1. 1.1

$$\lim_{x\to 2} ax^2 + 2x = \lim_{x\to 2} x^3 - ax$$
$$4a + 4 = 8 - 2a$$
$$a = \frac{2}{3}$$

1.2

$$\lim_{x\to 2} \frac{x^2 - 4}{x - 2} = \lim_{x\to 2} ax^2 - bx + 3$$
$$\lim_{x\to 2} \frac{(x+2)(x-2)}{x - 2} = \lim_{x\to 2} ax^2 - bx + 3$$
$$\lim_{x\to 2} x + 2 = \lim_{x\to 2} ax^2 - bx + 3$$
$$4 = 4a - 2b + 3$$
$$4a - 2b = 1$$

$$\lim_{x\to 3} ax^2 - bx + 3 = \lim_{x\to 3} 2x - a + b$$
$$9a - 3b + 3 = 6 - a + b$$
$$10a - 2b = 3$$

$$\begin{cases} 10a - 2b = 3 \\ 4a - 2b = 1 \end{cases}$$
$$6a = 2$$
$$a = \frac{1}{3}$$
$$\frac{4}{3} - 2b = 1$$
$$b = \frac{\frac{4}{3} - 1}{2}$$
$$b = \frac{1}{6}$$

2. 2.1

$$\lim_{x\to\infty} \left(2 - \frac{1}{x} + \frac{4}{x^2}\right) = 2 - 0 + 0 = 2$$

2.2

$$\lim_{x\to-\infty} \frac{4x^3-2x^2+1}{3x^3-5}$$

$$\lim_{x\to-\infty} \frac{4-\frac{2}{x}+\frac{1}{x^3}}{3-\frac{5}{x^3}} = \frac{4-0+0}{3-0} = \frac{4}{3}$$

2.3

$$\lim_{x\to\infty} \frac{x+1}{x}$$

$$\lim_{x\to\infty} 1+\frac{1}{x} = 1+0 = 1$$

2.4

$$\lim_{x\to-\infty} \frac{x+1}{x} = -1$$

2.5

$$\lim_{x\to-\infty} \frac{x^2+x-1}{2x+5}$$

$$\lim_{x\to-\infty} \frac{x+1-\frac{1}{x}}{2+\frac{5}{x}} = -\infty$$

2.6

$$\lim_{x\to\infty} \frac{x-2}{\sqrt{2+x}}$$

3. 3.1

$$f(x) = \frac{1}{x^2-4}$$

3.2

$$f(x) = \frac{2x^2}{x^2+1}$$

3.3

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

3.4

$$\frac{x^4}{x^2 - 16}$$