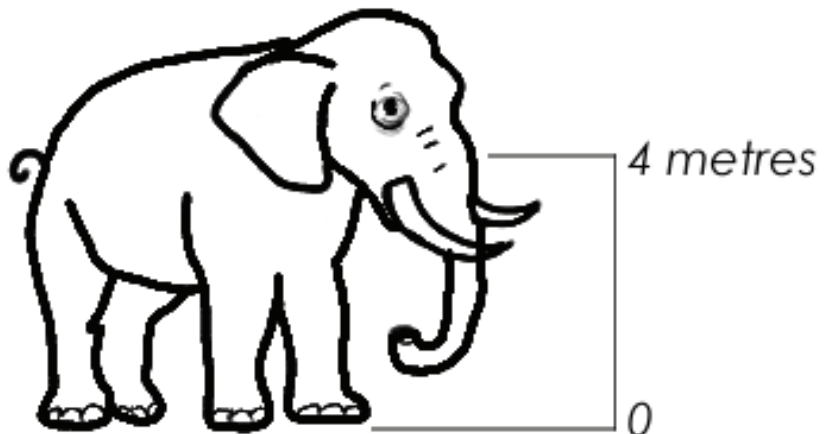
HEIGHT

C. Find the average height of the people in your class by creating a Stem and Leaf plot table.

D. Create a histogram showing the heights of the people in your class.

E. How many of *you* would it take to:

- Reach across the room?
- Reach the ceiling?
- Reach to the height of an elephant that commonly stands four metres at shoulder height?



F. This is a bonus question.

Find another class at the same grade level as your own. Compare the distribution of the data for both classes by creating a histogram and a circle graph for both classes. Then calculate the mean, the median, and the mode for each class and make comparisons. Finally, draw a double-bar graph comparing the number of people found in each range.

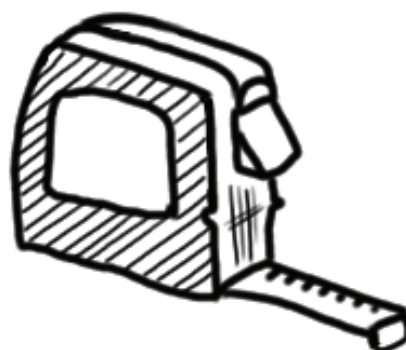
- Stand taller than the tallest human being?
(The tallest known human being is Robert Wadlow. Robert grew to:
162 cm by age 5;
183 cm by age 8;
201 cm by age 11; and
272 cm by age 22.)
- Reach across the gymnasium of your school?

Teaching Suggestions and Pitfalls for the **HEIGHT** Project

- This project is designed to take advantage of the natural interest children have both in their own bodies and in the environment around them.
- Several boxes in the *Height Project* spreadsheet remain incomplete, as it is anticipated that both students and teachers will wish to add their own items to the spreadsheet. Add or delete items to the table as your instructional program dictates.
- Ensure that you maintain a large stock of metre sticks, flexible cloth tapes, string, and blank adding-machine tape in your classroom. **Initially students should work in pairs when measuring objects and comparing findings.** Individuals will often encounter considerable differences in their findings, especially where they attempt lengthy measures, like the length or width of a classroom. However, these discrepancies in findings will provide you with opportunities to discuss common faulty measurement techniques such as:
 - Careless or “sloppy” procedures.
 - Failing to measure distance in a straight line.
 - Losing count.
 - Maintaining poor or inadequate records.

Note: *Students will soon understand that consensus regarding the length of a measured object will rarely (if ever) be reached unless great care is taken in the measurement process, and precise instruments are used. Students should recognize that most measurement has some margin of error. For example, the height of the author of this manual may be given as*

170 cm. However, this measurement may be a rounded version of a more exact measurement of 166 cm. Indeed, the author of this manual may reasonably stand as short as 1695 mm, or as tall as 1705 mm, although he may commonly choose to give his height as 170 cm. Accuracy of measurement depends entirely upon the precision of the measurement tools employed.



- **Assist your students when they make their first attempt at measuring their own heights.** The process of measuring individual student heights will move more quickly and efficiently if a measuring station is established in the classroom, in which metre sticks are taped to a wall or a doorway, and students are shown how to work in pairs when measuring their heights. Each student cuts a length of adding-machine tape that correlates to his height. Allow students to decorate their strips, and instruct students to print both their heights in centimetres and their names along the tops of the strips. When all strips are completed, arrange them in order from shortest to tallest, either on a large classroom bulletin board or in the hallway outside. The brightly decorated strips create an attractive and informative

display. You may wish to add further interest to the display by including student illustrations showing either Vince Carter's or Robert Wadlow's heights to the finished product, as this will provide powerful visual comparisons of human height variations, along with a realistic sense of individual student heights and growth potentials. Students should be able to read height as $100 + 28 = 128$ cm, or as **1m 28 cm**. Students should also be able to read this measurement as "one hundred and twenty-eight hundredths metres", and they should be able to write the decimal as **1.28 m**. This project works very well with the fraction and decimals exercises found in the *Fractions, Decimals and Percent* chapter of this manual.

