

Hello and welcome to Math 1450! We (your instructors) want to get you started off on the right foot this semester and will therefore be doing a quick skills check on the second day of class, during the discussion section. The rest of this document is a list of topics, with associated example questions, which may appear on this skills check. These topics roughly correspond to sections 1.1-1.6 in the textbook we'll be using. The hope is that each of these topics are familiar to you as we intend to move through this introductory material very quickly. As a quick note, the example problems interspersed throughout the topics list are provided again after the topics list as a single list of problems. The answers to these problems are on the very last page of this document.

### List of topics

- Fraction operations

- Adding, subtracting, multiplying, and dividing single-digit fractions without a calculator

Example problems:

1. Compute  $\frac{1}{3} - \frac{1}{4}$ .

2. Compute  $\frac{1}{3} \div \frac{1}{4}$ .

- Identifying which fraction is larger

Example problem:

3. Put the following fractions in order from smallest to largest:  $\frac{2}{5}, \frac{1}{2}, \frac{2}{7}, \frac{1}{3}$

- Properties of lines

- Find the slope of a line by using two points

Example problem:

4. Find the slope of the line which passes through the points  $(1, -2)$  and  $(-2, 3)$ .

- Point-slope and slope-intercept form of a line

Example problems:

5. Find the slope and  $y$ -intercept of the line  $y = 4x - 6$ .

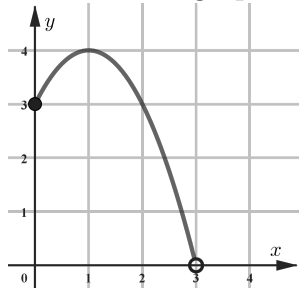
6. Find an equation of the line with slope  $-2$  which passes through the point  $(3, 1)$ .

- Functions in general

- Definition of a function, its range, and its domain

Example problem:

7. Consider the graph shown below.



Is the graph shown a function? If so, give its range and domain. If not, briefly explain why not.

- Transformations of functions

Example problems:

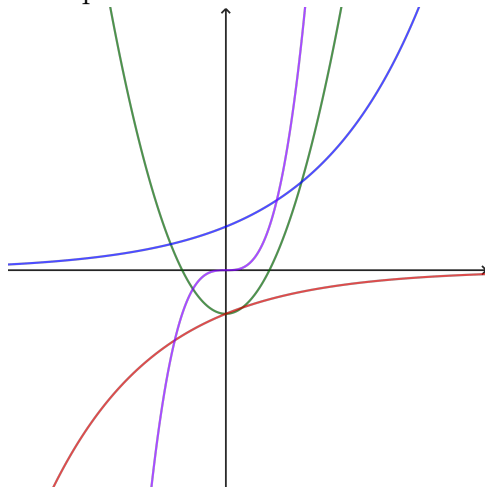
8. Suppose  $f(x) = x^2$  and  $g(x) = x - 1$ . Compute  $f(g(x)) - g(f(x))$  and simplify your answer.
9. Suppose  $s(t) = \sqrt{t - 1}$ . Compute  $s(x^2 + 1)$  and simplify your answer. (The  $x$  is not a typo.)

- Exponential functions and logarithms

- Recognize and manipulate exponential functions of the form  $P(t) = P_0 a^t$

Example problems:

10. An exponential function of the form  $f(x) = Q_0 a^x$  passes through the points  $(0, 4)$  and  $(1, 2)$ . Find the values of  $Q_0$  and  $a$ .
11. Which (if any) of the graphs shown below could represent the graph of an exponential function? There may be more than one correct answer.



- Simplification properties for exponents

Example problem:

- 12.** Simplify the expression below as much as possible. Any exponents in your answer must be positive.

$$\frac{x^{43}y^{-7}}{x^2} + \frac{x^{-12}y^2}{x^{-10}y^9}$$

- Definition and use of the natural logarithm

Example problem:

- 13.** Solve the equation  $6e^r = 12$  for  $r$ .

- Simplification properties for logarithms

Example problem:

- 14.** Simplify the expression  $\ln\left(\frac{2x^2}{e^6}\right)$  as much as possible.

