MTH 154 Quantitative Reasoning
Midterm Concept Review – Units 1-3

The goal of these questions is to help you organize the mathematical concepts learned throughout the first half of the course.

1. How are all the following words related: ratio, rate, scale, concentration, dosage, density, part-to-part, part-to-whole.

2. Think about the units? Units vs unit-less, units of observation vs units of measurement, ratio units vs interval units, measurement scale vs model scale, compound units.

3. How are these concepts related: function, ratio, proportional, "for every", "times as much", "a fraction of".

4. Describe the ways to solve proportional relationships.
        a. One proportion
        b. Multiple proportions
        c. Direct or Inversely Proportional Equation
        d. Dimensional analysis
        e. Ratio table

5. What does it mean to scale a proportion and how do you scale? How do you decide what to scale to? What are some reasons you scale?

6. Financial models – what do these formulas represent and what kind of decisions might they help you make? What are the formulas? What does each variable stand for? How do they differ from each other?
        a. Simple interest formula
        b. Amortized interest formula
        c. Periodic rate

7. How are all the following words related: loan, interest, principal, payment, term, rate, periodic rate, APR vs APY, credit card, balance, period.

8. What is the difference between average and weighted average? When would you use each one? How to find? What if you want to find a score to result in a certain average?

9. What is a consumer price index and what conversations does it allow us to have? How do you use it to compare prices? How does inflation tie into this?

10. What are things to consider for retirement planning? How are these related to retirement planning: capital, saving, mortgage, education, stocks/bonds? What two pieces of information are used to determine where you should be in your planning?

11. Describe the types of graphs and identify what they are best used for: pie, column, bar, line.
    Be able to label a graph appropriately and know the key parts.
    Read graphs to describe data and trends.

12. Mathematical processes
    a. Compute monthly payments on loans.
    b. Determine total loan repayment, total interest.
    c. Determine if two items are functions, proportional.
    d. Analyze given information and determine which option is financially better.
    e. Scale tables of information to given or appropriate values.
    f. Set-up and solve proportions to answer questions.

13. Reflections
    a. Using tables of "what if" data or presentation of data
    b. Using graphs

14. Major topics
    a. Credit card loans with variable payments
    b. Large data set table and graphs – analyze and comment
    c. Conversions given conversion factors. Scaling to compare.
    d. Retirement portfolios – based on recommendations
    e. Compound unit conversions – medical case studies
    f. Weighted average vs average

I. **MATCHING**- Match the vocabulary word with its definition.

1. Ratio	A. Annual rate of return taking into account the effect of compounding interest.
2. Proportion	B. Comparison between two quantities.
3. CPI	C. Two ratios set equal
4. PE	D. the weighted average of prices of a basket of consumer goods and services
5. Stock	E. the capital raised by a business or corporation through the issue and subscription of shares
6. Regression	F. An approach to modelling the relationship between a dependent variable and one or more independent variables- finding a function
7. Function	G. as one amount increases, another amount increases at the same rate.
8. Interpolate	H. constructing new data points within the range of a discrete set of known data points.
9. Inflation	I. a general increase in prices and fall in the purchasing value of money.
10. APY	J. When one variable increases the other decreases in proportion so that the product is unchanged.
11. Directly Proportional	K. A relation where each input (element of the domain) corresponds to one and only one output (element of the range)
12. Inversely Proportional	L. Price-to-earnings ratio.

II. Data Analysis- A student has begun the Backpack Lab below, by performing the lab and recording all of the data. However, they did not have time to complete the remaining portion of the lab. It is your job to complete the lab for them.

Backpack Lab

Let's determine the relationship between the amount of books added to a back pack and the weight of the backpack.
- A. Weigh your empty backpack using *lbs*.
- B. Add a book. Measure the new weight and record in the table below. Continue doing this until you have no more school books to add. Record the data in the table below.
- C. Graph your data on the axes on the back. (Be sure to put the DEPENDENT variable as the *y*-axis and the INDEPENDENT variable on the *x*-axis.)
- D. Answer the questions.

