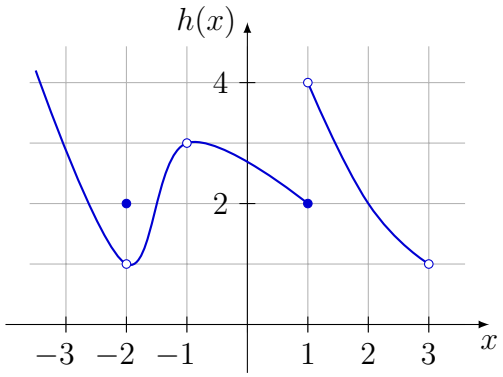
MATH 140
SPRING 2019
EXAM 1

NAME:

1. [3 pts. each] Use the graph below to find the following limits, if they exist. If a limit does not exist, explain why.

(a) $\lim_{x\to 1^-} h(x)$ (b) $\lim_{x\to 1^+} h(x)$ (c) $\lim_{x\to 1} h(x)$ (d) $\lim_{x\to 3^-} h(x)$ (e) $\lim_{x\to -2} h(x)$



2. [10 pts. each] Evaluate each limit algebraically using limit laws, showing work.

(a) $\lim_{x\to -1} \dfrac{2x^2+3x+1}{x^2-2x-3}$.

(b) $\lim_{t\to 0} \dfrac{\sqrt{1+t}-\sqrt{1-t}}{t}$.

3. [10 pts.] Let

$$G(t) = \begin{cases} 4 - \frac{1}{2}t, & \text{if } t < 2 \\ \sqrt{t+c}, & \text{if } t \geq 2 \end{cases}$$

Find the value of c so that $\lim_{t\to 2} G(t)$ exists.

4. [10 pts.] Use the precise definition of limit to prove that

$$\lim_{x\to 2} \frac{1}{x} = \frac{1}{2}.$$

5. [10 pts.] Let g be given by

$$g(x) = \begin{cases} x^2 + x, & \text{if } x < 1 \\ a, & \text{if } x = 1 \\ 3x + 5, & \text{if } x > 1 \end{cases}$$

Find the value of a for which g is continuous from the left at 1, and also the value of a for which g is continuous from the right at 1.

6. [10 pts.] If $f(x) = x^2 + 10 \sin x$, show that there is a number c such that $f(c) = 1000$.

7. [10 pts.] Find the derivative of $f(x) = 2.5x^2 + 6x$ using the definition of derivative.

8. [10 pts.] If $f(x) = \sqrt[3]{x}$, show that $f'(0)$ does not exist.

9. [10 pts. each] Use differentiation formulas to find the derivative.

   (a) $f(t) = \sqrt{t} - t^{-1}$

   (b) $h(x) = \dfrac{1 + 3x}{3 - 4x}$

   (c) $y = \sec\theta \tan\theta$

10. [10 pts.] For what values of x does the graph of $f(x) = x^3 + 3x^2 + x + 3$ have a horizontal tangent?

11. [10 pts.] Find an equation of the tangent line to the curve $y = (1 + x)\cos x$ at the point $(0, 1)$.

12. [10 pts.] Find the limit:

$$\lim_{t \to 0} \frac{\tan 6t}{\sin 2t}$$