

Below are 10 common math problems presented to students. These examples show how humane education can be included in any subject (in this case, math).

Describe the relationship between fractions, decimals and percents:

Convert the given numerical expression in each statement below to the other two forms:

A. 66% of US lakes were “impaired”—unsafe for drinking, fishing, or even swimming (Water Quality Inventory Report to Congress 2006-2008, USEPA)

B. Cutting meat, dairy and egg consumption by 50% lowers heart attack risk by 45% (Sierra Club World Hunger Fact Sheet)

C. Livestock production uses  $\frac{3}{10}$  of the land surface of the planet (Food and Agricultural Organization of the United Nations “Livestock’s Long Shadow” 2006).

D. 99% of livestock in the US are raised on factory farms (Farm Forward)

E. About 0.7 of the world's rangeland in dry areas is overgrazed (Food and Agricultural Organization of the United Nations, Agriculture and Consumer Protection Department Magazine 2006)

F. 85% of fur animals are raised on fur farms (PETA)

G. .72 of all poultry production, .43 of all eggs production and .55 of all pork production worldwide come from concentrated feeding operations (factory farms) (United Nations Food and Agricultural Organization as reported by Worldwatch Institute “Rising Number of Farm Animals Poses Environmental Public Health Risks”)

H. Grazing the US has impacted 22% of federal endangered/threatened species (Wilcove, D. S., D. Rothstein, J Dubow, A Phillips, E. Losos. 1998. Quantifying threats to imperiled species in the United States: assessing the relative importance of habitat destruction, alien species, pollution, overexploitation and disease. BioScience 48(8): 610 as reported by the National Public Lands Grazing Campaign)

Describe and Compare Two Sets of Data (Use Ratios and Notations)

1. It takes more than 10kg of grain to make 1 kg of beef (2008 Agricultural Statistics Annual, USDA)

- A. What ratio represents this?
- B. Write a ratio to represent a product of 3kg of beef
- C. What about producing 10 kg of beef?
- D. What does this tell you about the production of beef?

2. Americans eat the equivalent of 800 kg of grain per person per year. Most of this is in meat or animal product form. Underdeveloped countries, for example India, eat 200 kg of grain or grain equivalent per year. (Data from Lester R. Brown, Full House: Reassessing the Earth’s Population Carrying Capacity (New York: W.W. Norton, 1994) as reported in Ethics of Consumption, David A. Crocker and Tony Lindon, eds. )

- A. Express as a ratio.
- B. Compare, in words, the grain consumption of the U.S. and India

3. In 2012, there were an estimated 1.3 billion domestic cattle in the world (USDA) and 7 billion people (Population Reference Bureau).

A. Write this ratio using integers (no decimals).

4. As settlers moved west across America, they slaughtered almost all the buffalo. From 1864-1889, the population dropped from over 25 million to just over 1000.(Defenders of Wildlife)

A. What was the average number of buffalo slaughtered each year during the period from 1864-1889?

### Describe Orally and in Writing Prime and Composite Numbers

1.Solve the mystery phrase by choosing the answer applying to the given number, then plugging in its correlating letter.

1. 3 -- prime=B, composite=A
2. 5 -- prime=E, composite -D
3. 4 -- prime=I, composite=K
4. 146--prime=C, composite=I
5. 302--prime=G, composite=N
6. 57--prime=D, composite=S
7. 9--prime=E, composite=T
8. 31--prime=O, composite=M
9. 223--prime=A, composite=E
10. 108--prime=N, composite=L
11. 55--prime=S, composite=L
12. 442--prime=C, composite=L
13. 8--prime=B, composite=I
- 14.53 prime=V, composite=H
15. 21 prime=G, composite= I
16. 19 prime=N, composite=K
17. 775 prime=O, composite=G
18. 71prime=B, composite=A
19. 93 prime=E, composite=V
20. 15 prime =N, composite=I
21. 20 prime=C, composite=N
22. 11 prime=G, composite=E
23. 47 prime=S, composite=W

Answer: Be Kind To All Living Beings

2. Identify whether the statistics in the following statements are prime or composite:

- A. The domestic dog dates back over 50,000 years.
- B. As much as 29 million gallons of petroleum enter North American waterways every year as a result of human activity (The National Academies News, May 23, 2002)
- C. About 100,000 albatrosses are killed by long-line fisheries each year (Birdlife International)
- D. There are nearly 500 alternatives presently available to dissection for science research (Dissection and Student Rights, Animalearn)

### Identify and Represent Integers on Number Scale

1. Construct a BAR GRAPH representing world meat production from 1961-2001 (in million tons). Give your graph a title and label both the horizontal and vertical axes.

