Grade 7 (Pre-algebra) End-of-Year Test
International Version

This test is quite long, because it contains lots of questions on all of the major topics covered in the *Math Mammoth Grade 7* curriculum. Its main purpose is to be a diagnostic test—to find out what the student knows and does not know about these topics.

You can use this test to evaluate a student's readiness for continuing to Math Mammoth Grade 8, or continuing to an Algebra 1 course. In the latter case, it is sufficient to administer the *first four sections* (Integers through Ratios, Proportions, and Percent), because the topics covered in those are prerequisites for algebra or directly related to algebra. The sections on geometry, statistics, and probability are not essential for a student to be able to continue to Algebra 1.

Since the test is so long, I recommend that you break it into several parts and administer them on consecutive days, or perhaps on morning/evening/morning/evening. Use your judgement.

A calculator is *not* allowed for the first three sections of the test: Integers, Rational Numbers, and Algebra.

A basic calculator *is* allowed for the last four sections of the test: Ratios, Proportions, and Percent; Geometry, Probability, and Statistics.

The test is evaluating the student's ability in the following content areas:

- operations with integers
- multiplication and division of decimals and fractions, including with negative decimals and fractions
- converting fractions to decimals and vice versa
- simplifying expressions
- solving certain types of linear equations and linear inequalities
- writing simple equations and inequalities for word problems
- proportional relationships
- unit rates that involve fractions
- basic percent problems, including percentage of change
- working with scale drawings
- drawing triangles
- the area and circumference of a circle
- some angle relationships
- cross-sections formed when a plane cuts a solid
- solving problems involving area, surface area, and volume
- simple probability
- listing all possible outcomes for a compound event
- experimental probability, including designing a simulation
- biased vs. unbiased sampling methods
- making predictions based on samples
- comparing two populations and determining whether the difference in their medians is significant

If you are using this test to evaluate a student's readiness for Algebra 1, I recommend that the student score a minimum of 80% on the first four sections (Integers through Ratios, Proportions, and Percent). The subtotal for those is 120 points. A score of 96 points is 80%.

I also recommend that the teacher or parent revise with the student any content areas in which the student may be weak. Students scoring between 70% and 80% in the first four sections may also continue to Algebra 1, depending on the types of errors (careless errors or not remembering something, versus a lack of understanding). Use your judgment.

You can use the last four sections to evaluate the student's mastery of topics in Math Mammoth Grade 7 Curriculum. However, mastery of those sections is not essential for a student's success in an Algebra 1 course.

The two geometry problems marked with an asterisk (*) are beyond the Common Core Standards for 7th grade.

My suggestion for points per item is as follows.

Question #	Max. points	Student score
Integers		
1	2 points	
2	2 points	
3	2 points	
4a-f (1 pt each)	6 points	
4g-i (2 pts each)	6 points	
5	2 points	
6	2 points	
7	3 points	
	subtotal	/ 25
Rational Numbers		
8	3 points	
9	3 points	
10	4 points	
11	4 points	
12	6 points	
13	2 points	
14	4 points	
	subtotal	/ 26
Algebra		
15	6 points	
16	3 points	
17	8 points	
18	12 points	
19	2 points	

Question #	Max. points	Student score
20	2 points	
21	4 points	
22a	2 points	
22b	1 point	
	subtotal	/ 40
Ratios, Proportions, and Percent		
23	4 points	
24a	1 point	
24b	2 points	
24c	1 point	
24d	1 point	
25a	1 point	
25b	2 points	
26	Proportion: 1 point Solution: 2 points	
27	2 points	
28	2 points	
29	2 points	
30	2 points	
31	2 points	
32	2 points	
33	2 points	
	subtotal	/ 29
SUBTOTAL FOR THE FIRST FOUR SECTIONS:		**/120**

