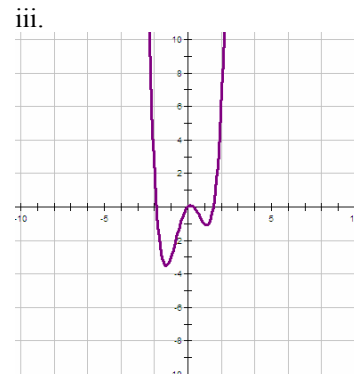
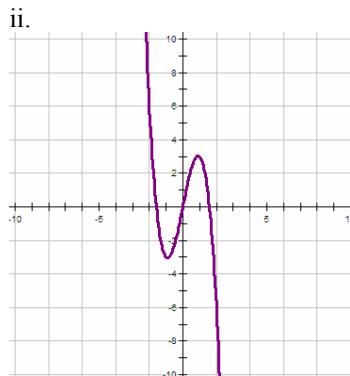
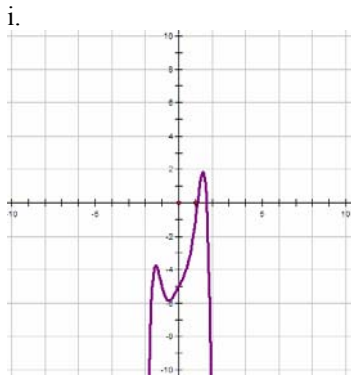


## A. Polynomial Functions

- Solve each inequality algebraically.
  - $(2x - 1)(x + 3) \geq 0$
  - $(5x + 2)(x - 3) < 0$
- Solve each inequality graphically.
  - $-3x^2 + 7x + 3 > 0$
  - $2x^2 - 3x + 4 \leq 0$
- Determine each quotient and remainder. State the restrictions on the divisor.
  - $(3x^2 + 2x - 5) \div (x - 2)$
  - $(x^3 - 6x^2 + 4) \div (x + 2)$
  - $(4x^3 - 10x^2 + 6x - 15) \div (2x - 5)$
  - $(x^5 - 1) \div (x - 1)$
- Identify the function that corresponds to the graph. Justify your choice. Discuss domain/range, intercepts, intervals of increase/decrease, end behaviour, etc.
  - $f(x) = -2x^3 + 5x$
  - $g(x) = x^4 - 3x^2 + x$
  - $h(x) = -x^6 + 3x^4 + 2x - 5$



- Sketch a graph of each function.
  - $y = -(x - 2)(x + 1)(x - 3)$
  - $y = (x - 1)^2(x + 4)^2$
- Determine the zeros of each function algebraically.
  - $y = x^4 - 16x^2$
  - $y = (x^2 - 4x - 12)(x^2 - 5x + 6)$
- Write an equation of a cubic function that has zeros -1, 2, 4 and y-intercept -3.
  - Write an equation of a quartic function that has zeros -3, -2, 2 (order 2).
- For each polynomial function:
  - determine the x- and y-intercepts
  - Determine local maximum(s) and minimum(s)
  - Determine points of inflection
  - State intervals of increase and decrease
  - Graph the function
  - $f(x) = -2x^3 + 3x^2$
  - $h(x) = x^4 - 6x^2$
- Determine the remainder when  $x^3 + 3x^2 - 5x + 4$  is divided by each binomial.
  - $x - 1$
  - $x + 1$
  - $x - 2$
  - $x + 2$
  - $x - 3$
  - $x + 3$

10. Factor

a.  $x^3 - 3x^2 - 6x + 8$

b.  $x^3 + 4x^2 - 7x - 10$

c.  $x^3 - 8x^2 + 20x - 16$

d.  $x^3 + x^2 - 8x - 12$

e.  $x^3 - 2x^2 - 11x + 12$

f.  $x^3 + 3x^2 - 6x - 8$

11. When the polynomial  $2x^2 + bx - 5$  is divided by  $x - 3$ , the remainder is 7.

a. Determine the value of  $b$ .

b. What is the remainder when the polynomial is divided by  $x - 2$ ?

