Lesson 4: How big are cetaceans?

Objectives: Students will research and compare the lengths of different cetaceans and will display them using a "whale-o-meter." They will use multiplication to estimate the weight of killer whale (orca) at different ages. Optional activity: Students will use math to create life-size drawings of different cetaceans.

What you will need:

- Whale-o-meter data sheets (1 per student or group of students)
- Whale-o-meter rope (100 feet, marked in 10 foot increments with flagging tape or colored cable ties; have each mark labeled with the length measurement.)
- Access to a long hallway, sidewalk or playing field (at least 100 feet)
- Cetacean fact sheets (from Lesson 3) or other cetacean reference materials (internet or library)
- Optional: How fast does a killer whale grow? worksheet (page 4-6; 1 per student)
- Optional: Globe or world map showing the names of the oceans
- Graph paper (quarter inch squares, 1 piece per student; one inch squares, approximately 2 sheets per student)
- Butcher paper roll

Standards: CCSS.ELA-Literacy.RI.4.1; CCSS.ELA-Literacy.W.4.2; CCSS.ELA-Literacy.SL.4.4; CCSS.ELA-Literacy.W.4.7; CCSS.Math.Content.4.MD.A.1 (*How fast does a killer whale grow?* addresses CCSS.Math.Content.4.OA.2, CCSS.Math.Content.4.NBT.B.1; CCSS.Math.Content.4.NBT.B.2)

Strategy:

1. If possible, before class starts, set up the whale-o-meter rope by extending it along the edge of a hallway or sidewalk, or across a playing field.
2. Explain to the students that they are going to create a "whale-o-meter" (rhymes with thermometer). Write this word on the board.
3. Ask students what the word "meter" is used for. Give them hints—what do we use each of these items for? Use the illustration page (4-12) to show students these different types of meters and explain what they are used for.
    a. Thermometer (measuring temperature)
    b. Speedometer (measuring how fast a car is driving)
    c. Pedometer (measuring the number of steps someone takes)
    d. Odometer (in a car) (measuring how far the car has driven)
    e. Barometer (used by weather forecasters) (measuring atmospheric pressure)
    f. Seismometer (measuring how strong an earthquake is)
4. What did all the words have in common? (the word "meter" and they were all ways of MEASURING something)
5. Ask the students what they think a whale-o-meter would be used for (measuring whales!)

6. Explain that the students will be researching different types of cetaceans, and will be using the whale-o-meter to show the rest of the class how different cetaceans compare in length.
7. If you have more than 16 students, pair them up so you have no more than 16 pairs.
8. Give each student/pair of students a copy of the whale-o-meter data sheet and a copy of a cetacean fact sheet. Each student/pair of students will get a different whale or dolphin fact sheet.
9. Have the students use the fact sheets to complete the information on the whale-o-meter data sheet. It may be helpful to have a globe or map showing the names of the oceans to help students answer the question about where their cetacean lives.
10. Once students have completed the data sheets, have them take turns sharing the information on the sheet with the rest of the class.
11. Once everyone has shared their information with the class, take the class to the area where the rope has been set up. Explain that the rope is the whale-o-meter, and explain that it is marked in 10-foot increments.
12. Have each student/pair locate the point along the rope that represents the maximum length for their cetacean, and place their data sheet at that point. They will have to estimate the distances by using the 10 foot increments as a guide (you can have them use rulers if you want them to get exact measurements).
13. Have one student (or teaching assistant) stand at the "zero" point of the line. Walk to the first whale-o-meter data sheet. If all 16 fact sheets were used, this first data sheet should be the spinner dolphin, at 7 feet. Pick up the data sheet. Explain to students that the distance between you and the person at the "zero" is the length of a spinner dolphin (7 feet). Replace the data sheet. Move to the next closest fact sheet. Repeat for all of the fact sheets (you should end up with the blue whale, which can get to 108 feet).
14. In the classroom, have students complete the "How fast does a killer whale grow?" worksheet.
15. OPTIONAL ACTIVITY: Creating a life-size drawing of a whale or dolphin. If using butcher paper, this activity is best done in a multi-purpose room or gymnasium with hard floors and lots of room to spread out! If done outside, a basketball court or empty parking lot is ideal.
    a. Divide the class into groups of five to ten. Assign each group one of the cetaceans for which there is a scale drawing (pages 4-8 to 4-9).
    b. Provide each student with one of each of the two types of graph paper (1/4"--page 4-10 and 1"-- page 4-11).
    c. Have students trace around a fairly small object (preferably something with an irregular shape, like their handprint; if you have access to stencils, those might be good for this activity) on the ¼" graph paper. The traced object should fit within the grid given.
    d. Explain to the students that they are going to make an enlarged version of their drawing, by using the 1" grid paper. Have the students number their small squares as shown below. Have them number their large squares the same way.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70

