

## Prerequisite Review for MATH 1333, Mathematics for Measurement

- Plugging in numbers into formulas
- Rounding, exponents, mathematical notation.
- Solving equations: linear and proportional equations
- Geometry
- Percentages
- Formula for a straight line: Identifying the coefficients, using the formula, graphing.
- Reading technical material: In reading technical material, often changes in just one word or even the order of the words, can make a difference in the meaning. Students must learn when and how to read carefully in this manner.

Most of these topics are used throughout the course. There is about two weeks of review of all of these topics in the first part of the course, but not enough to teach them to students who are completely unfamiliar with any of them. If you have worked problems like this in previous math courses, and, for at least 75% of the problems, can either work them on your own or feel reasonably comfortable with the explanations in the full answer key, then you have the math skills needed to learn the material in MATH 1333.

### Problems:

1. Round 17.39283 to the nearest thousandth.
2. Round 0.02397 to the nearest hundredth.
3. Use your calculator to find  $\sqrt{19}$ , correct to 3 decimal places.
4. Use your calculator to find  $18^2$
5. When a scientific calculator shows the answer for a computation is 7.23E-04, what number does that represent?
6. Consider the mathematical statement:  $x < 3.24$ 
  - a. How would you read that statement in words?
  - b. Give four numbers that make that statement true.
  - c. Give either a number line or an interval that indicates all the numbers that make that statement true.
7. Consider the mathematical statement:  $y \geq 5.8$ 
  - a. How would you read that statement in words?
  - b. Give four numbers that make that statement true.
  - c. Give either a number line or an interval that indicates all the numbers that make that statement true.
8. Solve for  $x$ :  $4 + 3x = 17$

9. Solve for  $y$ :  $8y - 9 = 23 + 27y$

10. Solve for  $r$ :  $\frac{8}{5} = \frac{7}{r}$

11. Solve for  $m$ :  $3.9 = \frac{34.2}{m}$

12. Solve for  $k$ :  $9.7 = \frac{157.4}{\sqrt{k}}$

13. Brent pays \$550 per month for rent and his monthly salary is \$1876.

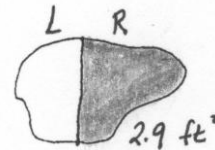
- (a) What proportion of his monthly salary is his rent? (This answer will be between 0.000 and 1.000)
- (b) What percentage of his monthly salary is his rent? (This answer will be between 0.0% and 100.0%)

14. At Joliet High School, there are 325 seniors who entered Joliet schools in the fifth grade or lower, and 897 seniors who entered Joliet schools in the sixth grade or higher. What percentage of the seniors entered Joliet schools in the fifth grade or lower?

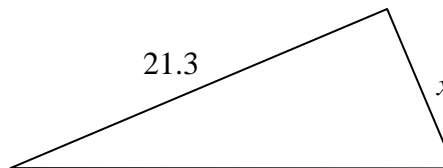
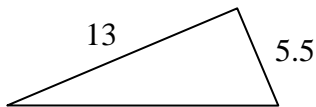
15. In a particular business college, the following table gives the numbers of men and women in various majors. What percentage of the women are accounting majors?

	Men	Women	total
Accounting	83	69	152
Administration	102	110	212
Finance	53	37	90
total	238	216	454

16. The figure at the right has total area of 5.3 square feet. The shaded area is 2.9 square feet. What is the area of the unshaded part, labeled L?



17. The two triangles below are similar triangles, which are the same shape (meaning here, the same angles) but are not necessarily the same size. In similar figures, the ratios of corresponding sides are equal. Find the length of the side labeled  $x$  in the right-hand figure.



One way of writing the equation of a straight line is in the slope-intercept form:  $y = mx + b$ , where  $m$  is the slope and  $b$  is the y-intercept.

When we graph the equation of a line on a Cartesian coordinate system, usually we put  $y$  on the vertical axis and  $x$  on the horizontal axis.