Question #	Max. points	Student score
Geometry		
34a	2 points	
34b	2 points	
35	3 points	
36	2 points	
37a	2 points	
37b	2 points	
37c	1 point	
38	2 points	
39a	1 points	
39b	3 points	
40	2 points	
41	2 points	
42	3 points	
43a	2 points	
43b	2 points	
44	3 points	
45a	2 points	
45b	1 point	
46a	1 point	
46b	1 point	
47a	1 point	
47b	1 point	
subtotal		/ 41

Question #	Max. points	Student score
Probability		
48	3 points	
49a	2 points	
49b	1 point	
49c	1 point	
49d	1 point	
50	3 points	
51	3 points	
subtotal		/14
Statistics		
52	2 points	
53a	1 point	
53b	2 points	
53c	2 points	
54	2 points	
55a	1 point	
55b	1 point	
55c	1 point	
55d	3 points	
subtotal		/15
SUBTOTAL FOR THE LAST THREE SECTIONS:		**/70**
TOTAL		**/190**

End-of-Year Test — Grade 7
International Version

Integers

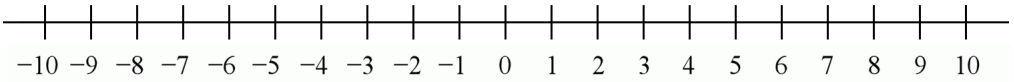
A calculator is not allowed for the problems in this section.

1. Give a real-life situation for the sum $-15 + 10$.

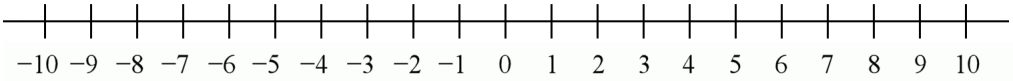
2. Give a real-life situation for the product $4 \cdot (-2)$.

3. Represent the following operations on the number line.

a. $-1 - 4$



b. $-2 + 7$



4. Solve.

a. $-13 + (-45) + 60 =$ _____	**b.** $-8 - (-7) =$ _____	**c.** $2 - (-17) + 6 =$ _____
d. $-3 \cdot (-8) =$ _____	**e.** $48 \div (-4) =$ _____	**f.** $(-2) \cdot 3 \cdot (-2) =$ _____
g. $2 \cdot (-22) - 5 \cdot 4$	**h.** $-16 + \frac{36}{4 - 13}$	**i.** $\frac{(-4)}{8} + 2 \cdot 5$

5. The expression $|20 - 31|$ gives us the distance between the numbers 20 and 31.
Write a similar expression for the distance between -5 and -15 and simplify it.

6. Numbers a and b are integers that are 15 units apart. Number a is positive and b is negative.
Both have an absolute value less than 9. What can their values be?

7. Divide. Give your answer as a fraction or mixed number in lowest terms.

a. $1 \div (-8)$	**b.** $-4 \div 16$	**c.** $-21 \div (-5)$

Rational Numbers

A calculator is not allowed for the problems in this section.

8. Write the decimals as fractions.

a. 0.1748	**b.** −0.00483	**c.** 2.043928

9. Write the fractions as decimals.

a. $-\frac{28}{10\,000}$	**b.** $\frac{2493}{100}$	**c.** $7\frac{1338}{100\,000}$

10. Convert to decimals. If you find a repeating pattern, give the repeating part. If you don't, round your answer to five decimals.

a. $\frac{7}{13}$	**b.** $1\frac{9}{11}$

11. Give a real-life context for each multiplication or division. Then solve.

a. $1.2 \cdot 25$
b. $(3/5) \div 4$

12. Calculate. For problems with fractions, give your answer in lowest terms, and as a mixed number if applicable.

a. $-\frac{2}{7} \cdot \left(-3\frac{5}{8}\right)$	**b.** $27.5 \div 0.6$
c. $-0.7 \cdot 1.1 \cdot (-0.001)$	**d.** $(-0.12)^2$
e. $\dfrac{\frac{3}{4}}{\frac{5}{12}}$	**f.** $\dfrac{5\frac{1}{2}}{-\frac{7}{8}}$

13. Calculate. You may give your answer as a decimal or a fraction.

a. $-\frac{1}{6} \cdot 1.2$	**b.** $-\frac{2}{5} \div (-0.1)$

14. Calculate. You may give your answer as a decimal or a fraction.

a. $-\frac{1}{2} + \frac{5}{2} \cdot (-0.8)$	**b.** $\frac{5}{8} \cdot 0.4 \cdot \left(-\frac{2}{3}\right) - 1.25$

Algebra

A calculator is not allowed for the problems in this section.