# of books added	Total Weight (*lbs.*)
0	2
1	13
2	21
3	29
4	40
5	50

13. **Graph**
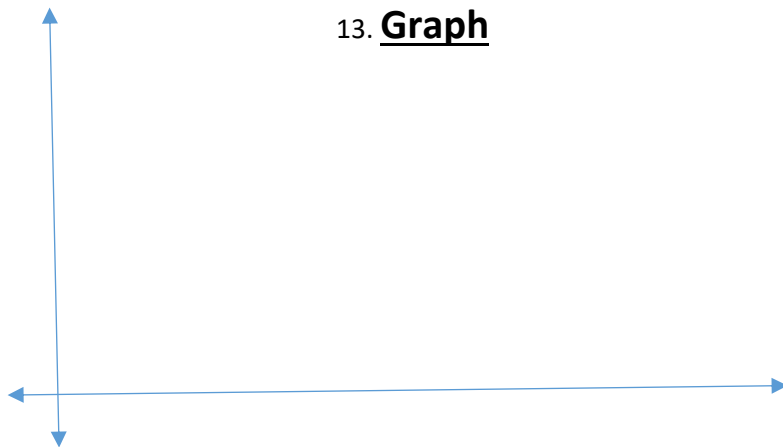
Questions

14. What is the domain? (Give both actual quantities as well as the meaning/interpretation of it.)
- A. Actual:
- B. Interpretation/meaning:

15. What is the range? (Give both actual quantities as well as the title/interpretation of it.)
- A. Actual:
- B. Interpretation/meaning:

16. What other way(s) could this data be represented?

17. Is this a function? Explain why or why not AND what significance/purpose this has.

18. In the Backpack Lab, a student ran a linear regression to get the function $f(x) = 9.4x + 2.3$ where x is the number of books. How much would the backpack weigh if the student put 10 books in the back pack?

IV. **Math (& Excel)-** Answer the following questions. Be sure to show all work for partial credit. (2 points each)

19. Evaluate: (6+2)/8+1-4*3

20. Given the formula $T = \dfrac{P*\frac{APR}{n}}{1-\left(1+\frac{APR}{n}\right)^{-nt}}$, how would you enter (type the formula) into Excel?

21. An individual borrowed $80,000 at an APR of 7%, which will be paid off with monthly payments of $635 for 19 years. Fill in the blanks below.

    a. The amount borrowed is $_____,

    b. The annual interest rate is _____%,

    c. The loan term is _____ years,

    d. The payment amount is $_____.

    e. The total amount paid is $_____.

    f. The total interest paid over the life of the loan is _____.

22. You are dominating this midterm and score a 90%. If you currently have a 78% on HW/Quizzes (Pearson) and an 82% on Excel/Labs (Blackboard), what is your current grade (no final exam) in MTH 154? (NOTE: the syllabus states HW/Quizzes are 30%, Excel/Labs are 30%, the midterm is 20%, and the final is 20% of the course grade.)

23. Compare the prices for various sizes of popcorn sold at the local movie theater and determine which is the best buy.

    Mega Bag $10.24 for 32 oz.
    Giant Bag $6.00 for 24 oz.
    Medium Bag $4.48 for 16 oz.
    Kid's Bag $2.40 for 8 oz.

24. The cost of a gallon of milk in 1977 was $1.50.   Using the CPI table below, how much did the gallon of milk cost in 2010?

	CPI	Cost of a Gallon of Milk
1977$	60.6	$1.50
2010$	218.1	

25. If the ratio of Euros to Dollar is 3:5, find an equation you could use to enter into Excel to find the number of Dollars if given the numbers of Euros. (i.e. D=?)

MTH 154 Midterm Review Questions

1. Match the vocabulary word with its definition.

Vocabulary	Definition
1. Rate	A relationship that compares the relative sizes of two quantities
2. Proportional	A relationship between quantities referred to as inputs and outputs, in which every input is paired up with one and only one output
3. Scale	A ratio between quantities with different units, with the second quantity scaled to a meaningful standard and read using the word per
4. Proportion	An equality of two ratios
5. Unit-less	Given a sequence of values occurring with different weights, the ratio of the sum of the products of each value with its weight to the sum of the weights
6. Constant of proportionality	Having a constant ratio, in a multiplicative sense: doubling one doubles the other
7. Function	Given two proportional quantities, the decimal equivalent of the constant ratio
8. conversion	The choice of measurement system in measuring a quantity
9. ratio	A reference standard used for purposes of measurement, either a system of ordered marks or a ratio indicating proportionate size
10. concentration	A model scale in which both quantities have the same unit; any unit can be used for both quantities
11. units	A ratio used to compare two different systems of measurement. It indicates a change in units of measurement
12. weighted average	The ratio of the amount of one substance mixed with the amount of another substance

2. Questions about Excel spreadsheets.

   (a) What does every Excel formula start with?
   (b) What does filling down a formula do?
   (c) How can I keep a cell reference from changing when I fill down a formula?