18. For this equation of a line, identify the slope and the y-intercept.  $y = 4x + 7$

19. For this equation of a line, identify the slope and the y-intercept.  $y = 18x - 9.87$

20. For this equation of a line, identify the slope and the y-intercept.  $y = -3 + 6x$

21. For this equation of a line, identify the slope and the y-intercept.

$$y = 0.00723 - 0.000452x$$

22. Graph this line between  $x = 4$  and  $x = 30$ .  $y = 4.23 - 0.65x$

23. The Anderson Realty Company bought an apartment house on January 1, 1997 for \$1.5 million. For their financial records, they set up a linear depreciation schedule for the building over the next 20 years. The value of the land was \$0.3 million, so the value of the building in 1997 was \$1.2 million, and that is the amount to be depreciated. The model for the depreciated value,  $V$ , of the building in terms of the years since 1997,  $t$ , is

$$V = 1.2 - 0.06t$$

and this model is used for values of  $t$  between 0 years and 20 years. Find the depreciated value of the building on Jan. 1, 2008 given by this model.

When practicing evaluating new formulas with your calculator, it is a good idea to first use some easy numbers and do the problem “in your head” to make sure your calculator is giving you the right answer. This is the way to explore what order you need to enter the numbers. Only after you are completely clear about the order in which to enter the numbers should you start using it to calculate with numbers that are so “messy” you couldn’t do it “in your head.” In each of the problems below, be sure you can do the first part easily before you attempt the second part. The answers are provided right here rather than in the answer key, but some commentary is given in the full answer key. Read it if you’re having difficulties.

24.  $L = X + f \cdot d$

a. Find  $L$  when  $f = 3$ ,  $d = 2$ ,  $X = 11$

b. Find  $L$  when  $d = -8$ ,  $f = 3$ ,  $X = 11$

c. Find  $L$  when  $X = 8.79$ ,  $d = 1.7$ ,  $f = 3.23$

25.  $M = -3v_1 - 9v_2 + 38$

a. Find  $M$  when  $v_1 = 4$ ,  $v_2 = -2$  ans 44

b. Find  $M$  when  $v_1 = 5.37$ ,  $v_2 = -8.67$  ans 99.92

26.  $L = \frac{X - 5m}{y^2 - 3d}$

a. Find  $w$  when  $X = 14$ ,  $m = 2$ ,  $y = 5$ ,  $d = 3$  ans  $\frac{1}{4}$  or 0.25

b. Find  $w$  when  $X = 27.3$ ,  $m = 4.1$ ,  $y = 8.6$ ,  $d = 3.8$  ans 0.1087

27.  $A = k + a \cdot 2^x$

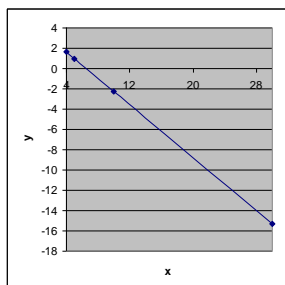
- a. Find  $A$  when  $x = 4$ ,  $a = 3$ ,  $k = 10$  ans 58
- b. Find  $A$  when  $x = 5.13$ ,  $a = 6.84$ ,  $k = 22.6$  ans 262.119

28.  $r = \frac{m-t}{s}$

- a. Find  $m$  when  $r = 2$ ,  $s = 3$ ,  $t = 4$ .
- b. Find  $m$  when  $r = 1.84$ ,  $s = 3.12$ ,  $t = 3.1$ .

**Brief answer key:**

1. 17.393
2. 0.02
3. 4.359
4. 324
5. 0.000723
6. "x is less than 3.24." Many numbers make this true. Some numbers which make this true are 3.2, 1.8, and 0 and -9.3. In interval notation, this is  $(-\infty, 3.24)$
7. "y is greater than or equal to 5.8." Many numbers make this true. Some numbers which make this true are 5.8, 6, 8.1, and 111.832. In interval notation, this is  $[5.8, +\infty)$
8.  $x = \frac{13}{3}$
9.  $y = \frac{32}{19}$
10.  $r = \frac{35}{8}$
11.  $m = 8.769$
12.  $k = 263.3092$
13. a. 0.29318 b. 29.318%
14. 26.596%
15. 31.94%
16. 2.4 sq. ft.
17. 9.0115
18. slope 4, y-intercept 7
19. slope 18, y-intercept  $-9.87$ .
20. slope 6, y-intercept  $-3$ .
21. slope  $-0.000452$ , y-intercept 0.00723.
- 22.