e. Have the students transfer their drawing from the small squares to the large squares. It is easiest to do this one square at a time. The numbers will help the students keep track of the squares.

f. Now explain to the students that they will be using this same method to create life-size drawings of whales. Distribute one or two sheets of 1" graph paper to each group. Explain that the students will copy the drawing of their whale from the scale drawing onto the 1" graph paper (they can trace the drawing if they would prefer). They should number the squares as they did for the first activity. If possible, make two or three copies of the finished drawing for the students to work from in the next step.

g. If using butcher paper, unroll the butcher paper*. Use a 100' tape measure to cut the butcher paper into lengths appropriate for the whales to be drawn. The larger whales will need several pieces of butcher paper, as they are from 20-30 feet high (the number of pieces will be determined by the width of the butcher paper). Help the students tape their butcher paper sheets together (masking tape is good for this as students will be able to draw over the masking tape with pencil).

h. Have pairs of students stretch out tape measures along all 4 sides of each sheet of paper. Have another student hold the end of a carpenter's chalk line at one of the ten foot marks. Stretch the line to the opposite ten foot mark. Have another student put their finger on the chalk line at that opposite side of the paper. Lift up the line slightly and allow it to snap down on the paper. Pick up the line and move it to the next ten foot increment (try not to drag it on the paper). Repeat. You may be able to get 3-4 lines marked before you have to wind the chalk line back into the spool and then start again.

i. Once the lines are marked, the group of students should use pencil to lightly number the squares to match the squares on their scale drawing.

j. The students should then work together to transfer the drawing to the butcher paper. Each student should copy an equal number of squares. Once the outline is finished, the students can use paint or thick markers to trace the complete outline.

k. If desired, you could have the students estimate the area of their whale's outline (each square is 100 square feet).

*Amount of butcher paper needed will be as follows:

Bottlenose dolphin: 3 feet x 10 feet
Beluga: 6 feet x 16 feet
Cuvier's beaked whale: 6 feet x 23 feet
Orca: 16 feet x 30 feet
Humpback: 18 feet x 50 feet
Right whale: 20 feet x 55 feet
Fin whale: 18 feet x 80 feet
Blue whale: 26 feet x 82 feet

References:

- *How fast does a killer whale grow?* worksheet is adapted from a Sea World activity called "Graphing Growth" http://www.seaworld.org/just-for-teachers/classroom-activities/4-8/pdf/Graphing%20Growth.pdf
- *Whale-o-meter* is adapted from Shark Trust's "Make your own sharkometer" www.eggcase.org/do_download.asp?did=26628
- *Life-size whale* is adapted from Aquatic Project Wild activity "Whale of a Tail"

Student name(s): _____

WHALE-O-METER data sheet

My whale is called a _____

My whale is a (circle one) baleen whale toothed whale

My whale can grow as big as _____ feet long.

My whale lives in the (circle all that apply)

Pacific Ocean Atlantic Ocean Arctic Ocean Indian Ocean

Some interesting things that I learned about my whale: (suggestions: How deep can it dive? How long can it hold its breath? Does it have unusual color patterns or markings? What does it eat? Does it have any other names?)

_____

_____

_____

_____

_____

_____

_____

Use the back side of this sheet to draw a picture of your whale

Student name: _____

How fast does a killer whale grow?