1961: 71  
1966: 88  
1971: 105  
1976: 118  
1981: 139  
1986: 160  
1991: 184  
1996: 207  
2001: 237

(Food and Agricultural Organization of the United Nations Data from Patterns of World Poultry Consumption and Production, Economic Research Service, USDA)

What has happened to meat production over the last 50 years?  
Do you think this is an important change? Is it good? Bad?

2. Read the following summary and construct a LINE GRAPH representing the amount of world carbon emissions due to fossil fuels from 1950 to 2009. In 1950, 1630 million metric tons of carbon were emitted into the air. While this may sound like a lot, it is dwarfed next to 2,577 million metric tons emitted in 1960. Indeed, only 5 years later, emissions had already increased by 568. By 1965, carbon emissions reached 3145, almost doubling the 1950 figure.

Until now, increases had been fairly steady, but in the five years from 1965-70, carbon emissions exploded, increasing by 931. In 1975, carbon emissions were at 4614 million metric tons, which increased to 5316 in the following 5 years, and then suddenly increased by only 118 in the five years between 1980 and 1985. By 1990, however, emission levels had reached 6149. The decade ended on a positive note, with emissions increasing only by 589 by decade's end. By 2005, emissions had increased to 7971 and for years later increased by another 427. (All data from "Global Carbon Dioxide Emissions from Fossil Fuel Burning 1751-2009" Earth Policy Institute)

Using the slope (steepness) of the line segments, what period of time accounted for the greatest increase in carbon emissions? For the least increase?

Based on your chart, can you make a guess of the carbon emissions from 2010-2020?

### MEASUREMENT

#### Compare, Estimate and Convert Length, Volume, Mass/Weight

1. Free Roam animal sanctuary is taking four zebras next week from a zoo across the country. Like many zoo animals, these zebra have lived a life behind bars, bored, lonely and frustrated. Thanks to public pressure, the zoo has agreed to give the zebras to a sanctuary where they can live a more natural life. Tomorrow, they will begin their journey by truck, across the country. Concerned for the zebras' safety, the sanctuary asked the zoo what route they will take, so they can calculate how many kilometers they must travel. Convert the zoo's answer, in meters, to kilometers.

- A. 80,000 m
- B. 960,000 m
- C. 6,400,000 m

2. Peace Pilgrim is an American woman who, for many years until her death, walked continuously across the U.S. in the name of peace. Her motto, "I shall remain a wanderer until mankind has learned the ways of peace," led her across the country several times. Estimate and then calculate various distances of her journey.

- A. The U.S. is around 4,000 km in length, across the middle. Assuming she walked straight through the middle, how many meters did Peace Pilgrim walk each time?
- B. How many kilometers would she have walked after 3 trips back and forth across the U.S.?

3. Factory farming forces animals to live in extreme, unnatural confinement. Many people and governments are now demanding better conditions for farm animals, including more space. Examine the measurements below, converting centimeters to both millimeters and meters.

a. Until January 2012, in Britain, broiler hens (egg-laying chickens) were crammed so tightly together in cages that each has only 17.8 cm x 25 cm of space. An average European battery hen cage contained four or five birds in a 35.5 cm x 43 cm cage.

b. In January 2012, the European Union changed the law and hens on farms of more than 350 birds must be kept in cages that are a minimum of 750 cm<sup>2</sup> and at least 45 cm high. Cages are also required to provide nest areas, a littered scratching area, perch space, and claw shortening devices.

c. A typical veal crate measures 61 cm wide x 152 cm deep, at the largest point. Veal calves are forced to live in this tiny space for 22 weeks. Most of this time, they cannot turn around or even stretch their legs.

4. Leroy has a fish tank at his house with five fish. Leroy never thought too much about them, but recently, he has been wondering whether his fish are happy living in a tank. He notices that all they are able to do is swim around and around, never going anywhere. This strikes Leroy as very unnatural and unfair, so he has decided to give his fish a larger tank with more to do. Leroy is considering various volumes for the new tank. Convert these amounts from liters to cubic meters.

Right now, he has a 19 liter tank.  
He may buy a 26 liter tank.  
How much would a 23 liter tank be?  
He is considering a 32 liter tank.

