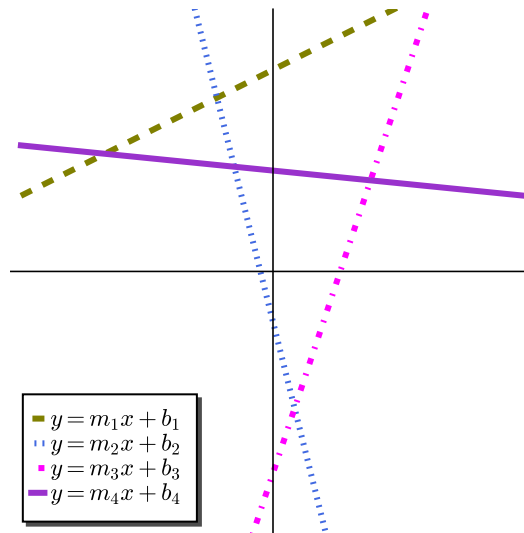


All work on this lab should be your own. The technology allowed on this lab includes: Desmos (<https://www.desmos.com/calculator>) and an approved TI calculator. Please be neat and show crucial steps to demonstrate your mastery of the information. This lab has 6 questions.

## Section 1.3

1. Below are the graphs of several different linear functions.



- (a) List the slopes  $m_1, m_2, m_3, m_4$  from smallest to largest.

- (b) List the  $y$ -intercepts  $b_1, b_2, b_3, b_4$  from smallest to largest.

2. A real estate agency has fixed monthly costs associated with rent, staff salaries, utilities, and supplies. It earns its money by taking a percentage commission on total real estate sales. During the month of July, the agency had total sales of \$832,000 and showed a net income (after paying fixed costs) of \$15,704. In August total sales were \$326,000 with a net income of only \$523. [Hint: Make two ordered pairs with this information.]

- (a) Use function notation to express the net income,  $N$ , as a linear function of total sales,  $S$ .

(b) What is the value of the slope of the linear function? What is the meaning of the slope as it relates to the real estate agency?

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(c) What is the value of the  $y$ -intercept? What meaning does the  $y$ -intercept have for the real estate agency?

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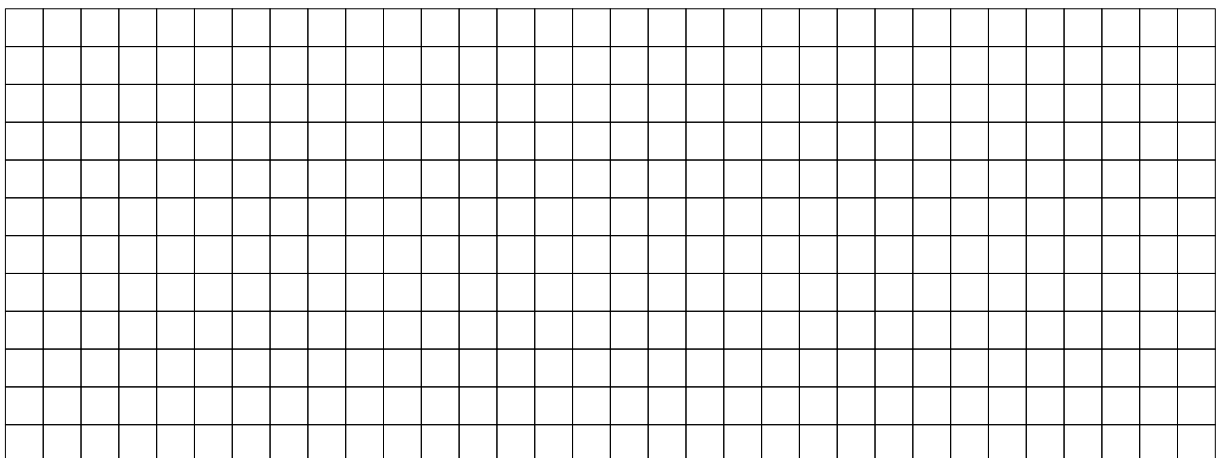
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3. Consider the graph of a circle that has diameter endpoints at  $(-1, -6)$  and  $(5, 2)$ .

(a) Find the equation of the circle.

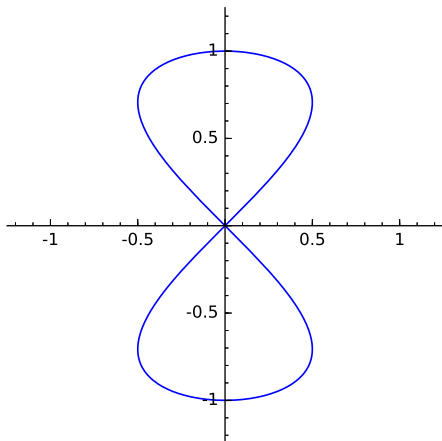
(b) Find the equation of the line that is tangent to the circle at the point  $(5, 2)$ .

