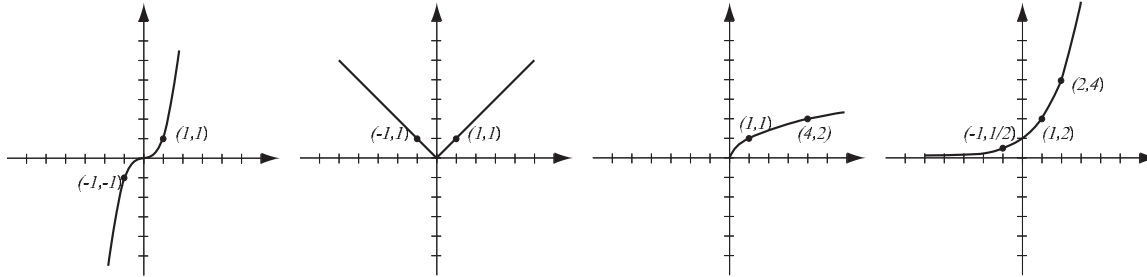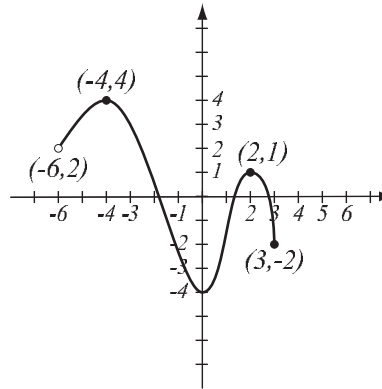**1.** (8pts) The following are graphs of basic functions. Write the equation of the graph under each one.

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

a) Find: $f(-4) = \qquad f(4) =$

b) What is the domain of f?

c) What is the range of f?

d) What are the solutions
  of the equation $f(x) = 1$?

**3.** (5pts) Find the equation of the line that passes through points $(3, -2)$ and $(1, 6)$.

4. (7pts) Draw the triangle with vertices $A = (-2, 1)$, $B = (6, 0)$ and $C = (0, 4)$. Use either the Pythagorean theorem and lengths of sides or use slopes to determine if this is a right triangle.

5. (3pts) Find the domain of the function $f(x) = \dfrac{1}{3x+6}$ and write it in interval notation.

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

$|x - 5| > 3$

7. (10pts) The graph of $f(x)$ is drawn below. Find the graphs of $-f(x+1)$ and $f(2x) - 3$ and label all the relevant points.
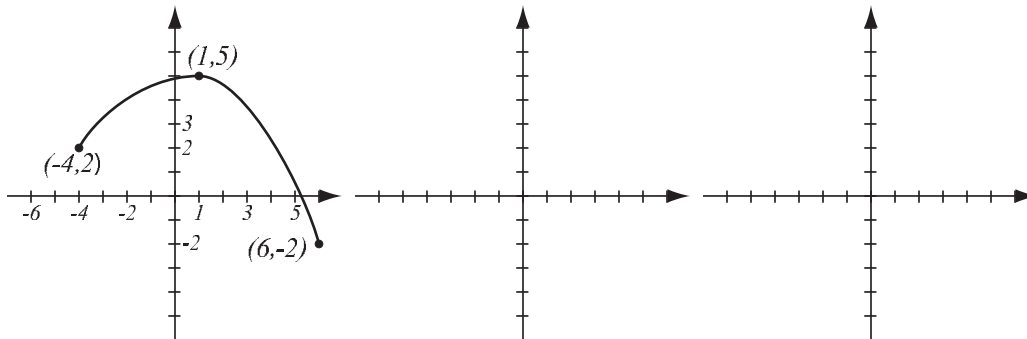
8. (6pts) Let $f(x) = \dfrac{3x}{x-1}$. Find the formula for f^{-1}.

9. (12pts) The quadratic function $f(x) = x^2 - 2x - 15$ 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.

10. (5pts) Write as a sum and/or difference of logarithms. Express powers as factors. Simplify if possible.

$$\log_8 \left(64 x^5 \sqrt[4]{y} \right) =$$

11. (6pts) Write as a single logarithm. Simplify if possible.

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

12. (6pts) Let $f(x) = x^2 + 2x$, $g(x) = x - 3$. Find the following (simplify where possible):

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

13. (20pts) The polynomial $P(x) = x^2(x - 4)(x + 4)$ is given (answer with 6 decimals accuracy).

a) What is the end behavior of the polynomial?

b) 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).

14. (8pts) Solve the equation.

$$\frac{x - 3}{x + 2} + \frac{3x}{x - 8} = \frac{3x^2 + 48}{x^2 - 6x - 16}$$

15. (14pts) A 166-mile road connects the Kentucky towns Princeton and Columbia. Pedro heads out from Princeton toward Columbia at 66mph. Jose heads out from Columbia toward Princeton a quarter of an hour later at 72mph. After a while, the friends meet on the road.
a) How long did each of them drive until they met?
b) How far from Princeton did they meet?

16. (14pts) Laura is designing a simple 3-room house with a 6-foot entrance door. To keep the home inexpensive, the budget allows for 150 feet of total wall length. Laura's goal is to maximize the total area of the house.
a) Express the total area of the house 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 house that has the biggest possible total area, and what is the biggest possible total area?
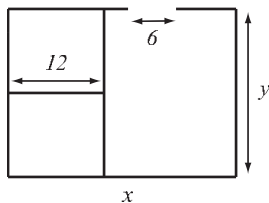
17. (12pts) According to census data, the population of McCracken County, KY, was 65,500 in 2000 and 67,900 in 2020. Assume that it has grown according to the formula $P(t) = P_0 e^{kt}$.
a) Find k and write the function that describes the population at time t years since 2000. Graph it on paper.
b) Find the predicted population in the year 2030.

Bonus (10pts) Solve the equation.

$\log_4(x + 1) + \log_4(x + 7) = 2$