Math 10A
Homework #2; Due Tuesday, 6/26/2018
Instructor: Roy Zhao

1. True   False   The composition of two continuous functions, assuming that it is well defined, is always continuous.

2. Write down the equation of the line that passes through the points $(1, 2)$ and $(5, 7)$.

3. Compute the derivative of each of the following functions.

    (a) 3

    (b) x^4

    (c) $3x^2 + 1$

    (d) $\dfrac{1}{x^2}$

4. Let $f(x) = |x|$. Compute the following two limits.

$$\lim_{h \to 0^+} \frac{f(0 + h) - f(0)}{h} \quad \text{and} \quad \lim_{h \to 0^-} \frac{f(0 + h) - f(0)}{h}.$$

    What does this tell you about the derivative of f at 0?

5. Calculate the following limits using the definition of a derivative.

    (a) $\displaystyle\lim_{h \to 0} \frac{(x + h)^2 - x^2}{h}$

    (b) $\displaystyle\lim_{h \to 0} \frac{\tan(x + h) - \tan(x)}{h}$

    (c) $\displaystyle\lim_{x \to \pi/3} \frac{\sin(x) - \sin(\pi/3)}{x - \pi/3}$

    (d) $\displaystyle\lim_{x \to 1} \frac{\ln x}{x - 1}$

    (e) $\displaystyle\lim_{x \to 0} \frac{\sin(x)}{x}$

6. True   False   The derivative of the function f at the point a tells you the slope of the curve $y = f(x)$ at the point $(a, f(a))$.

7. True   False   If the derivative of the function f at the point a is negative, then $f(a)$ is negative.

8. True   False   If $f'(0) = 0$, then the function f is a constant function.

9. True   False   If $f'(a) > 0$ and $g'(a) > 0$, then $(f + g)'(a) > 0$.

10. True   False   The derivative of $\dfrac{1}{f(x)}$ is $\dfrac{1}{f'(x)}$.

11. True   False   A function may be continuous at a $x = 1$ but not differentiable there.

12. Find the equation of the line tangent to $y = f(x)$ at the given point a.

   (a) $f(x) = \dfrac{1}{2 + \cos(x)}, a = \pi$

   (b) $f(x) = e^x - 1, a = \ln(3)$

   (c) $f(x) = \dfrac{1}{2x}, a = -4$

   (d) $f(x) = \sqrt{x}, a = 9$

13. Compute the derivative of each of the following functions.

   (a) $\cos(x)$

   (b) $x\ln(x)$

   (c) $\dfrac{1}{1 - x}$

   (d) $\dfrac{3x^3 + 1}{4x^2 - 2}$

   (e) $\cos(\tan(3x))$

   (f) $\tan(x^2)$

   (g) $\csc(x)$

   (h) $\sin(x)\cos(x)$

14. Sketch the graph of a continuous function whose derivative is positive on the interval $(-2, -1)$, is zero on the interval $(-1, 1)$ and is negative on the interval $(1, 2)$.

15. Using the graph below, indicate the values at which the derivative of the function f is undefined. Then, write the values $f'(-1.5), f'(-0.5), f'(2)$ in increasing order. No justification is necessary.
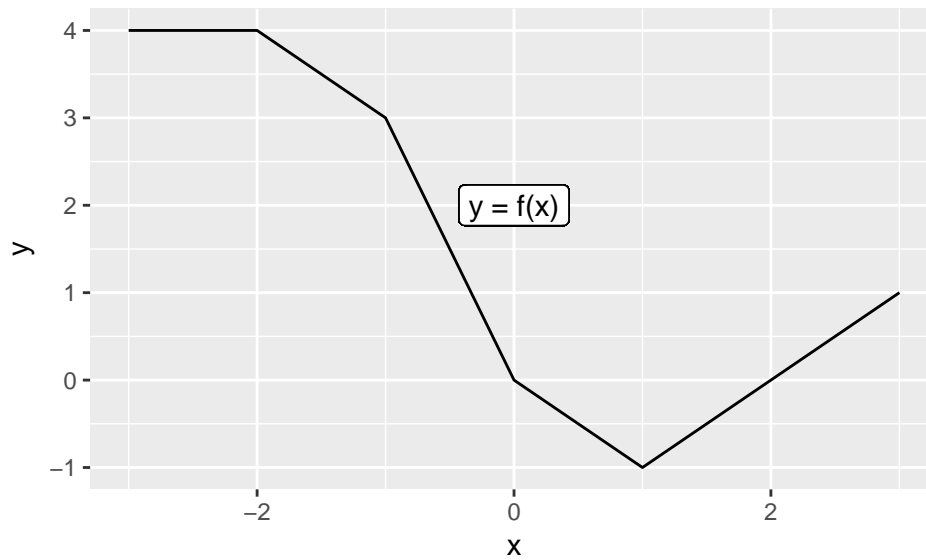
16. True   False   Every function is differentiable.

17. True   False   If a function is differentiable on $(0, 1)$ and on $(1, 2)$, then the function is differentiable at 1.

18. True   False   If f and g are differentiable, then $(fg)'(x) = f'(x)g'(x)$.