- Trigonometric functions

- How radians and degrees are related to each other and to the unit circle

Example problems:

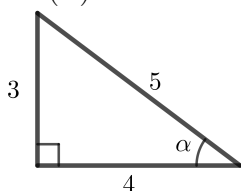
- 15.** Convert an angle of  $330^\circ$  to radians.

- 16.** Graph an angle of  $2\pi/3$  on the unit circle.

- Definitions of sine, cosine, and tangent, and their relationship with right triangles.

Example problem:

- 17.** Consider the right triangle shown below. Compute  $\sin(\alpha)$ ,  $\cos(\alpha)$ , and  $\tan(\alpha)$ .



- Definitions of arcsine, arctangent (a.k.a.  $\sin^{-1}$  and  $\tan^{-1}$ )

Example problem:

- 18.** Consider the right triangle shown in the problem above. Find  $\alpha$ .

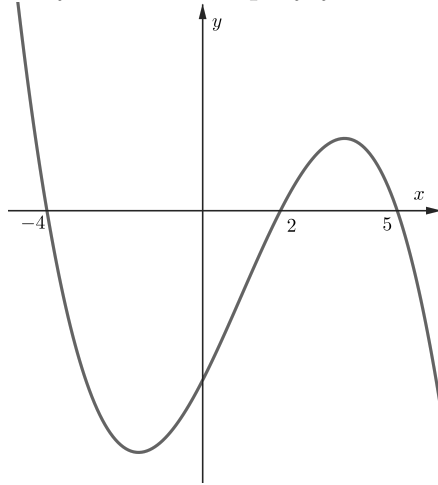
- Polynomial functions

- The structure and degree of a polynomial

Example problems:

**19.** Find the degree of the polynomial  $f(z) = 7 + 6z - 8z^4 + 3z^2 - z^3$ .

**20.** The graph of a polynomial  $f$  is shown below. Write a possible formula for  $f$ . Do not simplify your answer.



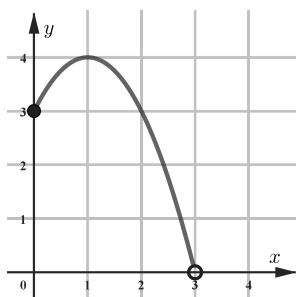
- Basic factoring of quadratic polynomials and/or the use of the quadratic formula

Example problem:

**21.** Find the  $x$ -intercepts, or roots, of the polynomial  $g(x) = x^2 - 3x - 4$ .

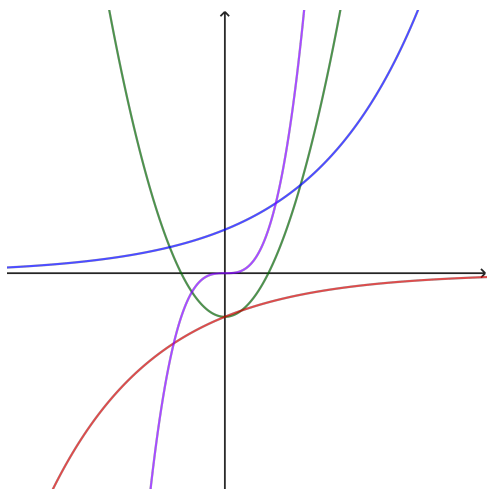
### List of practice questions

1. Compute  $\frac{1}{3} - \frac{1}{4}$ .
2. Compute  $\frac{1}{3} \div \frac{1}{4}$ .
3. Put the following fractions in order from smallest to largest:  $\frac{2}{5}, \frac{1}{2}, \frac{2}{7}, \frac{1}{3}$
4. Find the slope of the line which passes through the points  $(1, -2)$  and  $(-2, 3)$ .
5. Find the slope and  $y$ -intercept of the line  $y = 4x - 6$ .
6. Find an equation of the line with slope  $-2$  which passes through the point  $(3, 1)$ .
7. Consider the graph shown below.



- Is the graph shown a function? If so, give its range and domain. If not, briefly explain why not.
8. Suppose  $f(x) = x^2$  and  $g(x) = x - 1$ . Compute  $f(g(x)) - g(f(x))$  and simplify your answer.
  9. Suppose  $s(t) = \sqrt{t - 1}$ . Compute  $s(x^2 + 1)$  and simplify your answer. (The  $x$  is not a typo.)
  10. An exponential function of the form  $f(x) = Q_0 a^x$  passes through the points  $(0, 4)$  and  $(1, 2)$ . Find the values of  $Q_0$  and  $a$ .