- You will need to instruct students in operations involving the regrouping of large numbers, as they begin to look for differences in lengths. (See the *Numeracy* chapter of this manual for further information regarding the teaching of subtraction.) **Create concrete models of numbers showing differences when you teach strategies for finding differences.** Height strips will prove especially useful when you are showing visual representations of differences in length or height.
- **Demonstrate "counting on" when finding differences.** For example, a student whose height measures **129 cm** wishes to find the difference between her height and that of Vince Carter, whose height stands at **201 cm**. The student may count to **130**; then by tens to **200**; and then by one to **201**, yielding: $1 + 70 + 1 = 72$ cm. You may wish to model this regrouping process using base-ten blocks when showing the count to **200**. "Counting on in your head" provides an easy method for completing subtraction operations

with numbers less than **200**, while it also presents a useful parallel to the familiar process of making monetary change.

- In the grade-four year, **teach multi-step division in a contextualized, real-life setting**: divide the sum of all the students' heights by the number of students in the class in order to find the average class height. This process is modeled in the *Numeracy* chapter of this manual. Discuss the relationship between remainders, fractions and decimals. In almost all cases, it makes sense to round off remainders. **Calculators do not yield remainders**, and it is therefore important that you teach students to show long-division remainders in both fractional and decimal format. Remember that **the key to all effective instruction is the fostering of investigation and discovery, rather than rote memorization.**
- The *Height Project* allows you to introduce the concept of the "median" in both a visual and contextualized way with your students. Ask students to find the person situated in the middle of your display featuring decorated height strips. If the display features an odd number of strips, finding the median strip will be easy. In a class of **25** students the median will stand at the thirteenth strip. However, where your display features an even number of strips, you may initially wish either to avoid this activity altogether, or to calculate the median by finding the average of the two middle heights shown (person 13 and 14). You may also wish to ask students to find the median height of a group of students in the classroom. (Finding the median height of a group of four or five students is discussed more fully in the *Numeracy* chapter of the grades 4-6 manual.) Finding the median of given lengths may also

be employed as an introductory stepping-stone to the teaching of multi-digit division at the grade-four level.

Note: *Ensure that you collect all sheets of recorded data on a daily basis in order to avoid losing useful data.*

- **Asking:** “How many of you would it take to stretch as far as...?” employs the human body as a non-standard unit of measure. Posing this question promotes critical thinking and creative strategizing in problem solving. Use the adding-machine strips showing student heights when solving the question: “How many of you would it take to stretch to...?” You may also wish to expand this activity further by using other non-standard units of measurement, such as basketballs or batons when measuring the width or the length of the gym. This activity lends itself well to the teaching of multi-digit division and estimation skills. (*See the **Numeracy** chapter of this manual for further discussion regarding the teaching of multi-digit division and estimation skills.*)
- The percentage activities suggested in this project should only be introduced after students have had some practice with finding percentages during weekly graphing activities, and in some of the exercises found in either the **Fractions, Decimals and Percent** chapter or the **Probability and Data Analysis** chapter of this manual. **It is essential that students are able to use hundredths sheets** to show visual representations of percentages for fourths, fifths, tenths, and twentieths before attempting the percentage activities suggested in this project. It is also essential that students are able to understand the

decimal representations they see on a calculator. The percentages and fractions generated in this project yield mostly lengthy, repeating decimals. The **Height Project** will therefore present you with an opportunity to teach repeating and non-repeating fractions. This understanding is covered in the **Fractions, Decimals and Percent** chapter of this manual. This project will also present you with a wonderful opportunity to teach rounding and the need for it.

- Histograms can be used to collect and show data so that each class member does not have to be part of the bar graph. The employment of a histogram proves useful before drawing a circle graph. A histogram also proves useful when studying larger sampling groups, created perhaps by adding data drawn from another class at the same grade level.
- **Do not assign the bonus question unless mean, median and mode have been taught previously.** Avoid teaching all three together, as students find these terms confusing and often continue to use these terms interchangeably throughout subsequent school years.