

## Placement Solution Guide

This has the solutions to the Precalculus Placement Worksheet, starting on the next page. Be sure to do the problems before looking at the solutions.

At the end of the worksheet is some guidance about choosing the right course. If you have questions about anything or want help deciding what to do, contact Dr. Rachel Epstein: [rachel.epstein@gcsu.edu](mailto:rachel.epstein@gcsu.edu).

Color-coding guide:

Black: The original problems

Blue: the solutions, including explanation

Purple: Discussion that you should read if you missed the problem

**There is a discussion at the end of the solutions to help you decide what to do next.**

## Solutions

1. Simplify:  $\frac{3}{4} \times \frac{2}{3}$

$\frac{1}{2}$  (this starts as  $\frac{3 \cdot 2}{4 \cdot 3} = \frac{6}{12}$  and then simplifies to  $\frac{1}{2}$ .)

If you made a mistake with this one, ask yourself if it is a concept you understand and just made a little mistake on that you probably won't make often or if it is a concept you are still having difficulty with and are likely to make more mistakes on. If you aren't super comfortable with this, then Precalculus will probably be very challenging and it would probably make sense to take College Algebra first. However, if most of the rest of this worksheet goes okay, you could still be ready for Precalculus with a little review. Here is a link to a free online textbook that talks about fraction multiplication, with examples and exercises. [OpenStax Fractions](#)

2. Compute:  $\frac{\left(\frac{2}{3}\right)}{\left(\frac{3}{4}\right)}$

$\frac{8}{9}$  (commonly called "keep change flip" or "multiply by the reciprocal," you get  $\frac{2}{3} \times \frac{4}{3} = \frac{8}{9}$ )

If you made a mistake with this one, you can review fraction division here: [OpenStax Fractions](#). This is something that will be used quite a bit in Precalculus.

3. Simplify:  $2 \div \frac{1}{3}$

6 (same idea as the previous problem - you can think of 2 as  $\frac{2}{1}$  if it helps - you get  $\frac{2}{1} \times \frac{3}{1} = \frac{6}{1} = 6$ , or just do 2 times the reciprocal of  $\frac{1}{3}$ , which is 3)

If you made a mistake with this one, you can review fraction division here: [OpenStax Fractions](#). This is something that will be used quite a bit in Precalculus.

4. Solve for  $x$ :  $-2x + 4 = 6$

-1 (subtract 4 from both sides to get  $-2x = 2$ . Divide by  $-2$  to get  $x = -1$ .)

If you are not super comfortable solving linear equations, Precalculus will be very challenging, and it would probably make sense to take College Algebra first. However, if most of the rest

of this worksheet goes okay, you could still be ready for Precalculus with a little review. Here is a link to a free online textbook that talks about solving linear equations, with examples and exercises. [OpenStax Linear Equations](#)

5. Solve for  $x$ :  $3x + 5 = 6x - 4$

3 (Bring all the  $x$ 's to one side and the constants to the other. It doesn't matter which side. You get  $9 = 3x$  or  $-3x = -9$ . Dividing by either 3 or  $-3$  depending on which equation you used, you get  $x = 3$ .)

See the note in #4

6. Expand  $(x + 3)^2$

$x^2 + 6x + 9$  (use FOIL)

If you just forgot to do FOIL, but know that you are supposed to, that is probably not going to be a big problem. If this is unfamiliar, though, or you have difficulty with it, it would be a good idea to at least review it or you could start in College Algebra. You will find information about multiplying polynomials, which is what this is doing, here: [OpenStax Polynomials](#)

7. True or false:  $\sqrt{x + 2} = \sqrt{x} + \sqrt{2}$ .

False (to see why, just test it:  $\sqrt{2 + 2} = 2$ .  $\sqrt{2} + \sqrt{2} \neq 2$ )

It's going to take some practice to get out of the habit of separating square roots like this, and usually making this kind of mistake means you are probably making other algebra mistakes. If you did well on the rest of this worksheet, that's a good sign you are ready for Precalculus, but otherwise College Algebra may be a good idea to get more practice. To learn more about square roots, see: [OpenStax Radicals](#)

8. Compute  $2^3$ .

8 ( $2 \times 2 \times 2 = 8$ )

If you weren't sure what  $2^3$  meant, then Precalculus will likely contain a lot of material you aren't familiar with and you should start in College Algebra.

9. Compute  $\sqrt[3]{8}$

2 (We are looking for a number  $x$  where  $x^3 = 8$ . The previous problem was a hint here. It is 2)

If you aren't familiar with cube roots, then Precalculus will be more challenging. You could start in College Algebra, but you could also check out the information here if you are feeling otherwise well prepared: [OpenStax Radicals](#)

10. Compute  $4^{\frac{1}{2}}$ . (That's an exponent, not multiplication)

2 (since this is another way of writing  $\sqrt{4}$ )

Not being familiar with this notation is not a particularly big issue, and we will mention it in class, but it is good to know beforehand. There is information here about this type of problem if you go to where it says “Rational Exponents”: [OpenStax Radicals](#)

11. Solve for  $x$ :  $2x^2 - 4 = 0$

$x = \pm\sqrt{2}$  (add 4 to both sides to get  $2x^2 = 4$ , then divide by 2 to get  $x^2 = 2$ . Take the square root of both sides, and don't forget that the solution can be either positive or negative because  $(-\sqrt{2})^2 = 2$  also.)