A baby killer whale weighs about 350 pounds at birth. For the first two years of its life, it grows at a rate of about 60 pounds every month. Between year two and three, a killer whale averages about 80 pounds of weight gain per month. Between years three and five, the growth slows with an average weight gain of about 30 pounds a month.

1. Based on the information given above, calculate how much a killer whale should weigh at each age. Show your calculations in the "Weight" boxes and circle your answer:

Age (months)	Weight (pounds)
3	*Example:* 350 + (3 x 60) = 350 + 180 = (530)
6	
12	
24	
36	
48	
60	

2. A 2012 Volkswagen beetle car weighs 2939 pounds. Circle the one that weighs more: is it the 4-year-old killer whale, or the Volkswagen beetle?

ANSWER KEY

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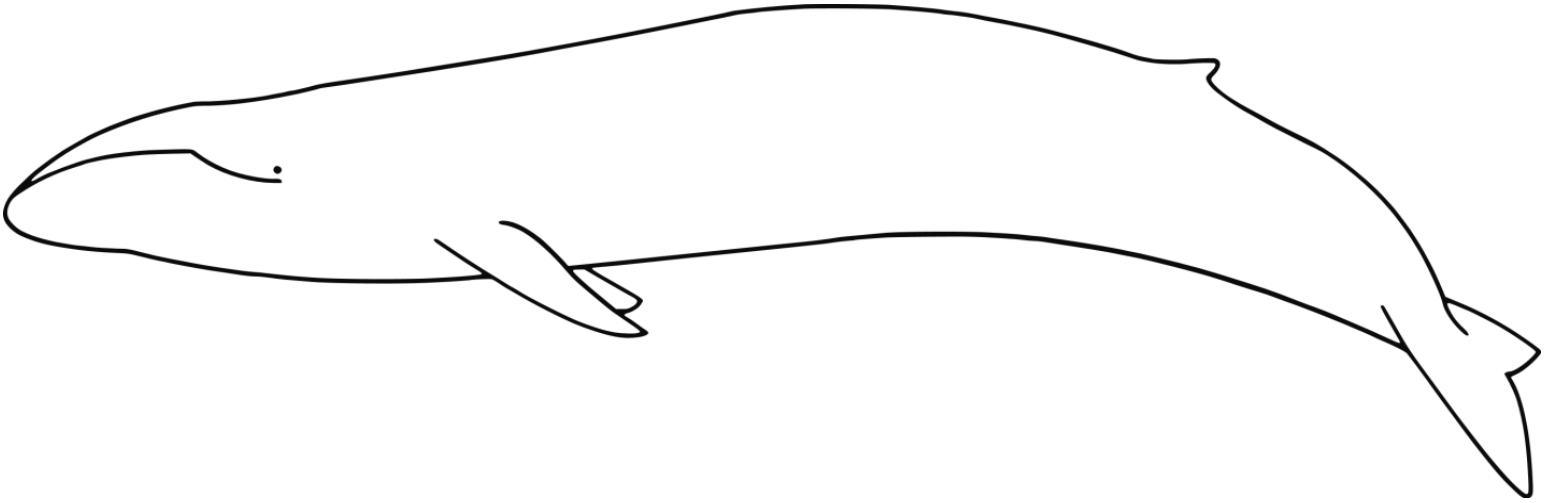
Age (months)	Weight (pounds)
3	*Example:* 350 + (3 x 60) = 350 + 180 = 530
6	350 + (6 x 60) = 710 *Alternate solution* 530 + (3 x 60)
12	350 + (12 x 60) = 1070 *Alternate solutions* 710 + (6 x 60) *Or* 530 + (9 x 60)
24	350 + (24 x 60) = 1790 *Alternate solutions* 1070 + (12 x 60) *Or* 710 + (18 x 60) *Or* 530 + (21 x 60)
36	1790 + (12 x 80) = 2750
48	2750 + (12 x 30) = 3110
60	3110 + (12 x 30) = 3470

2. A 2012 Volkswagen beetle car weighs 2939 pounds. Circle the one that weighs more: is it the 4-year-old killer whale, or the Volkswagen beetle?

