

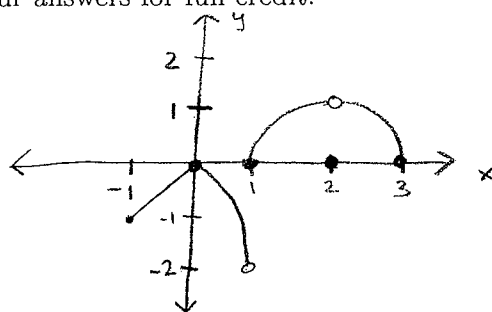
On the front of your bluebook, please write: a grading key, your name, student ID, and section and instructor. This exam is worth 100 points and has 6 questions. Show all work! Answers with no justification will receive no points. Please begin each problem on a new page. No notes, calculators, or electronic devices are permitted.

1. (14 points) Find the requested information.

(a) Find  $\frac{dg}{dt}$  for the function  $g(t) = \frac{t^2 - 4}{t^3 + 7t - 1}$ .

(b) Find  $\frac{df}{dx}$  for the function  $f(x) = \left(x + \frac{1}{x^{2/3}}\right) \left(x - \frac{1}{x^2} + 1\right)$ .

2. (20 points) Answer each of the following questions about the function  $y = f(x)$ , whose graph shown below. Justify each of your answers for full credit!



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

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

(c)  $\lim_{x \rightarrow 1} f(x)$

(d) Does the  $\lim_{x \rightarrow x_0} f(x)$  exist at every point  $x_0$  in  $(-1, 3)$ ?

(e) If  $f(x)$  has any discontinuities in  $(-1, 3)$ , state the  $x$ -coordinate where the discontinuities occur and which part of the definition of continuity is not satisfied.

3. (21 points)

(a) State the formal definition of the derivative of a function  $f(x)$ .

(b) Use the formal definition of the derivative to find  $\frac{df}{dx}$  for the function  $f(x) = \frac{4}{x^2}$ .

(c) Use the derivative you just found to find the equation for the line tangent to the curve of  $f(x)$  at the point  $(2, 1)$ .

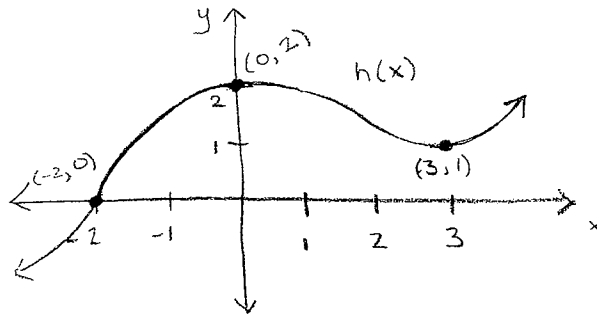
4. (15 points)

(a) Graph the function  $f(x) = \begin{cases} \sin(x) & \text{if } 0 < x \leq \pi/2 \\ -x & \text{if } -\pi/2 \leq x \leq 0 \end{cases}$

(b) Is  $f(x)$  continuous at  $x = 0$ ? Justify your answer using the definition of continuity.

(c) Is  $f(x)$  differentiable at  $x = 0$ ? Justify your answer using the definition of the derivative.

5. (20 points) Given the graph of  $h(x)$  below, sketch the following transformations. Put each on a separate graph (4 graphs total). Be sure to label three points on each graph for full credit!



- (a)  $h(x - 2)$   
(b)  $2h(x)$   
(c)  $h(x) + 3$   
(d)  $-h(x) - 1$
6. (10 points) True or False. If the statement is true, write out the word TRUE and *explain why it is true*. If the statement is false, write the word FALSE *explain why it is false*.
- (a) Suppose both  $f(x)$  and  $g(x)$  are continuous at  $x = 0$ . Then  $f(g(0))$  is continuous.  
(b) If  $f(x)$  is continuous at the point  $x = c$  then  $f(x)$  is differentiable at  $x = c$ .