If your only mistake was forgetting the  $\pm$ , that is very minor and also very common, so not something to be concerned about. Just remember that to solve an equation that is  $x^2 =$  some positive number, you will always get both a positive and negative answer. If you had trouble otherwise, this is something that we will use a lot in Precalculus and will definitely add to the challenge if you aren't comfortable with this sort of equation. If you want to just review instead of taking College Algebra, you can find some materials here if you scroll down to “The Square Root Property”: [OpenStax Quadratic Equations](#)

12. Solve for  $x$ :  $\sqrt{x+1} - 1 = 2$

$x = 8$  (add 1 to both sides to get  $\sqrt{x+1} = 3$ . Then square both sides to get rid of the square root.  $x+1 = 9$ . Finally,  $x = 8$ .)

You can find some help on solving radical equations (i.e. equations involving roots) here: [OpenStax Solving Equations](#) - scroll down to where it says “Solving Radical Equations.”

13. Add the fractions to get a single fraction:

$$3 + \frac{4}{3}$$

$\frac{13}{3}$  (rewrite as  $\frac{3}{1} + \frac{4}{3}$  then the common denominator is 3, so  $\frac{9}{3} + \frac{4}{3} = \frac{13}{3}$ )

Being comfortable with fractions will be important in Precalculus. For review of adding fractions, see the part about adding fractions with different denominators in: [OpenStax Adding and Subtracting Fractions](#)

14. Add the fractions to get a single fraction:

$$\frac{1}{x} + \frac{2}{y}$$

$\frac{y+2x}{xy}$  (here we need to choose a common denominator, which is  $xy$  since we don't know if  $x$  and  $y$  have any smaller common multiples. So we get  $\frac{y}{xy} + \frac{2x}{xy} = \frac{y+2x}{xy}$ .)

Being comfortable with fractions will be important in Precalculus. For review of adding

fractions, see the part about adding fractions with different denominators in: [OpenStax Adding and Subtracting Fractions](#)

15. Solve for  $x$ :  $x^2 + x - 6 = 0$ .

$x = -3$  and  $x = 2$  (Factor:  $(x + 3)(x - 2) = 0$ , so  $x + 3 = 0$  or  $x - 2 = 0$ , thus  $x = -3$  and  $x = 2$  are both solutions. The quadratic formula can also be used here to get the same answer.)

Solving quadratic equations through factoring is something you could get more practice with in College Algebra. To review the topic before Precalculus, see: [OpenStax Solving Quadratic Equations](#)

16. Solve for  $x$ :  $x^2 - 2x = -3x + 6$ .

$x = -3$  and  $x = 2$  (The first step is to get all the terms onto one side so that the other side is just 0. This is necessary before factoring. To do this, we can add  $3x$  and  $-6$  to both sides to get  $x^2 + x - 6 = 0$ . This might look familiar as it is #15, so continue as in that problem.)

See #15

17. Solve for  $x$ :  $\frac{3}{x} = 2$ .

$\frac{3}{2}$  (To solve this, we must get  $x$  by itself, which requires getting it out of the denominator. The first step is to multiply both sides by  $x$  so that the  $x$  is no longer in the denominator. Then we have  $3 = 2x$ , which we can divide by 2 to get  $\frac{3}{2} = x$ .)

A common mistake on problems like these is to divide by the numerator 3 and end up with  $x = \frac{2}{3}$  when in fact what you have is  $\frac{1}{x} = \frac{2}{3}$ . Notice that dividing by 3 just changes the numerator, but does not bring the  $x$  out from the denominator. To review solving rational equations, see: [OpenStax Solving Rational Equations](#). Note most of the examples there are harder than this one.