15. Simplify the expressions.

a. $7s + 2 + 8s - 12$	**b.** $x \cdot 5 \cdot x \cdot x \cdot x$	**c.** $3(a + b - 2)$
d. $0.02x + x$	**e.** $\frac{1}{3}(6w - 12)$	**f.** $-1.3a + 0.5 - 2.6a$

16. Factor the expressions (write them as multiplications).

a. $7x + 14$ =	**b.** $15 - 5y$ =	**c.** $21a + 24b - 9$ =

17. Solve the equations.

a. $2x - 7 = -6$	**b.** $2 - 9 = -z + 4$
c. $120 = \frac{c}{-10}$	**d.** $2(x + \frac{1}{2}) = -15$

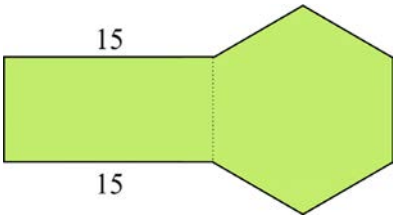
18. Solve.

a. $\frac{2}{3}x = 266$	**b.** $x + 1\frac{1}{2} = \frac{3}{8}$
c. $-5y + 9y - 2 + y = 10$	**d.** $2(x + 7) - 3x = -36$
e. $\frac{y + 6}{-2} = -10$	**f.** $\frac{w}{2} - 3 = 0.8$

19. Chris can run at a constant speed of 12 km/h. How long will it take him to run from his home to the park, a distance of 0.8 km?

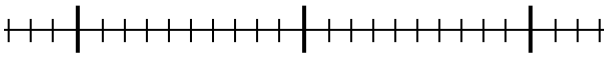
Remember to check that your answer is reasonable.

20. This shape consists of a rectangle and a regular hexagon. Its perimeter is 72 units and the longer side of the rectangle is 15 units. Write an equation to solve for the side of the hexagon, and solve it.

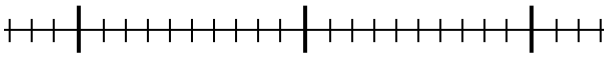


21. Solve the inequalities and plot their solution sets on a number line. Write appropriate multiples of ten under the bolded tick marks (for example, 30, 40, and 50).

a. $3x - 7 < 83$



b. $-2x - 16.3 > 10.5$



22. You need to buy canning jars. They cost \$19 per box, and you only have \$170 to spend. You also have a coupon for a \$25 discount on your total. How many boxes can you buy at most?

a. Write an inequality for the problem and solve it.

b. Describe the solution of the inequality in words.