23. \$0.54 million, or \$540,000
24. a. 17 b. -13 c. 14.281
25. a. 44 b. 99.92
26. a. 0.25 b. 0.1087
27. a. 58 b. 262.119
28. a. 10 b. 8.8408

**Answer key with comments:**

- 17.393. When you round, if the part you are leaving off is half or more, the previous digit is increased by 1.
- 0.02. Notice that the part you are leaving off is less than half.
- 4.359
324. Notice the difference between taking the square root of a number and squaring a number. It is very important to be clear about which one you're doing.
- 0.000723.  
This number is in scientific notation. It means  $7.23E-04 = 7.23 \times 10^{-4} = 0.000723$
- "x is less than 3.24." Many numbers make this true. Some numbers which make this true are 3.2, 1.8, and 0 and -9.3. In interval notation, this is  $(-\infty, 3.24)$
- "y is greater than or equal to 5.8." Many numbers make this true. Some numbers which make this true are 5.8, 6, 8.1, and 111.832. In interval notation, this is  $[5.8, +\infty)$
- $x = \frac{13}{3}$ . It is also acceptable to write this answer as a mixed number,  $y = 4\frac{1}{3}$ , or as a decimal,  $y = 4.333$ . When you write answers in decimal form, often the accurate answer has an infinite decimal expansion. You do not have to list as many decimal places as your calculator gives you. Your instructor will give you more specific guidelines for various types of problems. When no guidelines are given and it seems reasonable, you should keep about three decimal places.
- $y = \frac{32}{19}$ . Again, it is acceptable to write this as an improper fraction as is given here, or as an equivalent mixed number,  $y = 1\frac{13}{19}$ , or as an equivalent decimal,  $y = 1.684$
- $r = \frac{35}{8}$ . Again, it is acceptable to write this as an improper fraction, as given here, or an equivalent mixed number or an equivalent decimal number.
- $m = 8.769$ . In this problem, you must recognize how to solve a proportion equation when one of the sides is not written as a fraction. An easy way is to first turn it into a fraction, as  $\frac{3.9}{1} = \frac{34.2}{m}$  and then follow the same steps as in the previous problem. As part of the solution, you found  $m = \frac{34.2}{3.9}$  but that is not an acceptable final answer because fractions in final answers must have whole numbers for both the numerator and denominator. So you must divide these for an acceptable final answer.
- $k = 263.3092$ . Do this problem in a similar manner to the previous problem, except that, after you find  $\sqrt{k} = \frac{157.4}{9.7}$ , square both sides.
- a.  $550/1876 = 0.29318$  b.  $0.29318 = 29.318\%$   
You must know the difference between proportion and percent and how to easily convert between them.

14.  $325/(325+897) = 0.26596 = 26.596\%$

Notice that, to find the total number of seniors, you must add the two numbers given. Sometimes students assume that the two numbers given in the problem are the appropriate numbers to plug into a formula, and that is often not the case.

15.  $69/(69+110+37) = 69/432 = 0.3194 = 31.94\%$

The crucial point here is that you must be able to understand, by reading, the difference between the two questions “What percentage of the women major in accounting?” and “What percent of the accounting majors are women?” The difference in these two questions tells us the difference in the denominators we need to compute the answers. For the first question, the denominator is the total number of women. For the second question, the denominator is the total number of accounting majors. The question asked in the problem is “What percentage of the women major in accounting?” for which the answer is approximately 32% as shown in the first line of this solution. If this question were asked “What percentage of the accounting majors are women?” the answer would be

$$69/152 = 45.39\%.$$

16. 2.4 sq. ft. Area of the un-shaded part is  $5.3 - 2.9 = 2.4$

17. 9.0115. The proportion equation to be solved can be written as  $\frac{13}{5.5} = \frac{21.3}{x}$ . There are

several other correct ways to write this proportion equation. Three other ways are:

$$\frac{5.5}{13} = \frac{x}{21.3} \text{ or } \frac{13}{21.3} = \frac{5.5}{x} \text{ or } \frac{x}{5.5} = \frac{21.3}{13}.$$

When you solve any of these, the next step is  $13x = 5.5 \cdot 21.3$  and, when you divide both sides by 13, you find the given answer of 9.0115.