18. True or false:

$$\frac{1+y}{1+x} = \frac{y}{x} \quad \text{because we can cancel out the 1s}$$

False (test it:  $\frac{1+4}{1+1} = \frac{5}{2} \neq \frac{4}{1}$ . The reason the 1's don't cancel is that they are being added, not multiplied, and you can only simplify when the numerator and denominator have a factor in common)

Simplifying fractions correctly is a useful skill, and it's particularly important not to simplify things incorrectly. There is some good explanation with examples/problems here if you scroll down to "Simplify Rational Expressions": [OpenStax Simplify Rational Expressions](#)

19. True or false:

$$\frac{1+y}{x} = \frac{1}{x} + \frac{y}{x}$$

True - this is just adding fractions - if you add the fractions on the right, you get the one on the left. If you start on the left, you can remember that you can always separate sums and differences in the numerator, but never the denominator

Here is a resource on adding fractions that may be useful: [OpenStax Adding and Subtracting Fractions](#)

20. Simplify the following, if possible:

$$\frac{2x^2 + x^3}{2x}$$

$\frac{2x+x^2}{2}$  (we want to look for a common factor, which is just  $x$  as there is no 2 in  $x^3$ , so we get  $\frac{x(2x+x^2)}{2x} = \frac{2x+x^2}{2}$ )

If you are having trouble following the argument above, it may be best to start in College Algebra. However, you can also review this topic. There is some good explanation with examples/problems here if you scroll down to “Simplify Rational Expressions”: [OpenStax Simplify Rational Expressions](#)

21. Simplify the following, if possible:

$$\frac{1+x}{x}$$

There are two right answers here. Either “not possible” or  $\frac{1}{x} + 1$ . Deciding which of the expressions is more “simple” is just a matter of opinion, so either is fine. What would not be correct would be to cross out the  $x$ 's and just get 1.

Simplifying fractions correctly is a useful skill, and it's particularly important not to simplify things incorrectly. There is some good explanation with examples/problems here if you scroll down to “Simplify Rational Expressions”: [OpenStax Simplify Rational Expressions](#)

22. True or false:  $(x^3)^2 = x^6$

True - this is the power property of exponents

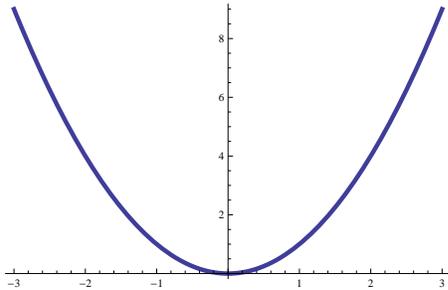
While we will do a brief review of exponent properties in Precalculus, it will be very helpful to already have a good understanding of them. There are some helpful explanations here: [OpenStax Multiplication Properties of Exponents](#)

23. Which is equal to  $x^2x^4$ ?  $x^8$  or  $x^6$ ?

$x^6$  - this is the multiplication property of exponents - the exponents get added

See #22

24. Sketch a graph of the function  $y = x^2$ .



This particular graph will be used frequently as an example in Precalculus, and it is helpful to know its shape. You won't need to graph complicated quadratic functions, but you should be familiar with plotting points if you don't know what a function looks like. There is some information about graphs here: [OpenStax The Rectangular Coordinate System and Graphs](#)

25. Plot four points on the graph of the function  $y = (x - 1)^3$

There are lots of possible answers. The method is to plug in different numbers for  $x$  and see what you get for  $y$ , then plot it on a set of axes. For example,  $x = 0$  leads to  $y = (-1)^3 = -1$ , so the point  $(0, -1)$  is on the graph.

We will need to plot points on graphs quite a bit to understand the shapes of functions that we are looking at. There is some explanation here, although the examples are more simple: [OpenStax The Rectangular Coordinate System and Graphs](#)

26. Suppose  $f(x) = 3x - 1$ . Find  $f(2)$ .

$$5 \quad (f(2) = 3 \cdot 2 - 1 = 5)$$

If you haven't seen function notation like this, it's okay, and we will talk about it briefly at the beginning of the course, but it will be a little more challenging if you are learning it for the first time. For a resource about functions, see [OpenStax Functions and Function Notation](#)

## Discussion about choosing the right course

Rather than giving a specific number of problems that you must have correct in order to take Precalculus, we want to give you the freedom to make the decision that you feel is right. That said, if you had difficulty with several of these problems and didn't understand the solutions, Precalculus will likely be extra challenging, and it is already a challenging course. Your course grade will primarily be determined by how proficient you have become in the course material, which means that if you start off needing to fill large gaps in the prerequisite material, you will need to work significantly harder to learn the new material enough to earn a passing grade. That is why we recommend that if you do not feel comfortable with the prerequisite material, that you take College Algebra before Precalculus.

If you don't need Precalculus for your major, we recommend Math Modeling (Math 1101) or Quantitative Skills and Reasoning (Math 1001) instead.

If you decide to take Precalculus, we recommend that you review the material on the missed problems. The peer tutors at the Learning Center on the second floor of the library would also be happy to help you go over the material. The Learning Center also has their own review worksheets on some of these topics.

If you still aren't sure what course to take, you are very welcome to contact the math department and ask for advice. The Precalculus course coordinators, Dr. Rachel Epstein and Dr. Marcela Chiorescu, would be happy to help. Our emails are [rachel.epstein@gcsu.edu](mailto:rachel.epstein@gcsu.edu) and [marcela.chiorescu@gcsu.edu](mailto:marcela.chiorescu@gcsu.edu).