1. Find the domain of the following functions.
   a) \( f(x) = \sqrt[3]{x^2 - 4x - 21} \)
   b) \( f(x) = \sqrt[3]{x^2 - 4x - 21} \)
   c) \( f(x) = \frac{\sqrt{x^2 - 4x}}{x^2 - 4} \)

2. A closed box with a square base is needed to mail an item that requires 15 cubic feet of space.
   a) If \( x \) represents a side of the square base, express the surface area \( S \) of the box in terms of \( x \).
   b) It was decided that a cardboard box with a square base of 2 feet on each side was going to be used. Find the total amount of material needed for this box.
   c) If the paper for the cardboard costs $0.45 per square feet, how much will the box cost?

3. Given that \( f(x) = -2x^2 + 16x - 26 \)
   a) Rewrite the above function in \( f(x) = a(x-h)^2 + k \) form.
   b) Using a series of transformations (shifting, compressing, stretching, and/or reflection), sketch its graph.

4. The demand equation for a product is given by \( p = -10x + 1500 \), where \( p \) is the price (in dollars) and \( x \) represents the number of units. [Assume \( 0 \leq x \leq 150 \)]
   a) Give the revenue function \( R(x) \) that corresponds to the above demand function.
   b) Determine the number of units needed to maximize revenue.
   c) What is the maximum revenue?
   d) What price should be charged to maximize revenue

Solve, expressing answer in interval notation.

5. \( x^3 - 2x^2 - 8x > 0 \)
6. \( \frac{x}{x+1} \leq 2 \)
7. \( \frac{(x-1)(x+4)}{x(x+3)(x-2)} \geq 0 \)

8. Given a polynomial function defined by \( f(x) = x^2(x+2)(x+5)^2(x-3) \),
   a) Determine its \( x \)- and \( y \)-intercepts.
   b) Determine whether its graph crosses or is tangent to the \( x \)-axis at each of the \( x \)-intercepts.
   c) Discuss left and right end behavior.
   d) Give the maximum number of turning points of the graph.
   e) Using the \( x \)-intercepts as “critical values,” determine the intervals on which the graph is above the \( x \)-axis and the intervals on which the graph is below the \( x \)-axis.
   f) Using the above information, sketch a possible graph.

For the following functions, determine, if any, the vertical and horizontal asymptotes.

9. \( f(x) = \frac{3x^2 + 2x + 4}{2x^2 - 3x + 1} \)
10. \( g(x) = \frac{x-4}{x^2 + 3} \)
11. \( h(x) = \frac{x^3 + 8}{x^2 - 4x - 21} \)

12. Using the guidelines discussed in class, graph \( h(x) = \frac{3x^2 + 12x}{x^3 - x - 6} \).
   [Include domain, intercepts, symmetry, asymptotes (and crossovers, if any), as well as a sign analysis]

13. Given that \( f(x) = 3x^4 - 14x^3 + 5x^2 + 14x - 8 \).
   a) List all the possible rational zeros of \( f(x) \).
   b) With the use of synthetic division, express \( f(x) \) in simplest factored form.
   c) Using the answer the part b, solve \( f(x) = 0 \).
1. a) \((-\infty,-3] \cup [7, +\infty)\)  
b) \((-\infty, +\infty)\)  
c) \((-\infty,-2) \cup [0, 2) \cup [4, +\infty)\)  

2. a) \(S(x) = \frac{2x^3 + 60}{x}\)  
b) 38 sq. ft.  
c) $17.10

3. a) \(f(x) = -2(x - 4)^2 + 6\)  

4. a) \(R(x) = -10x^2 + 1500x\)  
b) 75  
c) $56,250  
d) $750

5. \((-2, 0) \cup (4, +\infty)\)

6. \((-\infty, -2] \cup (-1, +\infty)\)

7. \([-4, -3) \cup (-3, 0) \cup \{1\} \cup (2, +\infty)\)

8. a) \(x\)-intercepts at \(-5, -2, 0, 3\); \(y\)-intercept at 0  
b) crosses at \(x = -2, x = 3\); tangent at \(x = 0, x = -5\)  
c) as \(x \to -\infty, f(x) \to +\infty\); as \(x \to +\infty, f(x) \to +\infty\)  
d) 5  
e) above \(x\)-axis on \((-\infty, -5) \cup (-5, -2) \cup (3, +\infty)\); below \(x\)-axis on \((-2, 0) \cup (0, 3)\)

9. VA at \(x = \frac{1}{2}, x = 1\); HA at \(y = \frac{3}{2}\)

10. No VA; HA at \(y = 0\)

11. VA at \(x = -3, x = 7\); no HA

12. \(h(x) = \frac{3x^2 + 12x}{x^2 - x - 6} = \frac{3(x + 4)}{(x - 3)(x + 2)}\)  
domain: \((-\infty, -2) \cup (-2, 3) \cup (3, +\infty)\)  
intercepts: \((0,0), (-4,0)\)  
symmetry: none  
asymptotes: VA at \(x = -2, x = 3\)  
HA at \(y = 3\)  
crossover at \(x = \frac{5}{2}\)  

13. a) \(-8, -4, -\frac{8}{3}, -2, -\frac{4}{3}, -1, -\frac{2}{3}, -\frac{1}{3}, \frac{1}{3}, \frac{2}{3}, 1, \frac{4}{3}, 2, \frac{8}{3}, 4, 8\)  
b) \(f(x) = (3x - 2)(x - 4)(x + 1)(x - 1)\)  
c) \(\frac{5}{3}, 4, -1, 1\)