18. slope 4, y-intercept 7

19. slope 18, y-intercept  $-9.87$ . To write this in the form  $y = mx + b$ , we have

$$y = 18x + (-9.87),$$

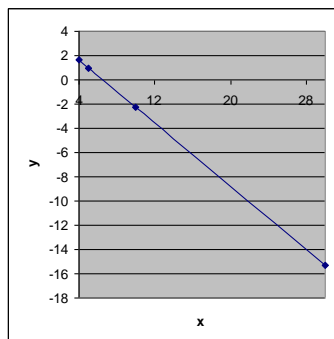
so the subtraction turns into a negative number for the y-intercept.

20. slope 6, y-intercept  $-3$ . To write this in the form  $y = mx + b$ , we have to reverse the order of the two terms. In fact, we wouldn't rewrite it. Instead we make a point to think of the slope coefficient as the number that is multiplied by the  $x$ . It doesn't matter whether that term comes first or second.

21. slope  $-0.000452$ , y-intercept  $0.00723$ . Notice that, if we had computed these coefficients, we should not be content to round all numbers to three decimal places, since we'd lose too much information. If we have very small numbers, like these, we usually keep at least three decimal places past all leading zeros.

22. You can choose any  $x$ -values in the appropriate interval to plug in. No matter what you choose, you should get the same line on a graph.

$x$	$y$
4	1.63
5	0.98
10	-2.27
30	-15.27



23. \$0.54 million or \$540,000.

It is important to be able to read a lot of background information and pull out the question to answer and the important ideas/formulas/numbers needed to answer it. In this case, that means that you need to see the formula here and realize that you need to plug in some number for  $t$  that stands for the time Jan. 1, 2008. It is also important to pay attention to the units of the variables. In this problem, that involves figuring out that Jan. 1, 2008 corresponds to  $t = 11$ , and that the answer of 0.54 means 0.54 million dollars, and then how to convert that to plain dollars.

24. a. 17    b. -13    c. 14.281

There are different ways to enter these numbers and operations and obtain a correct answer, depending on the type of calculator, whether you use parentheses or not, and whether you use negative numbers or just change to subtractions, as appropriate. It is crucial that you understand, from previous math courses, the appropriate order of operations, that is, that the multiplication here must be done before the addition. Maybe your calculator handles that and maybe it doesn't, depending on how you enter the numbers. Be alert and think about the results.

25. a. 44    b. 99.92

It is a challenge for some students to find how to enter the negative number at the beginning. To do this, you must find the key on your calculator that changes the sign of a number. Also you must notice that the two variables labeled  $v$  are different variables, which is denoted by the different subscripts.

26. a.  $\frac{1}{4} = 0.25$     b. 0.1087

The crucial point here is that you must use parentheses. For part a, that is  $(14-5*2)/(5^2-3*3)$ . It is sometimes hard to remember that the calculators will only let us put in one line of values, so we can't use the same fraction bar that we would use by hand to clarify what is the numerator and denominator. We must use parentheses.

27. a. 58    b. 262.119

Although it is best to be able to enter all the numbers in the calculator and have it compute one final result, sometimes that is difficult. In this case, you may need to use some parentheses or else enter this problem in a different order in order to get the exponential part done correctly. If you want to, you can work some parts separately with the calculator, write the results, and then combine those with the calculator to find the final answer.

28. a. 10    b. 8.8408

Here, you will need to solve a proportion equation to obtain the answer. For part a, we have

$$r = \frac{m-t}{s} \quad \text{becomes} \quad \begin{aligned} 2 &= \frac{m-4}{3} \\ \frac{2}{1} &= \frac{m-4}{3} \\ 6 &= m-4 \\ 6+4 &= m-4+4 \\ 10 &= m \end{aligned}$$

Alternatively, you could just solve the equation first for  $m$  in terms of the other variables, and then plug in the values of the other variables.

$$\begin{aligned} r &= \frac{m-t}{s} \\ \frac{r}{1} &= \frac{m-t}{s} \\ r \cdot s &= m-t \\ r \cdot s + t &= m-t+t \\ r \cdot s + t &= m \\ m &= r \cdot s + t \end{aligned} \quad \begin{aligned} \text{Then, we have} \\ m &= r \cdot s + t \\ m &= 2 \cdot 3 + 4 \\ m &= 6 + 4 \\ m &= 10 \end{aligned}$$