

This test is closed-book and closed-notes. No calculator is allowed for this test. When answering the questions you are only allowed to use tools and techniques that we have discussed up to this point, i.e. no advanced differentiation techniques. For full credit show all of your work (legibly!), unless otherwise specified.

The problems are in no particular order, and it is suggested that you look at all of them before beginning to answer any.

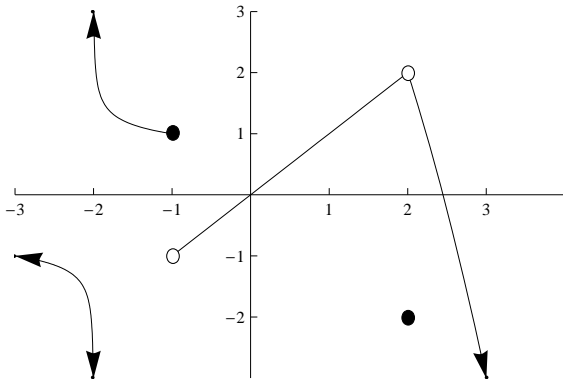
1. **(10 points)** Let $f(x) = 3x^2 - 6$.

(a) **(6 points)** Using the difference quotient, find $f'(x)$.

(b) **(4 points)** Find the equation of the tangent line to $f(x)$ at the point $(2, 6)$.

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2. **(10 points)** For the plot of $f(x)$ shown below, indicate whether or not each of the following quantities can be evaluated. If they can be evaluated, compute their values. If they cannot be evaluated, explain why.



$$\lim_{x \rightarrow -1^-} f(x)$$

$$f(2)$$

$$\lim_{x \rightarrow -2^-} f(x)$$

$$\lim_{x \rightarrow 2} f(x)$$

3. **(10 points)** Find the derivatives of the following functions:

(a) **(4 points)** $f(x) = 5x - 3\sqrt{x}$.

(b) **(3 points)** $g(x) = x^2 - \frac{1}{x} + \frac{3}{x^4}$.

(c) **(3 points)** $h(x) = x^5 - 3x^2 + 2x - 1$.

4. **(10 points)** Determine the domains of the following functions

(a) **(5 points)** $f(x) = \frac{\sqrt{x+5}}{x-3}$.

(b) **(5 points)** $g(t) = \frac{3t-6}{(t+1)(t-4)}$

5. **(15 points)** Evaluate the following limits; when a limit can not be evaluated, explain why.

(a) **(3 points)** $\lim_{r \rightarrow 2} \frac{r^2 + 2r + 1}{r - 3}$

(b) **(3 points)** $\lim_{x \rightarrow \infty} \frac{2x^2 - 3}{5x^3 - 2x}$

(c) **(3 points)** $\lim_{t \rightarrow -3} \frac{t^2 + 5t + 6}{t + 3}$

(d) **(3 points)** $\lim_{u \rightarrow 4} u^2 - 7u + 12$

(e) **(3 points)** $\lim_{x \rightarrow -\infty} \frac{x^2 - 3x + 2}{4x^2 + 4x + 1}$

6. **(5 point bonus)** On the back of this page, use the difference quotient to find the derivative of the function $f(x) = \frac{1}{x^2}$.