

Math-71 Sections 9, 11, 12

Exam #1

Name: \_\_\_\_\_

This exam is closed book and notes. You may use a scientific calculator; however, no other electronics are allowed. You may also use the instructor-provided cheatsheet. Show all work; there is no credit for guessed answers. Simplify your answers unless told otherwise. In particular, all answers should contain no negative or rational exponents. All numerical answers should be in exact form unless you are specifically asked for a decimal value.

1. Consider the function:

$$f(x) = \frac{x - 3}{x^2 - x - 6}$$

(a) Evaluate:

$$\lim_{x \rightarrow 3} f(x)$$

(b) Where is  $f(x)$  continuous? Be sure to express your answer in interval notation.

2. Consider the function:

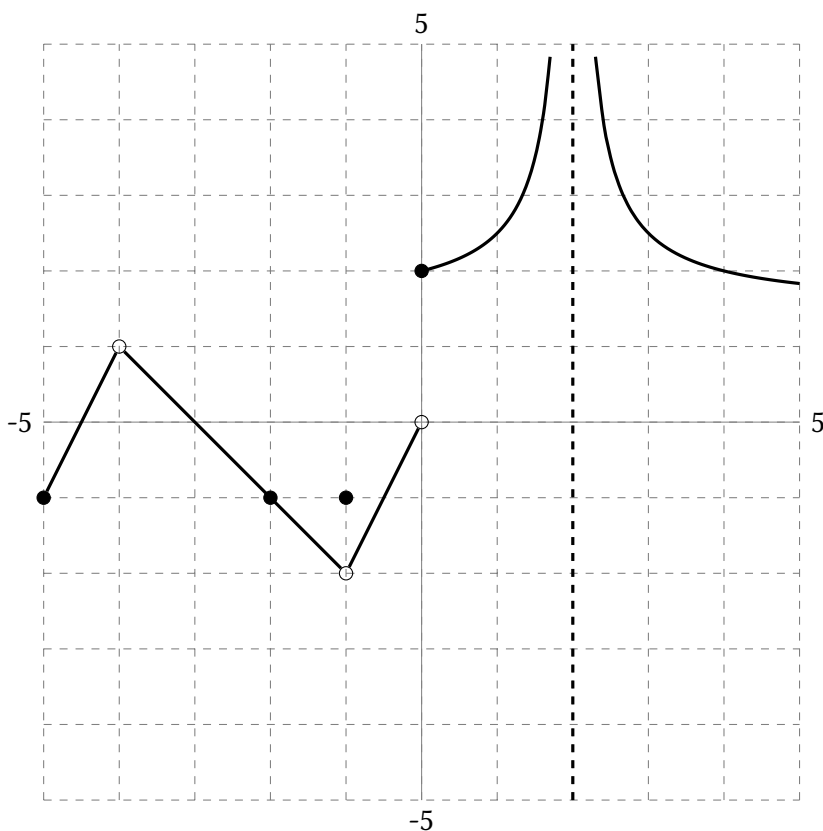
$$g(x) = \frac{\sqrt{x+1} - 1}{x-2}$$

(a) Evaluate:

$$\lim_{x \rightarrow 3} g(x)$$

(b) Where is  $g(x)$  continuous? Be sure to express your answer in interval notation.

3. Consider the following function. Assume that  $x = 2$  is a vertical asymptote and that the domain extends to  $+\infty$ .



- (a) Write down the three requirements for a function  $f(x)$  to be continuous at a point  $x = c$ .

- 1)
- 2)
- 3)

- (b) For each discontinuity in the above function, list the  $x$  value at where the discontinuity occurs and indicate (with an 'X') which of the three parts of the definition of continuity are violated. Note that you may or may not use all of the rows and each point could violate multiple parts.

$x$	(1)	(2)	(3)

4. Write down the definition of the derivative and the two characterizations that we discussed in class:

DEF:

CHAR1:

CHAR2:

5. Consider the function:

$$p(x) = 2x^3 + 5x^2 - 3x + 1$$

- (a) Using the derivative rules, determine  $p'(x)$  in a step-by-step fashion. You can combine multiple steps in each line; however, do not skip any steps.

- (b) Where is  $p(x)$  continuous? Be sure to express your answer in interval notation.

6. Differentiate the following function:

$$f(x) = -3x^2 + \frac{2}{x^2} - \frac{5}{\sqrt{x}}$$

7. Differentiate the following function using the product rule:

$$f(x) = (x^2 + 1)(x - 2)$$

8. Differentiate the following function using the quotient rule:

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

9. A certain company releases a poor earnings report. On the next day, the company's stock price falls considerably. You determine that the stock price follow the function:

$$p(t) = t^2 - 14t + 51$$

where  $t$  is the time since the opening bell (in hours) and  $p(t)$  is the stock price. How fast is the stock price changing at the 2 hour mark? Be sure that your answer includes the correct units.

10. You work for the ACME Widget Factory. The chief designer has come up with a revolutionary new widget design. The company cost accountant estimates that the cost function (in dollars) for making  $x$  of these new widgets is:

$$C(x) = 0.001x^3 - 0.04x^2 + 100x + 1500$$

The target production goal is 1000 widgets. Using marginal cost, estimate the difference in cost for making 1002 widgets. Be sure that your answer includes the correct units.