SHOW THEM YOU KNOW SOME MATH!

Preparing for the
Mathematics Diagnostic Test for Placement Test at UVI

Information to assist students in preparing to avoid the necessity of taking a non-credit mathematics course

A student who enters the University of the Virgin Islands with an SAT-M score below 490 is automatically placed in the *Math Skills* courses, MAT 023 – 024 unless the student demonstrates competence in essential mathematics skills on UVI's Mathematics Diagnostic and Placement Test.

The Mathematics test is administered to incoming students as a diagnostic tool. If you received adequate mathematics preparation in high school, you should review that mathematics now, brush up on your skills and be ready to demonstrate your proficiency on the diagnostic test for placement so that you do not waste your education dollars or your precious time by repeating your high school mathematics. For those students who are placed in the Math Skills program, the test helps your instructor to understand your mathematics needs.

This document contains the type of questions you should be able to answer at about the level you can expect on the placement tests.

University of the Virgin Islands
College of Science and Mathematics:
Department of Mathematical Sciences

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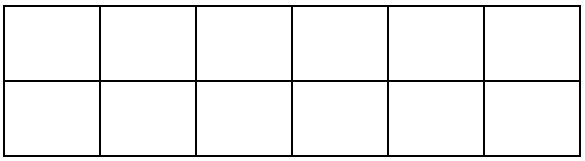
Questions to assess your understanding of numbers and basic arithmetic operations.

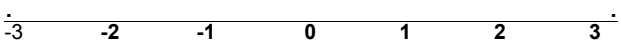
You must be able to perform simple examples of the operations of addition, subtraction, multiplication and division on fractions, decimals and integers without a calculator. Of even more importance, you must be able to demonstrate that you know what these numbers mean.

Let us begin with meaning; some might call this *number sense*.

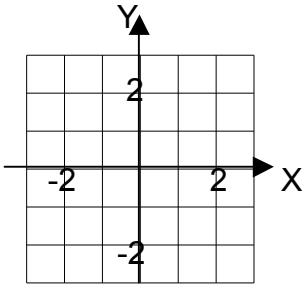
You probably have a good understanding of the number $\frac{1}{2}$. You could shade $\frac{1}{2}$ of this box.



You could mark the number $\frac{1}{2}$ in the appropriate position on this number line.



You could graph the point (-2, $\frac{1}{2}$) on this coordinate plane.



You need to be able to answer similar questions with other fractions. Answers begin on page 9.

Do the following:

1. Shade in $\frac{5}{6}$ of the box above. Explain why your shading illustrates the number $\frac{5}{6}$.
2. Mark the point that represents the number $\frac{5}{6}$ on the number line above. Be as accurate as you can. Explain why the point belongs in the position you chose.

3. Mark the point $(1, -\frac{5}{6})$ on the coordinate plane.

4. Mark the point that represents the number $\frac{5}{3}$ on the number line. Be as accurate as you can.

5. Mark the point $\left(-\frac{5}{3}, \frac{3}{2}\right)$ on the coordinate plane. Be as accurate as you can.

Next, we consider arithmetic operations.

You need to know how to add, subtract, multiply and divide fractions. You also need to understand the meaning of these operations. Computations will not be any harder than the types listed below. **Try these**.

6. $\frac{3}{2} - \frac{9}{8}$

7. $\frac{3}{2} \cdot \frac{9}{8}$

8. $\frac{3}{2} \div \frac{9}{8}$

9. $4 + \frac{1}{2}$

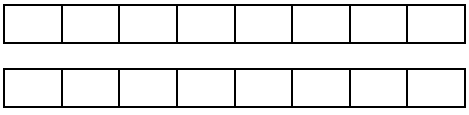
10. $4 \cdot \frac{1}{2}$

11. $\frac{1}{2} \div 4$

12. $4 \div \frac{1}{2}$

13. $1\frac{1}{2} - \frac{5}{8}$

14. Use the diagram below to explain the subtraction in question 6 by doing the following: Shade the diagram to illustrate $\frac{3}{2}$ using one color. Shade the diagram to illustrate $\frac{9}{8}$ using a different color. Then explain which part of the diagram is represented by the subtraction $\frac{3}{2} - \frac{9}{8}$.



15. Explain the difference between the meaning of questions 9 and 10. Use a real world example or else a diagram.

16. Explain the difference between the meaning of questions 11 and 12. What might it mean if you had "half a banana" and you "divided by 4"? What might it mean if you had "4 bananas" and you "divided by ½"?

