MATH 119—Mathematical Modeling and Reasoning
Final Exam Review

1. On The Price Is Right game show, to get into the showcase at the end, contestants spin a wheel with 20 equally sized spaces, numbered 5 cents, 10 cents, 15 cents, and so on, up to $1.00. If the contestant spins once, find the probability of each event below:
   a. $1.00

   b. An amount less than 50 cents

   c. An amount greater than 70 cents

   d. An amount that is divisible by five.

2. Draw a tree diagram to determine the sample space when three coins are tossed. Then answer parts a—b.

   a. Three coins are tossed. Find the probability that exactly two coins land tails up.

   b. Three coins are tossed. Find the probability that two or more coins land heads up.

3. How many 3-digit codes using the digits 0 through 9 are possible if:
   a. Repetitions are allowed

   b. Repetitions are NOT allowed

4. A babysitter has four lollipops of different colors. In how many ways can she give one lollipop to each of the four children she is watching?

5. In how many ways can a person select four books, two CDs, and one DVD from ten books, twenty CDs, and five DVDs?

6. In a class of 20 students, there are 12 girls and 8 boys. Three students are selected to be teacher's assistants. Find the probability that the group consists of one girl and two boys.

7. A package contains 15 candy canes, 3 of which are cracked. If 2 are selected, find the probability of getting no cracked candy canes.

8. Tickets for a drawing are sold for $35 each. The holder of the winning ticket wins a cash prize of $1,500. If 500 tickets are sold find the expected value of the gain.

9. A life insurance company is offering Dakota a $100,000 life insurance policy for $300. The insurance actuary has calculated that the probability of death within a year of a 21-year-old male is 0.00064. Determine the expected value of the insurance policy.

10. Forty new automobiles were tested for fuel efficiency by the Environmental Protection Agency (in miles per gallon). The individual values and a frequency distribution are displayed below.

24	20	18	32	16	30	23	33	23	18
29	26	34	25	31	24	23	8	33	34
26	29	14	20	26	22	29	25	26	30
22	27	32	18	37	27	14	24	32	19

Class	Frequency
8-12	1
13-17	3
18-22	8
23-27	14
28-32	9
33-37	5

a. Find the median, mode, and midrange of the data set.

b. Use the frequency distribution to approximate the mean.

11. Fifty families reported their annual household income (in thousands of dollars).

41	18	104	36	29	62	53	65	80	99
23	55	32	44	67	21	89	31	57	70
15	92	76	38	56	23	17	150	34	87
95	76	21	33	59	88	102	34	51	73
16	95	41	72	18	23	76	59	42	95

a. Construct a frequency distribution for the data using six classes.

b. Construct a histogram for the data.

c. Find the mean of the data using the frequency distribution (grouped mean).

12. Which data set would be likely to have the larger standard deviation? Explain.
    a. Data Set 1: Weights of all dogs at a golden retriever rescue shelter
    b. Data Set 2: Weights of all dogs for sale in a pet store

13. The table below shows the average points scored per game by several intramural softball teams. Find the range and standard deviation for the data.

Team	Points
Bombers	4.3
Crunchers	12.1
Homers	16.3
Pelters	8.1
Smackers	13.3
Whoppers	6.3

14. A person drives 5,000 miles in 6 months. How many miles will that person drive in 3 years?

15. A community college has 3,000 students and 90 instructors. The college plans that enrollment will be 3,500 neat year. How many new instructors should be hired if the college wants to keep the same student to instructor ratio?

16. The following table shows the cost of renting a full-size rental car, based on the number of miles driven

Distance driven (in miles)	Total Cost
0	$68.97
50	$88.47
100	$107.97
150	4124.97
200	$149.97

a. Explain why a linear function is appropriate for this relationship

b. Find the slope of the line and explain what it means

c. Find the y-intercept and explain what it means

d. Determine the equation of the line.

17. Decide if each conclusion was drawn using inductive or deductive reasoning:

a. Forensic experts determine that all cells in a sample from a subject XY chromosomes. It is concluded that the sample belongs to a man.

b. After a bank robbery in one city, a recently paroled convict that had committed give bank robberies using the same method was brought in for questioning.

18. Suppose that you're in desperate need of some quick cash, and a local restaurant owner offers you twenty-five bucks to stand on a street corner and hand out coupons to her place. You also get a \$0.40 bonus for every one of the coupons that gets turned in to the restaurant on that day. Write a function that describes the total amount of money you'll make $f(x)$ if x coupons are turned in.

    a. How many coupons need to be turned in for you to make \$105?

19. Find the coordinates of both the x and y-intercepts for the line $7x + 3y = 5$.

20. Suppose you bought a used car for \$13,000. After 5 years, it is worth \$5000.

    A) What is the slope of the line representing the car's value and what does it mean?

    B) Write an equation the models the value of the car after x years.

    C) What is the value of the car after 7 years?

21. The height in feet of an object after t seconds is given by the function $f(t) = -16t^2 + 90t + 5$. How many seconds will it be when the object reaches its maximum height? What is the maximum height of the object? When will the object hit the ground?

22. Write a counterexample to show that the statement is false: The sum of any two different even numbers minus any odd number is even.

23. A landscape architect is planning a new nature area in the middle of an urban campus. She wants the length to be twice the width, and wants to put a 3-foot high retaining wall around the perimeter. There will be a total of 222 ft. of wall installed. How wide will this nature area be?