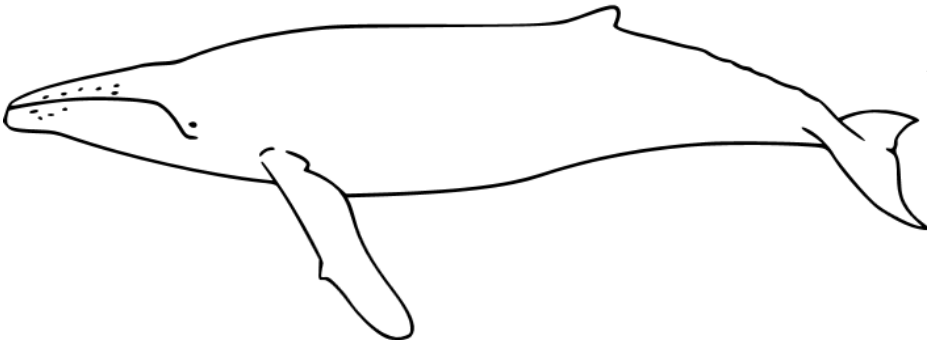
Cetacean Sketches for Scale Drawing

Beluga (16 feet)

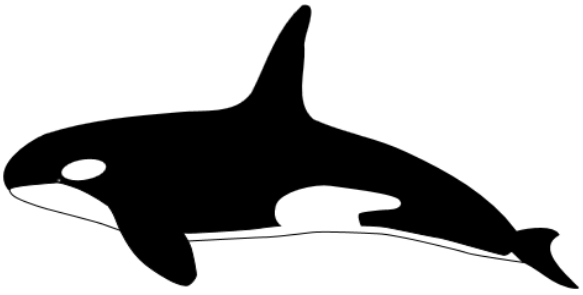
Blue whale in the Atlantic Ocean (88 feet)



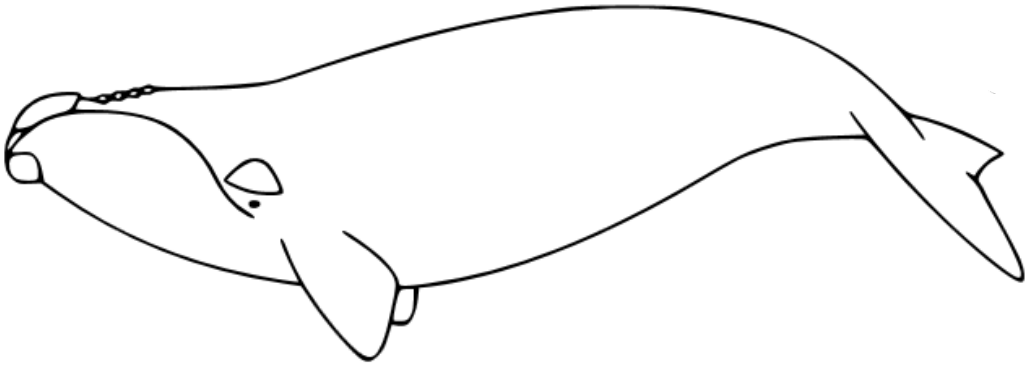
Humpback whale (48 feet)



Killer whale (orca) (30 feet)



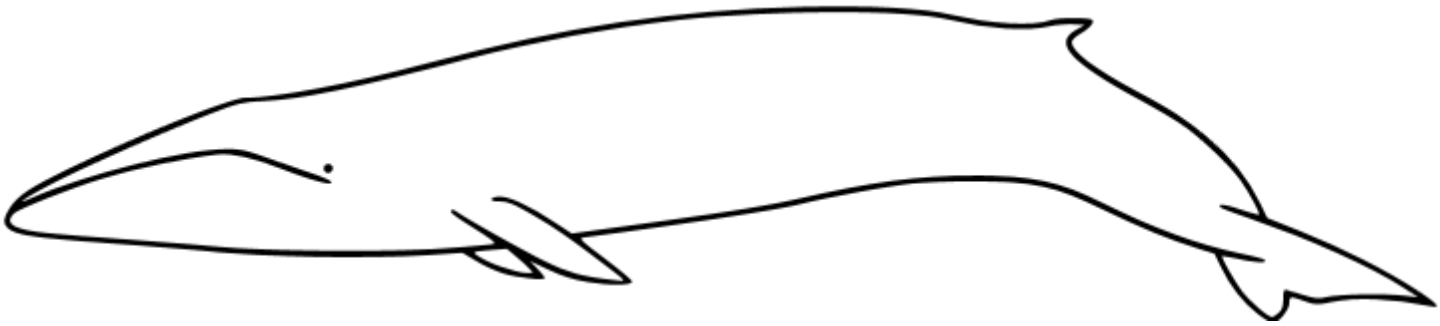
North Atlantic Right Whale (55 feet)