(c) Graph the circle, radius, and tangent line.

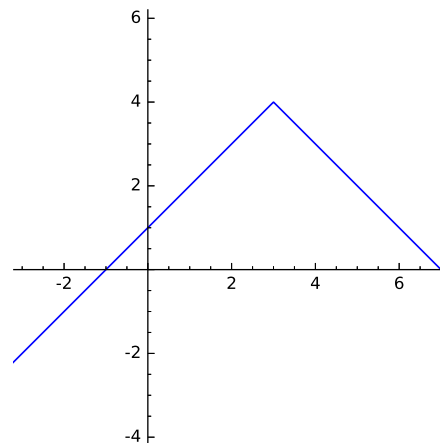


# Section 1.4

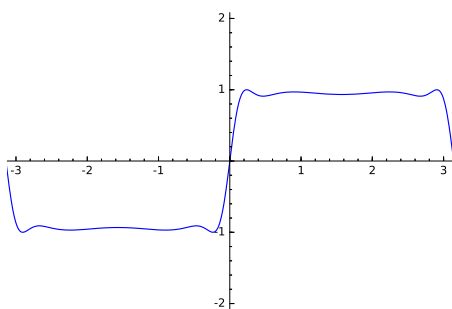
4. In the following parts, reference the graphs below.



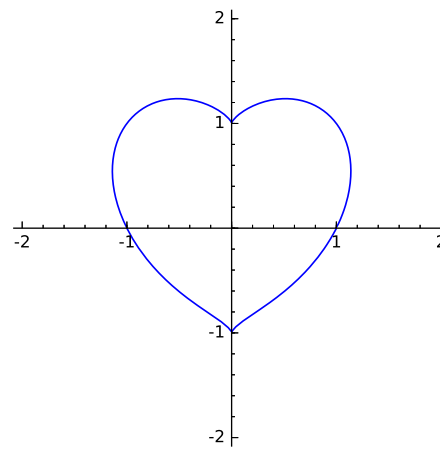
(a) Graph of  $f$



(b) Graph of  $g$



(c) Graph of  $h$



(d) Graph of  $k$

(a) Which of the graphs are functions?

(b) Give the domain and range of

i. graph  $f$

ii. graph  $g$

iii. graph  $h$

iv. graph  $k$

5. A simple substitution in which each letter is replaced by a different letter can be thought of as a function  $f$  whose domain is the letters of the alphabet  $A, B, C, \dots, Z$ . Suppose that the replacement is defined like so

$$\begin{array}{ccccc}
 f(A) = M, & f(B) = D, & f(C) = K, & f(D) = V, & f(E) = X \\
 f(F) = B, & f(G) = P, & f(H) = T, & f(I) = J, & f(J) = S \\
 f(K) = Z, & f(L) = Q, & f(M) = H, & f(N) = O, & f(O) = A \\
 f(P) = L, & f(Q) = W, & f(R) = C, & f(S) = F, & f(T) = Y \\
 f(U) = R, & f(V) = G, & f(W) = I, & f(X) = U, & f(Y) = N
 \end{array}$$

- (a) What is  $f(Z)$ ?

- (b) What value of  $x$  satisfies the equation  $f(x) = Y$ ?

- (c) Assume that the relationship  $f(xy) = f(x)f(y)$  holds true for this function. What would the expression  $f(AOHMUNRCJ)$  equal?

6. The 2017 tax brackets can be expressed as a piecewise-defined function. Below is the piecewise-defined function,  $T(I)$ , where  $I$  is the taxable income and  $T$  is taxes owed, for an individual filing single with no deductions.

$$T(I) = \begin{cases} 0.1I, & 0 \leq I < 9,325 \\ 932.50 + .15(I - 9,325), & 9,325 \leq I < 37,950 \\ 5,226.25 + 0.25(I - 37,950), & 37,950 \leq I < 91,900 \\ 18,713.75 + 0.28(I - 91,900), & 91,900 \leq I < 191,650 \\ 46,643.75 + 0.35(I - 191,650), & 191,650 \leq I < 416,700 \\ 120,910.25 + 0.35(I - 416,700), & 416,700 \leq I < 418,400 \\ 121,505.25 + 0.396(I - 418,400), & I \geq 418,400 \end{cases}$$

- (a) Use function notation to express how much a single person who makes \$41,250 during the year 2017 will owe in federal taxes.

- (b) Suppose that the United States used a flat-tax of 25% for all taxpayers, rather than the piecewise-defined function above. Compare and contrast the outcomes of  $T(I)$  versus a the 25% flat-tax. Who would pay more in taxes? Who would pay less in taxes?

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