MA1200 Calculus and Basic Linear Algebra I
Practice Exercise Chapter 3 Polynomials and Rational Functions

1. It is given that $g(x) = -3x^2 + 24x - 36$.

(a) Find $g(2x)$ and $g(-x)$.

(b) Determine whether $g(x)$ is odd or even or neither of them.

(c) Determine $g(x) + g(-x)$. Determine whether it is odd or even or neither of them.

(d) Determine $g(x) - g(-x)$. Determine whether it is odd or even or neither of them.

2. For each of the following functions,
   (i) express it in the standard form of quadratic function;
   (ii) find the vertex;
   (iv) find its domain and range;
   (iii) sketch the graph.

(a) $f(x) = 3x^2 + 12x - 36$ (b) $g(x) = -2x^2 + 12x + 14$

(c) $f(x) = -x^2 + 10x - 25$ (d) $g(x) = 3x^2 + 9x + 30$

3 Find the quotient and the reminder for each of the following cases:

(a) Dividend: $p(x) = 2x^3 + 11x^2 + 3x - 4$ Divisor: $2x + 1$

(b) Dividend: $p(x) = -3x^3 + 13x^2 - 10x + 29$ Divisor: $3x - 1$

(c) Dividend: $p(x) = -21x^3 - 9x^2 + 37x - 12$ Divisor: $7x - 1$

(d) Dividend: $p(x) = -3x^3 + 8x^2 - 2x + 21$ Divisor: $3 - x$

4. Find the remainder when

(a) $p(x) = -5x^3 + 12x^2 - x + 8$ is divided by $x + 1$;

(b) $p(x) = 2x^3 + 16x^2 - 3x - 9$ is divided by $x - 2$;

(c) $p(x) = 6x^3 - 11x^2 + x - 4$ is divided by $2x + 1$;

(d) $p(x) = -3x^3 + x^2 + x - 8$ is divided by $3x - 1$.

5 Factorize each of the following.

(a) $p(x) = x^3 + 6x^2 + 3x - 10$

(b) $p(x) = 3x^3 + 8x^2 - 33x + 10$

(c) $p(x) = 2x^3 - 5x^2 + x + 2$

(d) $p(x) = x^3 + 3x^2 - 4$

6. Find the domain of each of the following rational functions.

(a) $f(x)=\dfrac{3x^2-7x+1}{(x+2)(2x-1)(x+3)}$

(b) $g(x)=\dfrac{5x^2+3x-8}{(x+1)(x-5)^2}$

(c) $g(x)=\dfrac{-x^4+2x-9}{2x^2-3x-2}$

(d) $h(x)=\dfrac{-x^3+5x+11}{x^3+9x^2+23x+15}$

(e) $h(x)=\dfrac{2x^3+x-5}{x^3-x^2+2x-2}$

(f) $f(x)=\dfrac{(x+3)^2}{x+3}$

7. Resolve each of the following expressions into partial fractions.

(a) $\dfrac{3x^2+18x+18}{x^3+7x^2+14x+8}$

(b) $\dfrac{x^2+4x+1}{x^3+3x^2-x-3}$

(c) $\dfrac{-4x^2+9x-23}{x^3+5x^2+3x+15}$

(d) $\dfrac{x^2+4x+8}{x^3+9x^2+27x+27}$

(f) $\dfrac{4x(x+4)}{(x^2-4)(x+2)}$

(g) $\dfrac{x^3+9x^2+9x+15}{(x^2+1)(x^2+4x+4)}$