Ratios, Proportions, and Percent

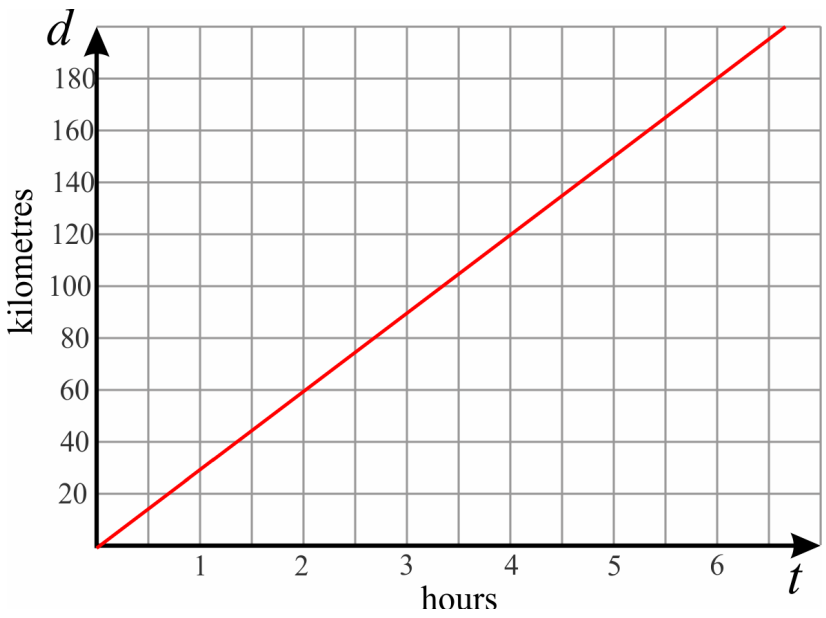
You may use a basic calculator for all the problems in this section.

23. Write a unit rate as a complex fraction and simplify it. Be sure to include the units.

a. Lily paid $15 for 3/8 kg of nuts.

b. Ryan walked 4 ½ kilometres in 3/4 of an hour.

24. The graph below shows the distance covered by a moped advancing at a constant speed.



a. What is the speed of the moped?

b. Plot the point that corresponds to the time $t = 4$ hours.
What does that point signify in this context?

c. Write an equation relating the quantities d and t.

d. Plot the point that corresponds to the unit rate in this situation.

25. A Toyota Prius is able to go 904 km on 45.0 litres of petrol (highway driving).
A Honda Accord can travel 990 km on 65.0 litres of petrol (highway driving).
(Source: Fueleconomy.gov)

a. Which car has better fuel efficiency?

b. Calculate the difference in costs if you drive a distance of 480 km with each car, if petrol costs $1.482 per litre.

26. Write a proportion for the following problem and solve it.

600 ml of oil weighs 554 g.
How much would 5 litres of oil weigh? _____ = _____

27. A farmer sells potatoes in sacks of various weights. The table shows the price per weight.

Weight	5 kg	10 kg	15 kg	20 kg	30 kg	50 kg
Price	$9	$18	$26	$32	$46	$70

a. Are these two quantities in proportion?

Explain how you can tell that.

b. If so, write an equation relating the two and state the constant of proportionality.

28. Sally deposits $2500 at an 8% interest rate for 3 years (simple interest, not compound). How much can she withdraw at the end of that period?

29. A kitchen gadget was discounted by 18%, and then a 5.5% sales tax was added. The final price is $51.82. What was the original price before the discount and sales tax?

30. A ticket to a fair initially costs $20. The price is increased by 15%. Then, the price is decreased by 25% (from the already increased price). What is the final price of the ticket?

31. Margaret was shopping for a mattress, and found a store which had a 20% off sale going on. On top of that, the seller gave Margaret a further $30 discount, so she only paid $144. What was the price of the mattress originally?

32. Alex measured the rainfall on his property to be 10.5 cm in June, which he calculated to be a 35% increase compared to the previous month. How much had it rained in May?

33. In December, Sarah's website had 72 000 visitors. In December of the previous year it had 51 500 visitors.

a. Find the percentage of increase to the nearest tenth of a percent in the number of visitors her website had for that year.