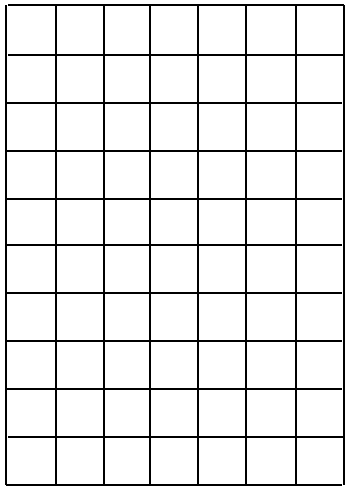


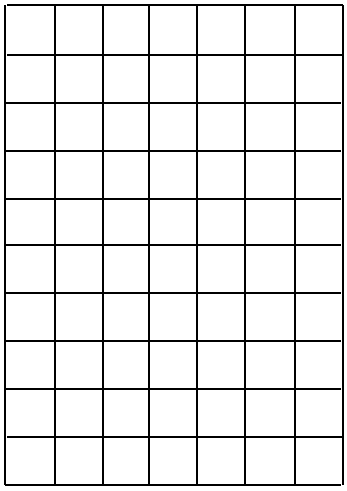
Bottlenose dolphin (9 feet)

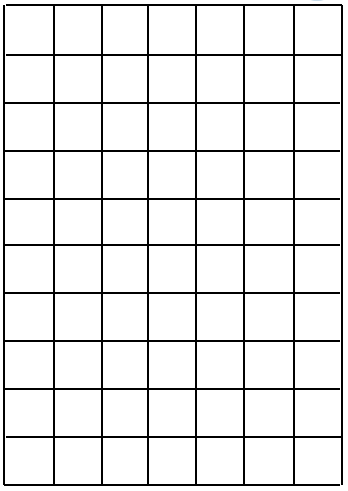
Cuvier's beaked whale (23 feet)

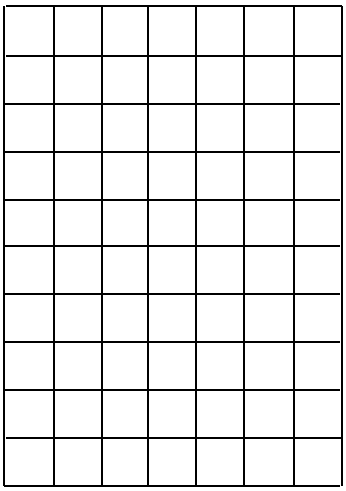
Fin whale (78 feet)