11. Which (if any) of the four graphs shown below could represent the graph of an exponential function? There may be more than one correct answer.



12. Simplify the expression below as much as possible. Any exponents in your answer must be positive.

$$\frac{x^{43}y^{-7}}{x^2} + \frac{x^{-12}y^2}{x^{-10}y^9}$$

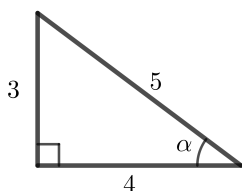
13. Solve the equation  $6e^r = 12$  for  $r$ .

14. Simplify the expression  $\ln\left(\frac{2x^2}{e^6}\right)$  as much as possible.

15. Convert an angle of  $330^\circ$  to radians.

16. Graph an angle of  $2\pi/3$  on the unit circle.

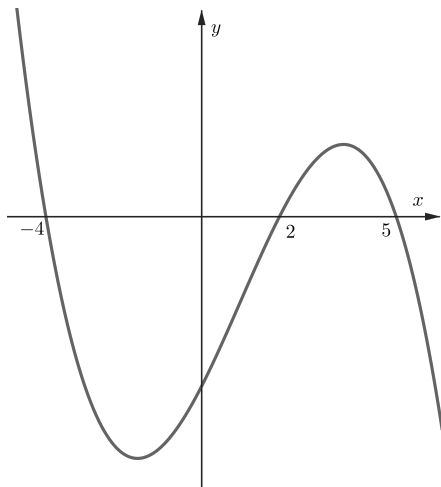
17. Consider the right triangle shown below. Compute  $\sin(\alpha)$ ,  $\cos(\alpha)$ , and  $\tan(\alpha)$ .



18. Consider the right triangle shown in the problem above. Find  $\alpha$ .

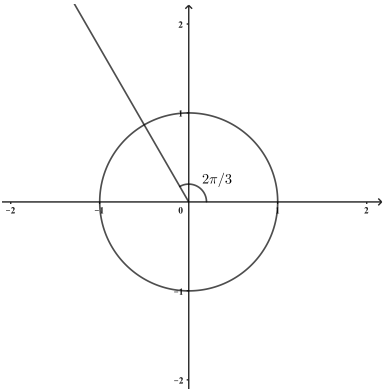
19. Find the degree of the polynomial  $f(z) = 7 + 6z - 8z^4 + 3z^2 - z^3$ .

20. The graph of a polynomial  $f$  is shown below. Write a possible formula for  $f$ . Do not simplify your answer.



21. Find the  $x$ -intercepts, or roots, of the polynomial  $g(x) = x^2 - 3x - 4$ .

### List of answers to the practice questions

1.  $\frac{1}{12}$
2.  $\frac{4}{3}$
3.  $\frac{2}{7}, \frac{1}{3}, \frac{2}{5}, \frac{1}{2}$
4.  $-5/3$
5. Slope = 4,  $y$ -intercept is  $(0, -6)$
6.  $y - 1 = -2(x - 3)$
7. Yes; the domain is  $0 \leq x < 3$  (or  $[0, 3)$ ), and the range is  $0 < y \leq 4$  (or  $(0, 4]$ )
8.  $2 - 2x$
9.  $|x|$
10.  $Q_0 = 4, a = 1/2$
11. The red and blue graphs could be exponential functions, but the green and purple graphs could not.
12.  $\frac{x^{43} + 1}{x^2 y^7}$
13.  $r = \ln(2)$
14.  $\ln(2) + 2\ln(x) - 6$
15.  $11\pi/6$
- 16.
17.  $\sin(\alpha) = 3/5, \cos(\alpha) = 4/5, \tan(\alpha) = 3/4$
18.  $\alpha = \sin^{-1}(3/5)$  or  $\alpha = \tan^{-1}(3/4)$



**19.** 4

**20.**  $f(x) = -k(x + 4)(x - 2)(x - 5)$ , where  $k$  is any positive constant

**21.**  $x = -1, 4$