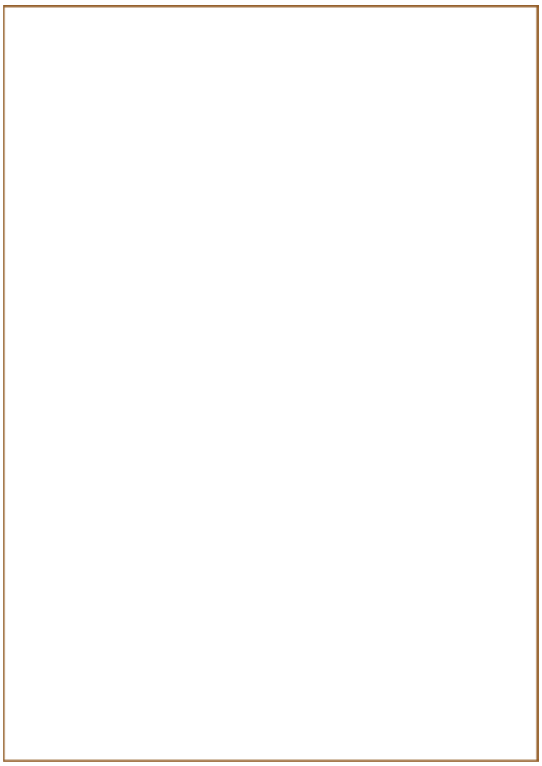
b. If the number of visitors continues to grow at the same rate, about how many visitors (to the nearest thousand) will her site have in December of the following year?

Geometry

You may use a basic calculator for all the problems in this section.

34. The rectangle you see below is Jayden's room, drawn at the scale of 1:45.

a. Calculate the area of Jayden's room in reality, in square metres.
Hint: measure the dimensions of the rectangle in centimetres.



Scale 1:45

b. Do another scale drawing of Jayden's room, at a scale of 1:60.

35. A room measures 4 cm by 3 cm in a house plan with a scale of 1 cm : 0.8 m.
Calculate the actual dimensions of the room.

36. A square with 15-cm sides is enlarged with a scale factor of 4/3.
What is the area of the resulting square?

37. A circle has a diameter of 16.0 cm.

a. Calculate its area (to the nearest square centimetre)
and circumference (to the nearest tenth of a centimetre).

b. That circle is shrunk with a scale factor of 0.8. Calculate
the area and the circumference of this smaller circle.

c. What percentage is the area of the smaller circle of the area of the original?

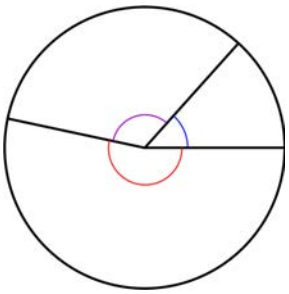
38. Draw a triangle with sides 8 cm, 11 cm, and 14.5 cm using a compass and a ruler.

39. A triangle has angles that measure 36°, 90°, and 54°, and a side of 8 cm.

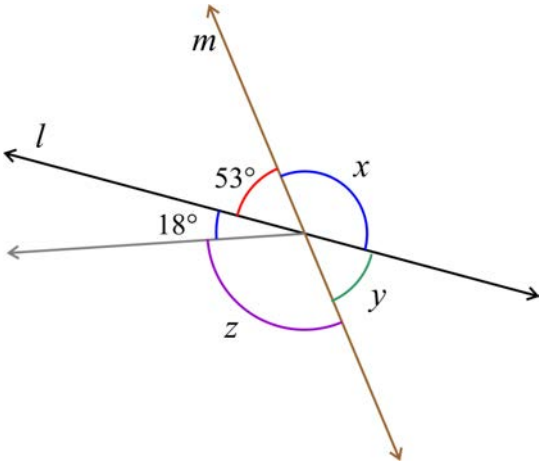
a. Does the information given determine a unique triangle?

b. If so, draw the triangle. If not, draw at least two different triangles that fit the description.

40. Three angles form a complete circle. Their measures are in the ratio of 5:2:8. Find the measure of those angles by writing an equation for the problem, and solve it.

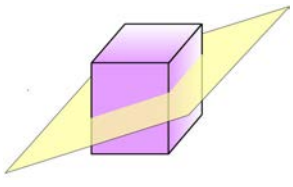
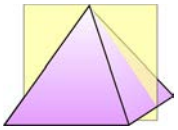
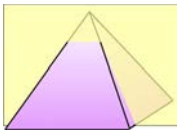


41. **a.** Write an equation for the measure of angle *x*, and solve it.

