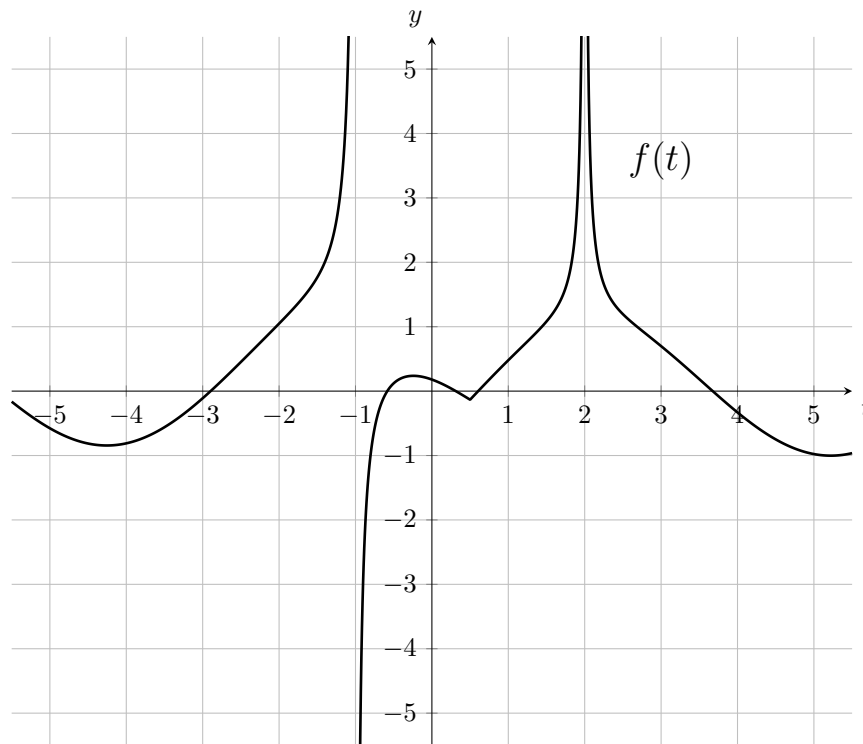


## Practice Midterm 1 – Math 1161.0X

1. Decide if the following statements are TRUE or FALSE. **You do NOT need to justify your answers.**
  - (a) (1 point) If  $f$  and  $g$  are differentiable at  $a$  then  $f \circ g$  is differentiable at  $a$ .
  - (b) (1 point)  $\lim_{x \rightarrow \infty} \arctan x = 1$ .
  - (c) (1 point) If  $f'(c) = 0$  and  $g'(c) = 0$  then  $\frac{d}{dx}(f(x)g(x))|_{x=c} = 0$ .
  - (d) (1 point) If  $f(0) = 10$ ,  $f(7) = 4$ , and  $f$  is continuous on the closed interval  $[-1, 8]$  then there must be some number  $c \in (-1, 8)$  such that  $f(c) = 9$ .
  - (e) (1 point) If  $f'$  has a vertical asymptote at  $c$  then  $f$  must have a vertical asymptote at  $c$ .
  - (f) (1 point) If  $f$  is left continuous at  $c$  and right continuous at  $c$  then  $f$  is continuous at  $c$ .
2. Give examples of the following. Be as explicit as possible. **You do NOT need to justify your answers.**
  - (a) (2 points) Give an example of a function  $f(x)$  which is continuous on the interval  $(-\infty, 1]$  and continuous on the interval  $(1, \infty)$  but **not continuous** on the interval  $(-\infty, \infty)$ .
  - (b) (2 points) Give an example of a function  $f(x)$  with exactly one vertical asymptote and two distinct horizontal asymptotes.
3. (5 points) The graph of a function  $y = f(t)$  is given below. Sketch its derivative.



4. Let

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

- (a) (3 points) What is  $f'(x)$ ?
  - (b) (7 points) Using **only the definition of the derivative** compute  $f'(x)$ .
5. Find  $\frac{dy}{dx}$  for the following functions. You do not need to simplify your answers.

(a) (5 points)  $y = (10 - e)\sqrt[5]{x^7} - \frac{4}{\sqrt[3]{\pi + 4}} + e^2$

(b) (5 points)  $y = \frac{4e^x + 6x^2 - 3 + \tan x}{11x - 4x^2}$

(c) (5 points)  $y = (\sin x)(e^x)(x^7)$

6. (5 points) Show that

$$\lim_{x \rightarrow -2} -\frac{1}{4}x^3 + 1 = 3$$

using **only the limit laws**.

7. Evaluate the following limits using any technique you like.

(a) (5 points)  $\lim_{x \rightarrow 0} \frac{3x^2 + 7x}{2x + 5}$

(b) (5 points)  $\lim_{x \rightarrow \infty} \frac{\sqrt{x^2 + \sqrt[3]{2x^6 + 1}}}{x + 5}$

8. Consider the function

$$g(t) = \frac{2t^3 - t^2}{t^2 - t - 2}$$

(a) (5 points) Find all vertical asymptotes of  $g$

(b) (5 points) Find all horizontal asymptotes of  $g$ .

(c) (5 points) Find the equation for the tangent line to the graph of  $g$  at the point  $t = 1$ .

9. A particle's position at time  $t$  is given by the equation

$$s(t) = \cos(p\pi t).$$

(a) (5 points) Find the average velocity of the particle on the time interval from  $t = 0$  to  $t = \frac{2}{p}$

(b) (5 points) Give an equation for the acceleration of the particle at time  $t$ .

10. Simplify the following expressions

(a) (5 points)  $\sec(\tan^{-1} x)$ .

(b) (5 points)  $\sin(\cos^{-1} x)$