You need to know how to operate on decimals. If you understand the meaning of the numbers, you won't make any major errors. Remember, no calculators will be allowed; you actually need to think about these!

17. 18 + 1.2

18. 1.23 x 1.1

19. $\frac{1.23}{0.1}$

You must be able to perform simple operations on integers without recourse to a calculator. Test yourself on the following examples.

20. – 12 + 18
21. –6 – 6
22. (-5)(-2)
23. (-5)(2)
24. $(-5)^2$
25. -5^2
26. $(-5)^3$

Questions to assess your understanding of percents and other ratios.

Percents give us a common language for comparing amounts. You should be able to relate percents to equivalent fractions and decimals. **Try these. Give corresponding values in each column.**

Percent	Decimal	Fraction
27. 50%		
28.	0.25	
29.		$\frac{3}{2}$
30. $33\frac{1}{3}\%$		
31.	0.3	

Some questions, like the next three, may require analysis of a situation. In general, you will be expected to show your work. These three use the concept of ratio, sometimes as a percent and sometimes not. You should be able to think through these easily.

32. If you are being paid $10 an hour and get a raise that will increase your hourly rate by 10%, what will your hourly wage be then?

33. A newspaper reporter wishes to report that 40 students from a group of 200 students who were chosen to receive a special award came from his school district by stating the number as a percent. What percent of the 200 students are from his district?

34. If the amount of rum needed for 10 gallons of a recipe for punch is 2 liters, how much rum would you need for the same punch if you only wanted to make 2 gallons of punch?

Solving linear equations in one variable.

Try these examples.

35. Solve 2x + 8 = 6

36. Solve 2(3 – x) = 7 – x

37. Solve 5 – 4x = 2x

Basic graphing concepts

You may be asked to complete an input/output table, given its equation, and then to graph the points on an x-y coordinate plane. For linear equations, you should also be able to draw the line that represents the equation.

38. Complete this input/output table for the equation $y = \frac{3}{5}x - 1$. Then use the points in your table to graph the line representing $y = \frac{3}{5}x - 1$ on an x-y coordinate plane. Be careful to label the units on your axes in a consistent and useful way.

x	y
-5	
0	
5	

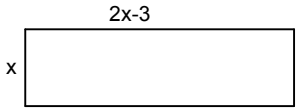
You should be able to plot points with fraction coordinates, too, when necessary.

39. Plot the points $\left(\frac{1}{2}, -4\right)$ and $\left(-2, \frac{1}{4}\right)$ on an x-y coordinate plane.

Area and perimeter concepts

You may be asked to demonstrate understanding of area and perimeter of geometric figures.

40. What is the area of the rectangle below? Its length is 2x – 3 cm and its width is x cm. Give your answer in terms of the variable x. Don't forget to give units.
41. What is the perimeter of the rectangle below? Simplify your answer. (Remember to give units.)



42. Draw and label 3 rectangles that all have area 12 square centimeters but have different perimeters. Tell what the perimeter is for each one.

43. Draw some other figure (not a rectangle) that has an area of 12 square cm. Tell how you know its area is 12 cm^2.

Notice that question 41 required that you simplify your answer. Some questions will just ask you to simplify an expression.

44. Simplify $2x^2 + x^2 - 5x - x + 5$

45. Simplify $2x(x-1) + 3 + x - 5$

46. Multiply and simplify: (2x – 7)(x + 3)
47. Simplify: a. $\frac{6x^3}{x}$ b. $\frac{6x^3}{8x^5}$
48. Write these expressions with no negative or zero exponent.
    a. $2x^{-1}$ b. $(3x)^0$ c. $3x^0$ d. $(2x^{-1})(5x^3)$

If you are proficient with the skills discussed above, you should pass the part of the placement diagnostic that exempts you from the first Math Skills course, MATH 023.

The diagnostic test will allow you to move directly to MATH 140 or MATH 143, without taking MATH 024, if you are proficient with all of the above and also show that you can:

- solve linear inequalities;
- solve systems of linear equations;
- solve quadratic equations;
- solve equations that contain fractions;
- graph a line in a coordinate plane and use the concept of slope of a line;
- simplify expressions involving exponents and radicals;
- do operations on polynomials and fractions.

For problems about these topics, you will be permitted to use a calculator if you wish. However, you do not need a calculator to answer the questions.

