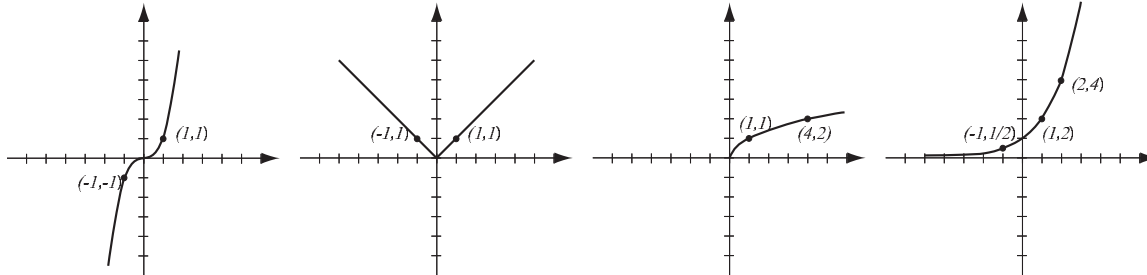
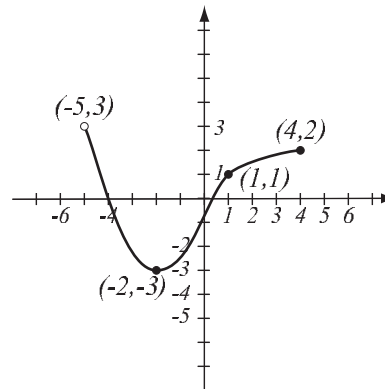


1. (8pts) The following are graphs of basic functions. Write the equation of the graph under each one.



2. (8pts) Use the graph of the function  $f$  at right to answer the following questions.

- Find:  $f(-2) =$        $f(-5) =$
- What is the domain of  $f$ ?
- What is the range of  $f$ ?
- What are the solutions of the equation  $f(x) = 1$ ?



3. (10pts)

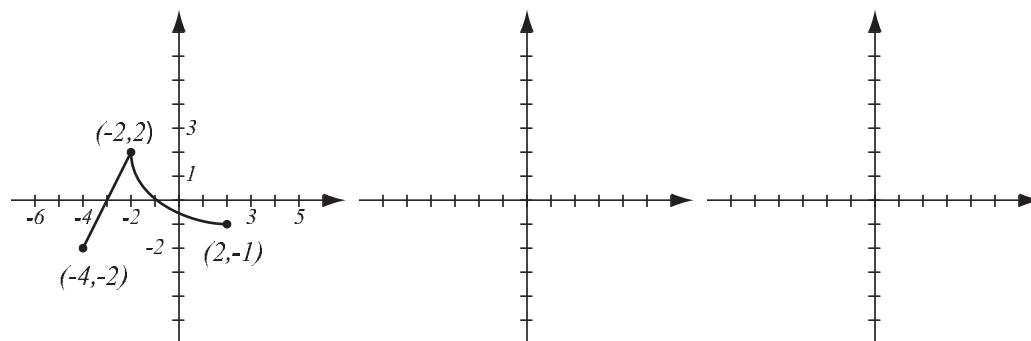
- Find the equation of the line that passes through points  $(-1, 2)$  and  $(3, 4)$ .
- Find the equation of the line (in form  $y = mx + b$ ) that is parallel to the line in a) and also passes through the point  $(2, -1)$ .
- Draw both lines in the same coordinate system

4. (3pts) Find the domain of the function  $f(x) = \frac{2x - 3}{3x - 1}$  and write it in interval notation.

5. (6pts) Solve and write the solution in interval notation.

$$|2x - 1| \geq 5$$

6. (10pts) The graph of  $f(x)$  is drawn below. Find the graphs of  $-f(2x)$  and  $f(-x) + 2$  and label all the relevant points.



7. (6pts) Let  $f(x) = \frac{2x}{x - 1}$ . Find the formula for  $f^{-1}(x)$ .

**8.** (12pts) The quadratic function  $f(x) = x^2 - 2x + 5$  is given. Do the following without using the calculator.

a) Find the  $x$ - and  $y$ -intercepts of its graph, if any.

b) Find the vertex of the graph.

c) Sketch the graph of the function.

**9.** (5pts) Write as a sum and/or difference of logarithms. Express powers as factors. Simplify if possible.

$$\log_2 \left( 32x^3 \sqrt[5]{y^2} \right) =$$

**10.** (6pts) Write as a single logarithm. Simplify if possible.

$$4 \ln(2u^5) - 3 \ln v^{-2} - 2 \ln(6u^4v^2) =$$

11. (8pts) Let  $f(x) = \frac{3x+1}{x^2-4}$ ,  $g(x) = x+2$ . Find the following (simplify where possible):

$$(fg)(x) =$$

$$(f \circ g)(x) =$$

12. (20pts) The polynomial  $P(x) = x(x-3)^2(x+3)^2$  is given (answer with 6 decimals accuracy).

a) What is the end behavior of the polynomial?

b) Factor the polynomial to find all the zeros and their multiplicities. Find the  $y$ -intercept.

c) Determine algebraically whether the function is odd, even, or neither. (Multiply out the factors if you need to.)

d) Use the graphing calculator along with a) and b) to sketch the graph of  $P$  (yes, on paper!).

e) Verify your conclusion from c) by stating symmetry.

f) Find all the turning points (i.e., local maxima and minima).

13. (8pts) Solve the equation.

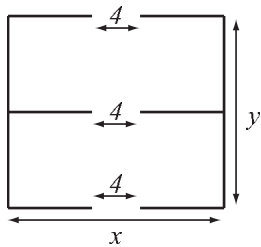
$$\frac{2}{x} = \frac{x+1}{x-4} + \frac{2x-28}{x^2-4x}$$

**14.** (14pts) Because she was afraid of being late, Emma drove to work at 64 mph. She drove home at 56 mph, so it took her 6 minutes longer.

- a) How long did it take Emma to drive to work?
- b) How far is her workplace from home?

**15.** (14pts) A hiking club is building a simple two-room hut as a refuge in the mountains with 4-foot openings left for doors. They have enough money to build 105 feet of walls, and their goal is to maximize the total area of the hut.

- a) Express the total area of the hut as a function of the length of one of the sides. What is the domain of this function?
- b) Graph the function in order to find the maximum (no need for the graphing calculator — you should already know what the graph looks like). What are the dimensions of the hut that has the biggest possible total area, and what is the biggest possible total area?



- 16.** (12pts) According to census data, the population of McCracken County, KY, was 65,500 in 2000 and 67,900 in 2020. Assume that it has grown according to the formula  $P(t) = P_0e^{kt}$ .
- Find  $k$  and write the function that describes the population at time  $t$  years since 2000. Graph it on paper.
  - Find the predicted population in the year 2030.

**Bonus** (10pts) Let  $f(x) = \frac{x}{x+3}$  and  $g(x) = \frac{3x}{1-x}$ . Find the functions  $(f \circ g)(x)$  and  $(g \circ f)(x)$  and simplify.