12. Solve for  $x$ .

a.  $x^3 - 5x^2 + 2x + 8 = 0$

b.  $x^3 - 2x^2 - 5x + 6 = 0$

13. The position function of a toy car that moves along a straight path is given by

$s(t) = t^3 - 9t^2 + 15t + 4$ , where  $s$  is measured in metres and  $t$  in seconds,  $t \geq 0$ .

a. When is the object at rest? When is it moving in the positive direction?

b. Draw a diagram to illustrate the motion of the object. Describe intervals of increase and decrease in the context of the problem.

c. How far does the object travel in the first 1s? Find the average velocity over this time period. What is the instantaneous velocity at 1s? Explain the differences between average and instantaneous velocity.

## B. Rational Functions

1. Determine the  $x$ - and  $y$ -intercepts of each rational function.

a)  $f(x) = \frac{1}{x+3}$

b)  $g(x) = \frac{x^2 - 4x + 4}{x - 2}$

c)  $h(x) = \frac{x - 1}{x^2 - x}$

d)  $k(x) = \frac{x^2 + 6x + 9}{x + 3}$

2. State an equation representing horizontal asymptote of each function.

a)  $f(x) = \frac{5}{x}$

b)  $g(x) = \frac{x}{x^2 + 3}$

c)  $h(x) = \frac{3x}{2x - 1}$

3. State an equation representing vertical asymptote of each function.

a)  $f(x) = \frac{1}{x+4}$

b)  $g(x) = \frac{x-1}{x^2-1}$

c)  $h(x) = \frac{x+2}{x^2-x-6}$

4. For each rational function:

i) Determine whether its graph has a horizontal asymptote, an oblique asymptote, or neither.

ii) Determine the equations of the asymptotes.

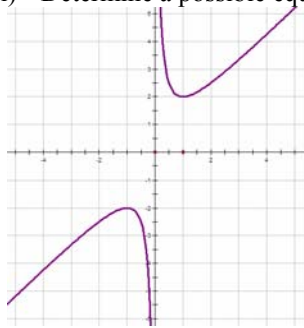
a)  $f(x) = \frac{x}{x^2 + 5}$

b)  $g(x) = \frac{x^2 - x + 3}{x + 5}$

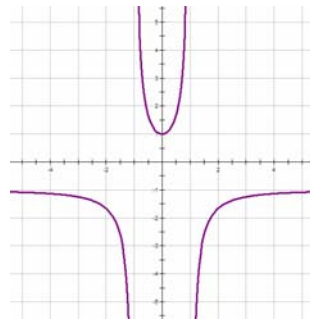
c)  $h(x) = -\frac{x^2}{x + 5}$

5. For each function below,  
 i) Determine intercepts, asymptotes, domain, and range.  
 ii) Determine a possible equation for the function.

a)



b)



6. For each function  
 i) state equations for the vertical and horizontal asymptotes  
 ii) determine the  $x$  and  $y$ -intercepts  
 iii) describe the increasing and decreasing intervals  
 iv) sketch a graph of the function  
 v) state the domain and range

a)  $f(x) = \frac{x-5}{x^2-25}$     b)  $g(x) = -\frac{10}{x^2+5}$     c)  $h(x) = \frac{2x^2+3}{x}$     d)  $k(x) = -\frac{x^2+2}{x-1}$

7. A polynomial function  $y = f(x)$  has zeros at  $x = -1$  and  $x = 4$ . Determine the equations of the vertical asymptotes to the graph of the reciprocal function  $y = \frac{1}{f(x)}$  and state an equation of the reciprocal function.

8. Summarize the key features of each function. Then graph the function.

a)  $f(x) = \frac{5x}{6-x}$     b)  $g(x) = \frac{1}{(x-5)^2}$     c)  $y = \frac{1}{x^2+3}$

9. Solve the following rational inequalities. Use a graphing calculator to find the intersection

a)  $\frac{x}{2x-8} \geq \frac{x^2+x-6}{x+2}$     b)  $\frac{x^2-16}{x^2-4x-5} > 0$

10. The average speed of a certain particle in meters per second is given by the equation

$S(t) = \frac{2t^2+8t+5}{t+3}$ . Find the average rate of change as time changes from 0.5 seconds to 3.5 seconds, and find the instantaneous rate of change at 3.5 seconds.

11. A manufacturer is predicting profit, in thousands of dollars, on the sale of  $x$  tonnes of fertilizer

according to the equation  $P(x) = \frac{600x-15\,000}{x+100}$ .

- a) Sketch a graph of this relation.  
 b) Describe the predicted profit as sales increase.  
 c) Compare the rates of change of the profit at sales of 100 t and of 500 t of fertilizer.