



Bilkent University

Quiz # 02
Math 101-Section 12 Calculus I
14 October 2021 Thursday
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Solution Key

Q-1) Let f and g be two functions defined as

$$f(x) = 1 + x + x^2 + 3x^3, \text{ and } g(x) = \sin\left(\frac{\pi}{4}x\right).$$

- (i) Find $f'(x)$ and $g'(x)$.
- (ii) Calculate $(f \circ g)'(1)$.
- (iii) Calculate $(f \circ f)'(0)$.
- (iv) Calculate $(g \circ f)'(2)$.
- (v) Calculate $(g \circ g)'(4)$.

Show your work. Simplify as much as possible.

Grading: 2 points each

Solutions:

(i) $f'(x) = 1 + 2x + 9x^2$ and $g'(x) = \frac{\pi}{4} \cos \frac{\pi}{4}x$.

(ii) $(f \circ g)'(1) = f'(g(1))g'(1) = f'\left(\frac{\sqrt{2}}{2}\right)g'(1) = \left[\frac{11}{2} + \sqrt{2}\right]\left[\frac{\sqrt{2}\pi}{8}\right] = \frac{\sqrt{2}\pi}{16}(11 + 2\sqrt{2})$.

(iii) $(f \circ f)'(0) = f'(f(0))f'(0) = f'(1)f'(0) = [12][1] = 12$.

(iv) $(g \circ f)'(2) = g'(f(2))f'(2) = g'(31)f'(2) = \left[\frac{\sqrt{2}\pi}{8}\right][41] = \frac{41\sqrt{2}\pi}{8}$.

(v) $(g \circ g)'(4) = g'(g(4))g'(4) = g'(0)g'(4) = \left[\frac{\pi}{4}\right]\left[-\frac{\pi}{4}\right] = -\frac{\pi^2}{16}$.