Solve linear inequalities

Solve, and graph the solution set on a number line:

49. $2(x-7) < x-17$

50. $7-2x < 12$

Solve systems of linear equations

51. Solve this system of equations: $\begin{cases} 2x-5y=18 \\ x-y=6 \end{cases}$

52. Graph the line y = 2x – 5 and the line y = 4 – x on the same coordinate plane. Mark the point on the graph that represents the solution to the system $\begin{cases} y=2x-5 \\ y=4-x \end{cases}$

Solve quadratic equations

53. Solve $x^2-5x-36=0$

54. Think about this one before you start working! (Don't take a step backwards.) Solve $(2x-5)(x+1)=0$

55. If you can do that, you could extend your knowledge to solve this: 2x(x - 4)(3 - 2x)=0

Solve equations that contain fractions

Some of these require a very familiar technique.

56. Solve $\frac{x}{3} = \frac{x-1}{2}$

You may need more work on others:

57. Solve $\frac{x}{3} = \frac{x-1}{2} - 4$

Graph a line in a coordinate plane and use the concept of slope of a line

58. Graph the line y = 3x – 8. What is the slope of this line? What is its y-intercept?

59. Find the slope of the line that passes through the points (-3, 5) and (2, 7).

Simplify expressions involving exponents and radicals and perform operations on polynomials and fractions

Some questions require numerical or algebraic computations. For example,

60. Simplify a. $\sqrt{64}$ b. $\sqrt{5^2+12^2}$ c. $\sqrt[3]{125}$

With radicals, it is probably as important to know what cannot be simplified as how to simplify what can be simplified.

61. Simplify the expression that can be simplified and let the other one alone:

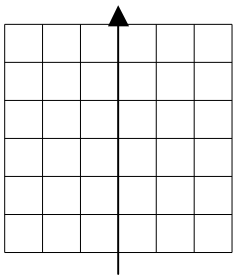
a. $\sqrt{4x^2+25}$ b. $\sqrt{49x^6}$

Interpret information from graphs.

You may be given information about a situation in graphical form and asked questions about that situation. Such questions would differ a great deal from test to test. We suggest that you read the graphs carefully and use common sense along with your basic mathematical understanding.

Best wishes for effective review of your elementary mathematics skills.

Note: *You may not use a calculator on the diagnostic placement test. However, you will need a* ***graphing calculator*** *for MATH 023, MATH 024, MATH 140, and for MATH 143. We recommend the TI-84 or TI-84 Plus or TI-84 Silver.*



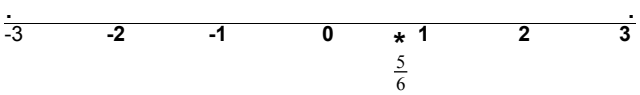
Answers

1. For example,

or,

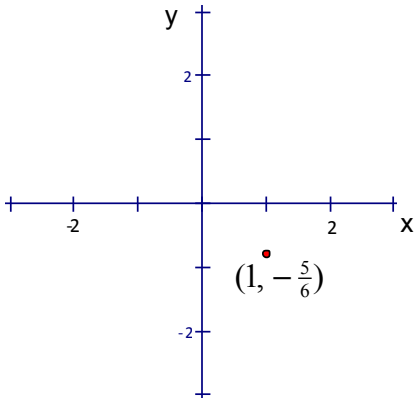
Be sure you see why either one of these shadings is a correct response. The first example is more helpful than the second one in demonstrating the meaning of the number 5/6, but both are correct. You could find other ways to shade 5/6 of the box if you wanted to.

2.



Practice placing other fractions on the number line. Try improper fractions as well as proper ones. Try negatives as well as positives.

3.



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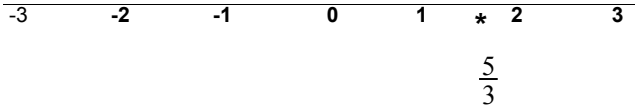
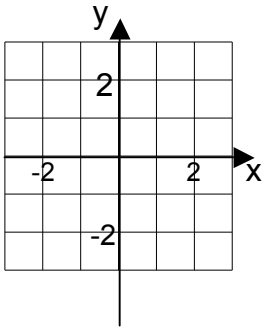


Use your knowledge that $\frac{5}{3} = 1\frac{2}{3}$ to help you locate the correct position.

5. 

