# Sample Exam I
## Math 115

**1. (10 points)** Find the domain for the function

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

**2. (10 points)** 1. People are willing to pay $100 - \sqrt{x}$ dollars for a limited edition etching, where $x$ is the number sold. What is the domain of $x$?

**3. (15 points)** Find

$$(a) \quad \lim_{x \to \infty} \frac{x + 3}{x^2 - 9}$$

$$(b) \quad \lim_{x \to 7} \frac{x - 7}{x^2 - 49}$$

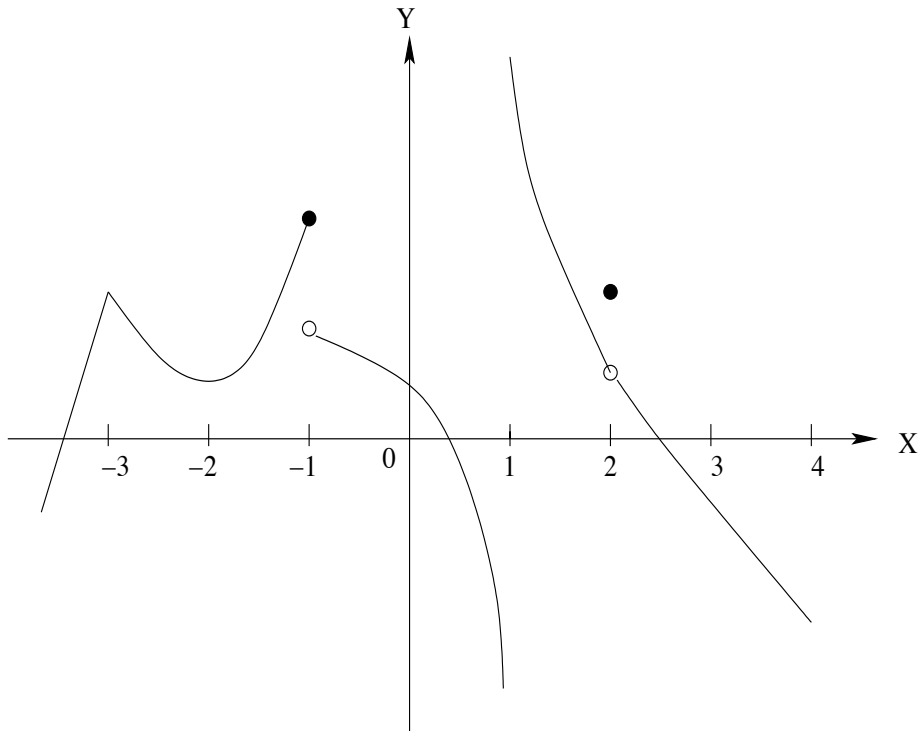$$(c) \quad \lim_{x \to 3} \frac{x^3 - 8}{x - 3}$$

**4. (10 points)** Let $f(x) = x^2(x + 1)$. Find the equation of the line tangent to the curve $f(x)$ at $x = 1$ **whithout using the rules of differentiation**.

**5. (10 points)** Determine all values of x, if any, for which $f(x)$ is discontinuous.

$$f(x) = \begin{cases} x + 1, & x \leq 1 \\ -x^2 + 4x - 1, & x > 1 \end{cases}$$

**6. (15 points)** The graph of a function $f$ is sketched below



(i) Find the points at which $f$ has no limit; explain your reasoning.

(ii) Find the points at which $f$ is not continuous; explain your reasoning.

(iii) Find the points at which $f$ has no derivative; explain your reasoning.

**7. (10 points)** If the price of a product per item is given by $p(x) = x^2+2x+4$ and the total cost function is given by $C(x) = 8 + x$ where x is the number of items produced and sold. Find the profit function $P(x)$. What is the profit when the production and sales are $x = 6$?

**8. (10 points)** Suppose an egg is thrown straight upward from the ground with initial velocity 96 feet/second and the egg's height at time t is given by the function $s(t) = 96t - 16t^2$. Find the velocity at any time t **whithout using the rules of differentiation**. What is the velocity of the egg when t=3 seconds?

**9. (10 points)** The monthly demand and supply functions for the Luminar desk lamp are given by $p = d(x) = -1.1x^2 + x + 40$ and $p = s(x) = 0.1x^2 + 15$ respectively, where $p$ is measured in dollars and $x$ in units of a thousand. Find the equilibrium quantity and price.