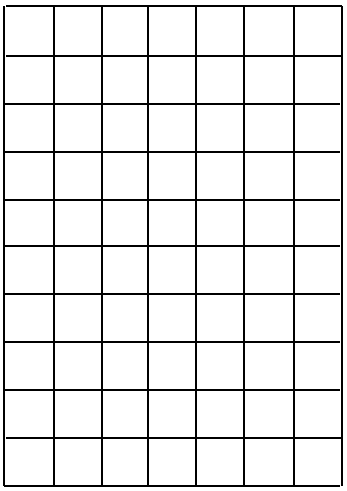


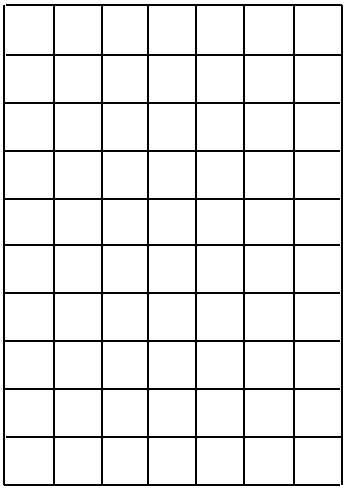


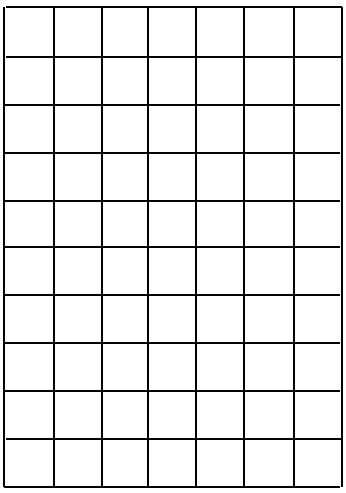


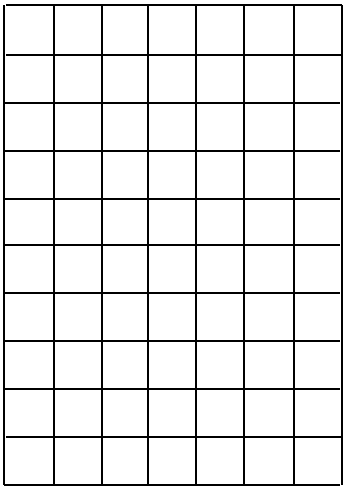


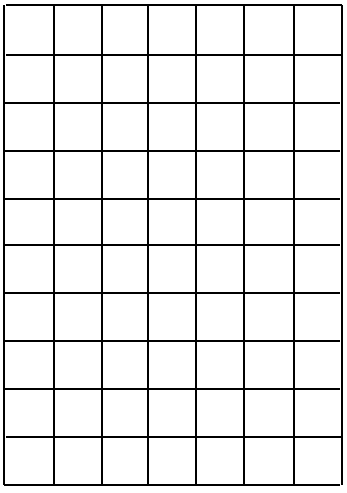






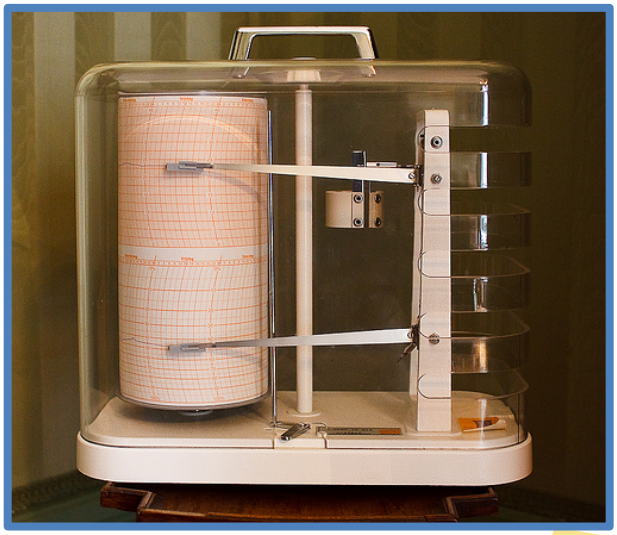






SEISMOMETER

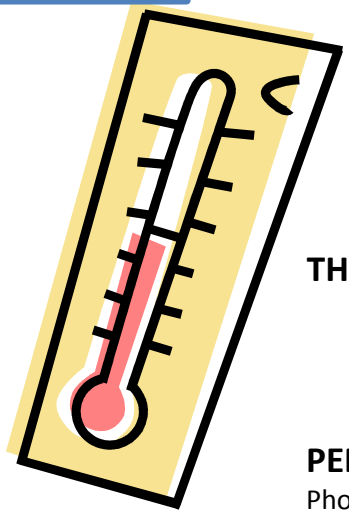
Photo credit: Michele Ahin



SPEEDOMETER / ODOMETER

(looks a bit like a clock)

Photo credit: Flickr user exfordy



THERMOMETER

BAROMETER

www.edupic.net

PEDOMETER

Photo credit: Flickr user yksin