The following example problems are just for practice and in no way represent an inclusive overview of examination material.

Some example problems to think about:

1. Determine if \( f(x) = \frac{x}{x + 1} \) is even, odd or neither.

2. If \( f(x) = x^2 - x + 1 \), first rewrite the function in a standard way for parabolas (i.e. \( f(x) = a(x-h)^2 + k \)). Then, write down expressions that represent \( f(x-h) \), \( f(2a) \), and \( [f(a)]^2 - 1 \). Explain in words what these expressions mean. (shifts, scales, etc)

3. (a) Sketch a graph of an example of a function \( f \) that satisfies all of the following conditions:
   \[
   \lim_{x \to 0^+} f(x) = 1, \quad \lim_{x \to 0^-} f(x) = -1, \quad \lim_{x \to 2} f(x) = 0, \quad f(2) = 1, \quad f(0) = \text{undefined}
   \]

   (b) Tougher - Offer an example function that has the following properties:
   \[
   \lim_{x \to 3^-} f(x) = -\infty, \quad \lim_{x \to 3^+} f(x) = 1, \quad \lim_{x \to 3} f(x) = 2
   \]
   Furthermore, \( f \) is continuous from the right at 3.

4. When do limits fail to exist?

5. Explain the difference between the ideas of continuous and discontinuous. What kinds of discontinuities are there and how can you characterize a discontinuity using limits?

6. State the intermediate value theorem, then use it to show that there is a root for \( 2 \sin x = 3 - 2x \) in the interval \((0, 1)\).

7. Evaluate the following limits.
   a. \[ \lim_{x \to 3} \frac{i^2 - 9}{2t^2 + 7t + 3} \]
   b. \[ \lim_{t \to 0} \frac{\tan 4t}{3t} \]
   c. \[ \lim_{x \to \infty} \frac{\sqrt{9x^2 + x - 3x}}{x} \]
   d. \[ \lim_{u \to \infty} \frac{4u^4 + 5}{u^2 - 2(2u^2 - 1)} \]
   e. \[ \lim_{x \to \pi^-} \cot x \]
   f. \[ \lim_{\theta \to 0} \frac{\cos \theta - 1}{\theta} \]
   g. \[ \lim_{x \to 0} x^2 \sin \left( \frac{1}{x} \right) \]
   h. \[ \lim_{x \to \infty} \frac{x}{\ln(1 + 2e^x)} \]
   i. \[ \lim_{x \to \infty} \frac{1}{x^{e^x} - x} \]
   j. \[ \lim_{x \to 0} \frac{x + \tan x}{\sin x} \]
   k. \[ \lim_{x \to 0} \sqrt{x} \ln x \]