$(-1\frac{2}{3}, 1\frac{1}{2})$

6. $\frac{3}{8}$

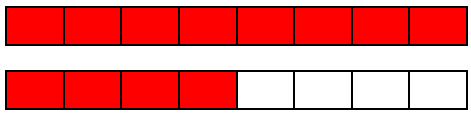
7. $\frac{27}{16}$ is one way to write this answer.
Or you can write it as $1\frac{11}{16}$.
The improper fraction is the more useful form for mathematical computation. The mixed number helps us to understand the value of the number and see where it fits on a number line.

8. $\frac{4}{3}$ is one way to write this answer.
Or you can write it as $1\frac{1}{3}$.

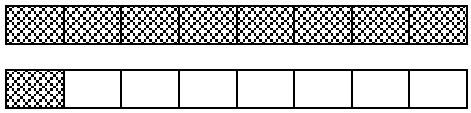
9. $4\frac{1}{2}$. Of course, you can write this answer in other forms, too.

10. 2 11. $\frac{1}{8}$ 12. 8 13. $\frac{7}{8}$

14. Shade this way in one color for 3/2:



And this way in a second color for 9/8:



Then you can explain to someone that subtracting
3/2 – 9/8 results in 3/8 by showing the difference between the two diagrams.

15. You might illustrate 4 + ½ this way: □ □ □ □ ◺

Or, you might say that you had 4 bananas and half of another banana.

However, (4)(½), multiplication, means something like 

These 4 half-circles would be the same as 2 circles if we re-arranged them nicely.

Using the banana story, you could say that you had 4 half-bananas. That is equivalent to 2 whole bananas if you eat them right away.

16. In #11, imagine that you cut up a half of a banana into 4 equal parts. The answer, 1/8, tells you what fraction of the banana is in each of those parts.
In #12, you might imagine that you have 4 bananas and you want to know how many half bananas you will be able to serve on a plate.

17. 19.2

18. 1.353

19. 12.3

20. 6

21. –12

22. 10

23. –10

24. 25

25. –25

26. –125

27. 0.5, $\frac{1}{2}$

28. 25%, $\frac{1}{4}$

29. 150%, 1.5

30. 0.333..., $\frac{1}{3}$

31. 30%, $\frac{3}{10}$

32. $11. (You can take 10% of $10 and add the result to the original $10. Or you can take 110% of $10.)

33. 20% (One way to do this is to use the fact that a percent is a ratio with a base of 100. You can solve the equation $\frac{40}{200} = \frac{x}{100}$.)

34. 0.4 liters. (If the recipe is going to result in the same punch, the ratios of ingredients will have to be the same as in the original recipe. So you could solve the problem with the solution to the equation $\frac{x}{2} = \frac{2}{10}$, where what you mean is $\frac{x \text{ liters of rum}}{2 \text{ gallons of punch}} = \frac{2 \text{ liters of rum}}{10 \text{ gallons of punch}}$.

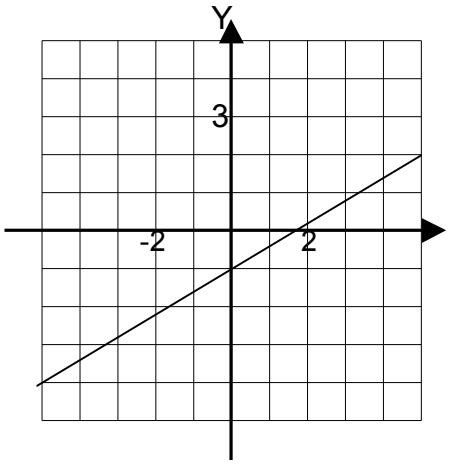
35. x = -1

36. x = -1

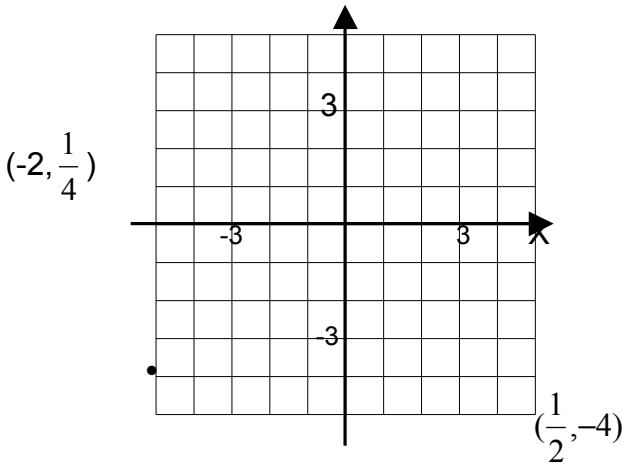
37. x = $\frac{5}{6}$

38.

x	Y
-5	-4
0	-1
5	2



39.