3. Which of the following relationships are functions?

   For each one answer "Yes" if it is a function and "No" if not a function.

   (a) Inputs: People Output: Anyone they have been married to Function?
   (b) Inputs: People Output: Number of spouses Function?

4. Evaluate the expression, $3x^2 - 4x + 6$, for $x = -7$. Show your work.

5. An individual borrowed \$83,000 at an APR of 4%, which will be paid off with monthly payments of \$520 for 19 years. Fill in the blanks below.

   (a) The amount borrowed is \$
   (b) the annual interest rate is %
   (c) the number of payments per year is
   (d) the loan term is years
   (e) the payment amount is \$
   (f) the total number of payments toward the loan is
   (g) the total amount paid is \$
   (h) The total interest paid over the life of the loan is

6. What two quantities are being compared in the following ratios?

Ratio	Thing 1	Thing 2
13% of U.S. adults are numerate		
Speed is 38 mph		

7. For A = 140 and B = 380, compute the following.

   (a) The ratio of A to B is _____. Write an integer or simplified fraction.
   (b) A is _____ percent of B. Write an integer or a decimal rounded to one decimal place as needed.

8. Solve for n. Round your answer to 4 decimal places. Show your work.

$$\frac{13.43}{1.58} = \frac{8.65}{n}$$

9. Set up a proportion for solving the following problem. Include the units. Show your work.

   A particular hybrid car travels approximately 172 mi on 4 gal of gas. Find the amount of gas required for a 559-mi trip.

   A proportion that could be used to solve the problem is _____. (Don't solve, give proportion)

10. Use the table to answer the questions.

Private Four-Year Room and Board	Public Four-Year Room and Board In-State
$12,276	$10,053
1.22	1
100	81.89

(a) For every $100 a student spends on room and board at a private four-year school, a student at a public four-year school spends $ _____

(b) A student spends _____ times as much on room and board at a private four-year school as a student does at a public four-year school.

11. In another class, MyMathLab assignments are worth 25%, labs are worth 25%, the project is worth 20%, the midterm exam is worth 15%, and the final exam is worth 15%. If a student has a 91 MyMathLab average, a 84 lab average, and a 58 on the midterm exam, what is the student's grade at this point? Simplify your answer. Round to the nearest tenth as needed.

12. Use the information in the table below to set up a proportion and compute the cost of a package of Nabisco Oreo Cookies in 2015$ that cost $0.89 in 1977$.

	CPI	Cost of An Item
1977$	60.6	$0.89
2015$	237.0	

Proportion:

How much would it cost? Round your answer to the nearest cent. _____$

13. Convert the measurement to the units specified. Round to the nearest tenth as needed. Show your work.

118 pounds to kilograms (1 lb. = 0.4536 kg. 1 kg = 2.205 lb.)

118 pounds = _____kg

14. An ant that weights $\frac{1}{450}$ ounces can lift $\frac{1}{15}$ ounces. Use this information to fill in the blanks. Show your work

a. The unit-less scale of what the ant weighs to what it can lift is 1:_____

b. Find the equation that represents this relationship between an ant's weight (W) and the weight of what it can lift (L). The equation is L = _____ W.

c. Assume Susan is as strong as an ant and she weighs 150 pounds. How many pounds can she lift? (The correct answer does not have to be realistic.)

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15. To convert 134 meters per second to miles per hour, we have to convert meters to miles and seconds to hours. Use dimensional analysis and the given information to convert 134 meters to miles. Round your final answer to 3 decimal places.

1 meter = 3.28 feet and 1 mile = 5280 feet.

134 meters = _____ miles.