

## MATH 180 – Hour Exam 1

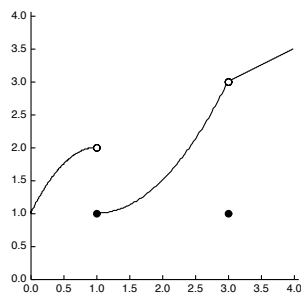
NAME \_\_\_\_\_

TA \_\_\_\_\_

Calculators are NOT allowed on this exam.

To receive full credit, you must show all of your work and write legibly.

1. (15 points) The graph of a function  $f(x)$  is shown below:



- (a) At which values of  $x$  is  $f$  discontinuous? Which of these discontinuities are removable? Which are jump discontinuities?
- (b) Determine the limit at each removable discontinuity.
- (c) Determine the left and right limits at each jump discontinuity.
2. (30 points) Evaluate the following limits, or show they do not exist.
- (a)  $\lim_{x \rightarrow \pi} 3 \cos(x + \pi)$
- (b)  $\lim_{x \rightarrow -2} \frac{x^2 - 4}{x - 2}$
- (c)  $\lim_{x \rightarrow 9} \frac{2 - \sqrt{x - 5}}{x - 9}$
3. (20 points) Let  $f(x) = 2x^2 + 1$ .
- (a) Express  $f'(3)$  as the limit of a difference quotient, as in the definition of the derivative.
- (b) Evaluate the limit in part (a).
4. (20 points) Use the differentiation laws to find the derivative of each of these functions. Show each step and do not simplify your answers.
- (a)  $g(x) = x^3 e^x$
- (b)  $h(x) = \frac{3x}{1 + \sqrt{x}}$
5. (15 points) The table below shows values of a function  $g(x)$  for  $x$  near 0. Use these data to estimate  $g'(0)$ , and give a complete explanation of how you arrived at your estimate.

$x$	-0.2	-0.1	0	0.1	0.2
$g(x)$	3.5	4.6	5.6	6.7	7.9

**Hand this sheet in with your exam booklet.**