5. Moshe loves visiting his local swimming pool on hot days. It's always fun to fool around in the water with friends, but every time Moshe comes to the pool, he finds many insects in the water, unable to fly out. This really upsets him, and he and his friends have taken to paddling through the pool at regular intervals, saving drowning bugs. How much water (convert to cubic meters and cubic centimeters) are they paddling through if the pool is:

- A. 19,000 L
- B. 38,000 L
- C. 247,000 L

6. Rex, a tiger has been with the Galaxy Circus for eight years. Taken from the jungle as a baby, he is forced to live in captivity and perform for people all over the country. Rex is fortunate. The circus has lost so much money, they are closing, and they have agreed to send Rex to an animal sanctuary where he can at last live in peace. To keep Rex calm while they transport him, sanctuary workers will sedate him. They asked the circus to tell them his weight in order to determine how much sedative to administer. The circus gave them Rex's weight in tons, but they need it in kilograms. Help them convert Rex's weight if he is:

- A. 1 ton
- B. .175 tons
- C. .035 tons

7. Myrna directs a camp that brings Arab and Israeli children together each summer. The camp focuses on breaking down barriers and stereotypes between the groups by showing them that they are more similar than different. Today, Myrna is leading an activity called the Human Pyramid in which the camp divides into groups of 10 people each. Each group makes a human pyramid by forming rows which kneel on one another, reducing the numbers as it goes up. Everyone's weight must be compared so the heaviest are on the bottom and the lightest on top. Each camper has told Myrna his/her weight, but some told her in kilograms and others in grams. Help her by converting each answer to its alternate form (convert kg to g, and g to kg).

- A. 100 kg
- B. 126 kg
- C. 144,000 g
- D. 116 kg
- E. 158,000 g

#### Applying Perimeter Versus Area

1. The citizens of Red Hill town have become upset over the use of carriage horse rides on their streets. Carriage horses live lives of servitude, often suffering from heat or cold stress, as well as physical exhaustion. The concerned citizens are collecting information about how far the horses must pull people, to present to the city board. Do the methods below involve area or perimeter?

- A. They want to measure how much distance the horses cover as they follow the path around the city, in a big loop.
- B. They want to measure the distance the horses travel as they cover the roads within the city limits, zig-zagging back and forth.

2. Dog racing is a multi-million dollar industry. Thousands of people make and lose money on bets based on which dog can run the fastest. Many dogs suffer permanent injuries from overtraining and being forced to compete while injured. Many dogs are killed once they are too old or ill to compete. A concerned group is calculating how far these dogs are forced to run on average. Do the methods below involve area or perimeter?

- A. They are measuring the track on which the dogs run, which encircles a field.
- B. They are measuring a field on which the dogs run up and down, across and back, until they have covered the whole field.

3. Leah has always kept stray dogs and cats at her house, taking them in when they have no one. Her house is becoming increasingly filled with non-humans, and she has decided that she needs to calculate its maximum capacity before it gets overcrowded. Do the methods below involve area or perimeter?

- A. She plans to measure the amount of space in each room in her house and add it all together.
- B. She will walk around her house, measuring the total length of each side, then add these all together.

#### Finding the Quotient

1. As an experiment, for the past 2 years, a university has been using plastic animal models in place of real animals for certain biology experiments. Professors have noted an increase in students' performance and grades, but they want to calculate the exact difference. They have compiled exam scores from various courses over the past 2 years, and are comparing the percentage of A's to previous years, before the models were introduced. Performing the division below shows that using models rather than real animals will multiply the number of A's by your result. For example:  $.452/.245 = 1.84$  This means that by using models in this course the number of A's increased 1.84 TIMES or almost twice as many more A's!!!!

- A.  $.293/.068$
- B.  $.825/.470$
- C.  $.922/.701$
- D.  $.889/.617$

2. While playing in the playground, a group of friends found an ant who appeared to be hurt. They were very concerned and decided to build him a little shelter he could retreat to when he wanted to rest. They want to make it four times the length of his body, so he has enough room to move around comfortably. Fill in the table below, dividing the ant's body length into the length of the proposed shelter, and determine whether the shelter will be long enough for him. If it is bigger than needed, how many times bigger is it?