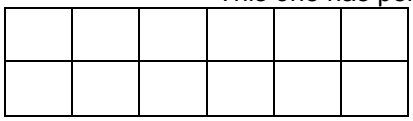


40. You can give this answer as x(2x – 3) square centimeters, or you can multiply and give your answer as $2x^2 - 3x\ \text{cm}^2$.

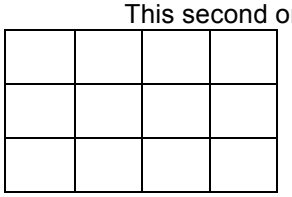
41. 6x – 6 cm. (Recall that perimeter is the distance around the figure. Area tells us how much space is enclosed by the figure. That's why the area is measured in square units while the perimeter is a measure of length.)

42. Here are some possible answers. Assume each little square in these drawings has sides 1 cm long.

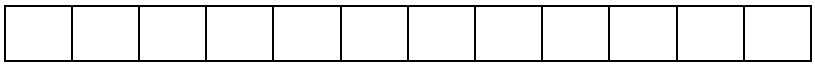
This one has perimeter 16 cm.



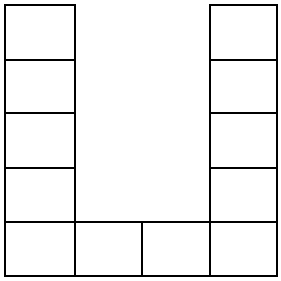
This second one has a 14 cm perimeter.



perimeter 26 cm



43. There are countless possibilities! Anything that encloses the same space that you have in your three rectangles will do. Here is an example. You do something else.



44. $3x^2 - 6x + 5$

45. $2x^2 - x - 2$

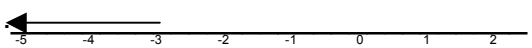
46. $2x^2 - x - 21$

47. a. $6x^2$ b. $\frac{3}{4x^2}$

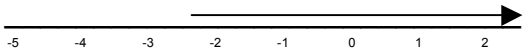
48. a. $\frac{2}{x}$ b. 1

c. 3 d. $10x^2$

49. x < -3

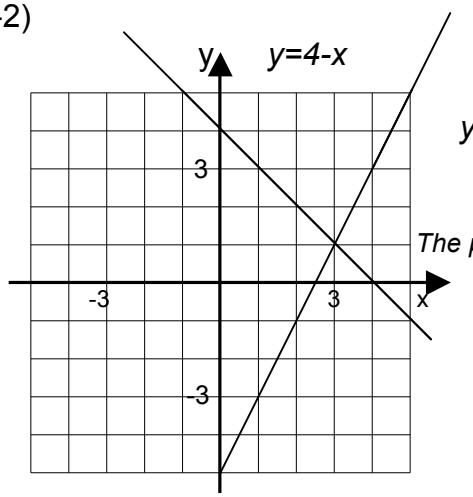


50. x > $-\frac{5}{2}$



51. (4, -2)

52.



The point(3,1) represents the solution .

53. x = 9, x = -4

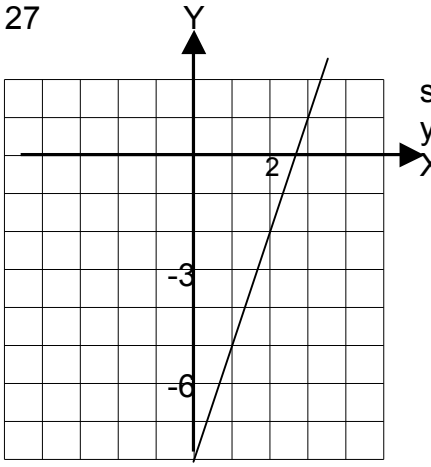
54. $x = \frac{5}{2}, x = -1$

55. $x = 0, x = 4, x = \frac{3}{2}$

56. x = 3

57. x = 27

58.



slope: 3
y-intercept: (0, - 8)

59. The slope is $\frac{7-5}{2-(-3)} = \frac{2}{5}$

60. a. 8 b. 13 c. 5

61. a. This expression cannot be simplified.
b. This one can: $7x^3$

Best wishes!