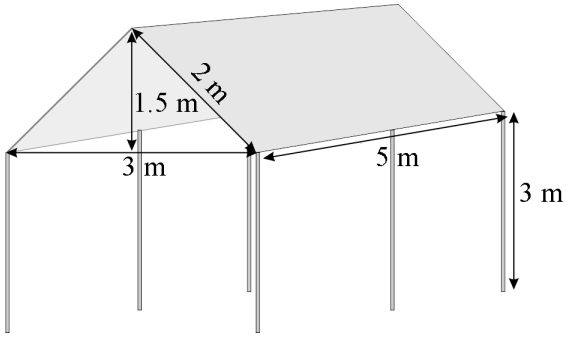


b. Write an equation for the measure of angle *z*, and solve it.

42. Describe the cross sections formed by the intersection of the plane and the solid.

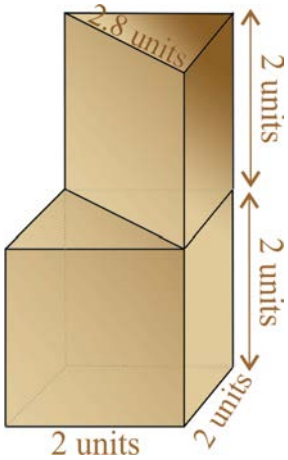
a. 	**b.** 	**c.** 
The cross section is _____.	The cross section is _____.	The cross section is _____.

43. **a.** Calculate the volume enclosed by the roof (the top part).

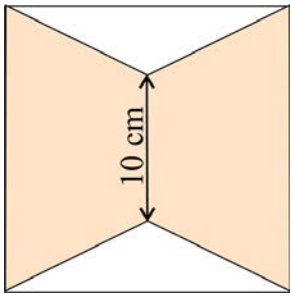


b. Calculate the total volume enclosed by the canopy.

44. Here you see a cube (with 2-unit edges) and a right triangular prism that sits on top of that cube. The bottom face of the triangular prism covers exactly half of the top face of the cube. Find the surface area of this compound shape.



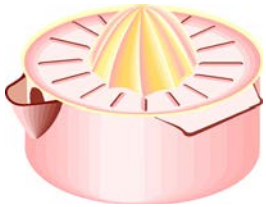
45. Two identical trapeziums are placed inside a 15 cm by 15 cm square.



a. Calculate their area.

b. What percentage of the square do the trapeziums cover?

46. **a.** *Find the volume of the cylindrical part of the juicer, if its bottom diameter is 12 cm and its height is 4.5 cm.



b. *Convert the volume to millilitres and to litres, considering that 1 ml = 1 cm^3.

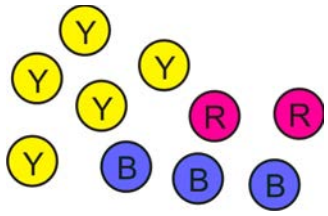
47. **a.** How many cubic centimetres are in one cubic metre?

b. Each edge of a cube measures 0.89 m. Calculate the volume of the cube in cubic centimetres.

Probability

You may use a basic calculator for all the problems in this section.

48. You randomly pick one marble from these marbles.
Find the probabilities:



a. P(not red)

b. P(blue or red)

c. P(green)

49. A cafeteria offers a main dish with chicken or beef. The customer then chooses a portion of rice, pasta, or potatoes, and a side dish of green salad, green beans, steamed cabbage, or coleslaw.

a. Draw a tree diagram or make a list of all the possible meal combinations.