	<u>Ant's body length</u>	<u>Proposed shelter length</u>	<u>Divide</u>	<u>Big enough?</u>	<u># times bigger</u>
A.	4 mm	12 m			
B.	6 mm	24 mm			
C.	5 mm	2 cm			
D.	5 mm	4 cm			
E.	5 mm	21 mm			

Find Circumference and Area of Circle When Given Radius/Diameter

1. A group of birds, deer and other wild animals in Great Tree Forest are joining forces to stop humans from hunting them. They know the hunters hang bulls-eye targets on trees to practice shooting, so they will cover these with messages like "Hunting is cruel, not recreation" and "All animals have a right to life." To cover the targets perfectly, they need the exact measurements of each bull's eye. They measured the radius/diameter of each. Help them find the area and circumference, based on this information.

- A. diameter = 17 cm
- B. radius = 10 cm
- C. radius = 8 cm
- D. diameter = 26 cm

2. The foxes at Farmer Jack's fur farm have an escape plan which they hope will save their lives. They found a way to sneak out of their cages and into an abandoned wagon large enough to carry all of them to safety. But one wheel is broken and they must build another of the exact size. They measured the diameter of another wheel, so they know how big it must be. Help them calculate the necessary area and circumference, based on the diameter.

- A. diameter = 1 m
- B. diameter = 1.5 m
- C. diameter = 2 m

Calculate Angle Measures and create a pie chart (need compass and protractor)

1. Create a pie chart representing the following statistics showing greenhouse gas emissions which lead to global warming. You will need to convert the percentages to degrees. For example: Water is 3%, so  $.03(360)=10.8$  degrees. You may need to round up or down to get a total of 360 degrees. Don't forget to title and label your chart.

Agriculture 14%  
Forestry 17%  
Industry 19%  
Energy Supply 26%  
Transportation 13%  
Residential and commercial buildings 8%  
Water/wastewater 3%

(International Panel on Climate Change, Fourth Assessment Report:  
Climate Change 2007)

What can you deduce about the impact of agriculture on greenhouse gas emissions compared to other factors?

2. Create a pie chart for the following Year 2020 World Population Breakdown(7.5 billion)  
You will need to calculate percentages first, then angle degrees. Title and label your chart.

Asia 4,641,054,775  
Africa 1,340,598,147  
Europe 747,636,026  
South America 430,759,766  
North America 368,869,647  
Oceania 42,677,813

(world population review.com)

### Rectangular Prisms, Cones, Cylinders, Pyramids (Sketch, Construct, Classify)

1. A local architect was commissioned to design a series of buildings for downtown Tel Aviv. To demonstrate his ideas, he built smaller reproductions. When the project was over, he offered to give the reproductions to the local animal shelter, as it is the right size for individual dog and cat houses. The shelter has accepted them and is now trying to match each house's shape with a corresponding animal. Read the description of each animal below and match each with the shape that would best house him or her. Sketch each shape next to your answer.

A. Seymour the cat is long and thin. He loves standing on his hind legs and stretching straight up. He can stay that way for an hour!

B. Hans the dog loves to sit with all four paws spread out, forming a square around himself, but his body gets narrower higher up, ending with his small head.

C. Sandra the cat loves curling up on the floor. She can get her body into almost a perfect circle. She's most comfortable when her surroundings are tight around her.

D. Sylvester the cat loves nooks and crannies. He prefers a space that isn't smooth, but has angles, which are more fun. He isn't partial to roundness.

E. Sadie, the dog, has a big, bushy tail. She likes to wrap it around her body, making a big circle. Her torso is also very big and fluffy. In fact, when she is sitting up, Sadie's body appears quite streamlined from top to bottom: it is uniformly big and fluffy.

F. Geoffrey, the dog, loves four-sided rooms because he enjoys pressing himself up against the wall and walking around while leaning into it. To do this, he needs a smooth, flat walking surface.

2. Choose two of these shapes and construct them with construction paper.

3. Alisheva is building a bird house for the birds in her yard because she wants to ensure that they always have food and shelter. She has directions to make either a cylinder- or pyramid-shaped house, but only has the supplies to make one. For each criteria below, name the option that would work the best:

- A. She has a food stick that is most easily hung from a high corner.
- B. The birds who hang around have big tails, lower bodies, and small heads.
- C. The birds tend to be long-legged and thin, with short tail and wing feathers.
- D. The birds enjoy perching on slanted surfaces and sharp corners.
- E. The birds enjoy perching on flat surfaces.