24. Jack receives $49 for working one 5-hour day. One day he had to stop working after 3 hours because of a doctor's appointment. How much did he make that day?

25. Convert 14 inches to yards using dimensional analysis. Round to two decimal places if necessary.

26. Convert 43 feet to yards using dimensional analysis. Round to two decimal places if necessary.

27. Convert 55,940 cm to km.

28. How many miles will a runner cover in a 20 km race? Rounded three decimal places, if necessary.

29. A cricket pitch is 66 feet long.
    a. Find the length in inches.

    b. Find the length in meters.

30. Convert $247{,}848 ft^2$ into acres.

31. Convert 26,000 cubic feet to gallons.

32. Convert $15.6\, m^2$ into ft^2.

33. Convert 72 millimeters into cubic meters.

34. A Jacuzzi was filled with 300 gallons of water. That Jacuzzi itself weighed 50 lb. If a person who weighed 100 lb and a person who weighs 160 lb get into the Jacuzzi, how much is the total weight including the two people, the tub, and the water? Round the answer to the nearest pound.

35. About 600,000 gallons of water flow over Horseshoe Falls in Niagara Falls, Canada, every second.
    a. Find the total weight and tons of water that flows over the falls in an hour. (Hint: 1 ton (T) is 2000 pounds.)

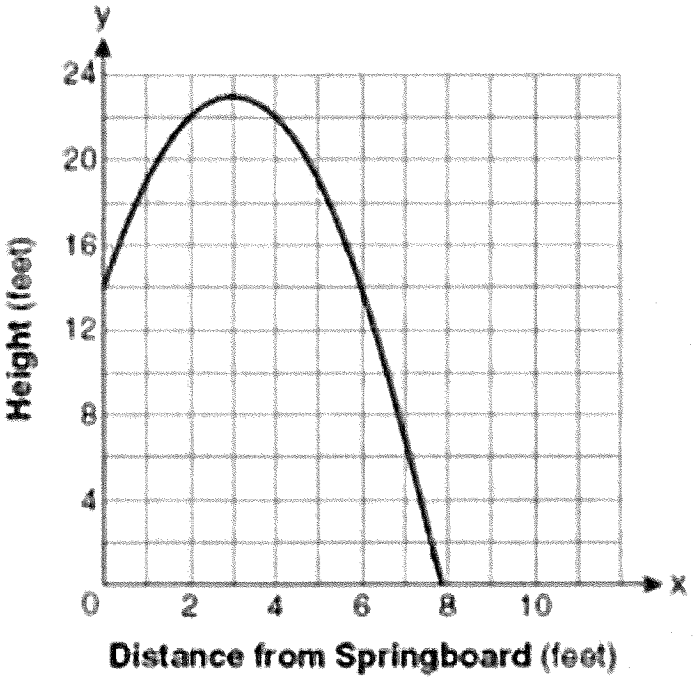
    b. A local stadium has a volume of 60 million cubic feet. If the water flowing over Horseshoe Falls were somehow diverted into the stadium, how long, in minutes, would it take to completely fill the building?

36. Richard needs 6 in of topsoil for his vegetable garden that is in the shape of a rectangle, 18 ft by 20 ft.

    a. Find the amount of topsoil needed in cubic feet.

    b. If topsoil can be purchased in bags containing 2 ft^3, how many must Richard purchase?

37. A swim team member performs a dive from a 14-foot high springboard. The parabola below shows the path of her dive.



a) What is the y-intercept and what does it represent?

b) What is the x-intercept and what does it represent?

c) What is the maximum height the swim diver can reach?

d) How many feet must the swim diver go to reach the maximum height?

38. Anna and Brooks are competing for a scholarship for a graduate program. Anna is ranked 3 in a class of 389. If Brooks is ranked 15^{th} in a class of 450, who has the better percentile ranking? (Show your work.)

39. If a student's rank in a class of 300 students is 273, find the student's percentile rank.

	US Customary System	
Units of Length	**Units of Weight**	**Units of Capacity**
12 inches = 1 foot	16 ounces = 1 pound	8 fluid ounces = 1 cup
3 ft = 1 yd	2000 lb = 1 ton	2 c = 1 pt
5280 ft = 1 mile		2 pt = 1 quart
		4 qt = 1 gallon

Metric System

Metric Unit	kilometer	hectometer	dekameter	meter (base unit)	decimeter	centimeter	millimeter
Meaning	1,000 meters	100 meters	10 meters	1 meter	$\frac{1}{10}$ meter	$\frac{1}{100}$ meter	$\frac{1}{1{,}000}$ meter

	US ↔ Metric Conversions	
Units of Length	**Units of Weight**	**Units of Capacity**
1 in = 2.54 cm	1 oz ≈ 28.35 g	1 L ≈ 1.06 qt
1 m ≈ 3.28 ft	1 lb ≈ 454 g	1 gal ≈ 3.79 L
1 m ≈ 1.09 yd	1 kg ≈ 2.2 lb	
1 mi ≈ 1.61 km		

Volume of a rectangular box: $V = lwh$

Slope: $m = \frac{y_2 - y_1}{x_2 - x_1}$

Equation of line: $y = mx + b$

Quadratic Formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Vertex: $x = -\frac{b}{2a}$