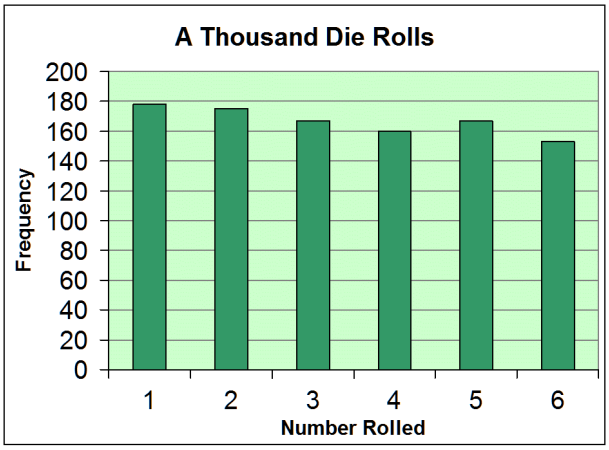
A customer chooses the parts of the meal randomly. Find the probabilities:

b. P(beef, rice, coleslaw)

c. P(no coleslaw nor steamed cabbage)

d. P(chicken, green salad)

50. John and Jim rolled a die 1000 times. The bar graph shows their results. Based on the results, which of the following conclusions, if any, are valid?



(a) This die is unfair.

(b) On this die, you will always get more 1s than 6s.

(c) Next time you roll, you will not get a 4.

51. Let's assume that when a child is born, the probability that it is a boy is 1/2 and also 1/2 for a girl. One year, there were 10 births in a small community, and nine of them were girls. Explain how you could use coin tosses to simulate the situation, and to find the (approximate) probability that out of 10 births, exactly nine are girls. (You do not have to actually perform the simulation—just explain how it would be done.)

Statistics

You may use a basic calculator for all the problems in this section.

52. To determine how many students in her college use a particular Internet search engine, Cindy chose some students randomly from her class, and asked them whether they used that search engine.

    Is Cindy's sampling method biased or unbiased?

    Explain why.

53. Four people are running for mayor in a town of about 20 000 people. Three polls were conducted, each time asking 150 people who they would vote for. The table shows the results.

	Clark	Taylor	Thomas	Wright	Totals
Poll 1	58	19	61	12	150
Poll 2	68	17	56	9	150
Poll 3	65	22	53	10	150

    a. Based on the polls, predict the winner of the election.

    b. Assuming there will be 8500 voters in the actual election, estimate to the nearest hundred votes how many votes Thomas will get.

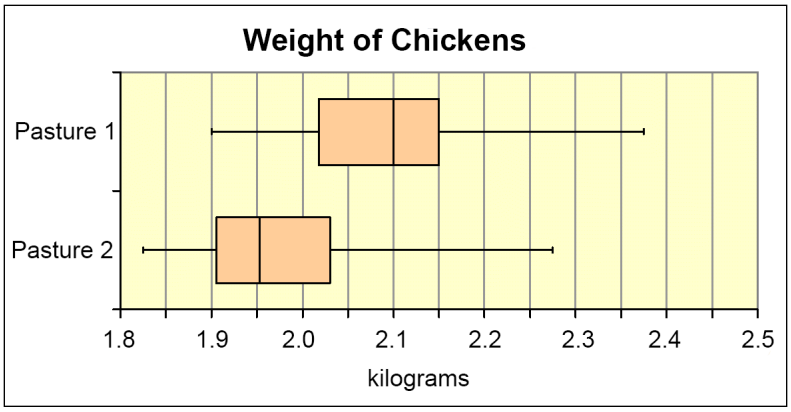
    c. Gauge how much off your estimate might be.

54. Gabriel randomly surveyed some households in a small community to determine how many of them support building a new highway near the community. Here are the results:

Opinion	Number
Support the highway	45
Do not support it	57
No opinion	18

If the community contains a total of 2120 households, predict how many of them would support building the highway.

55. A farmer had chickens (of the same breed) in two locations on his farm (pastures 1 and 2). He wanted to compare the weights of these two flocks of chickens, so he weighed every chicken in each flock. Here is a side-by-side boxplot showing the results.



a. Just looking at the two distributions, do chickens in either flock appear to weigh more? Explain how you know.

b. Do chickens in either flock appear to vary more in weight? Explain.

c. Does one of the flocks have *significantly* heavier chickens than the other?

If so, which one?

Justify your reasoning.