

# Quiz #4 Study Guide

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$$(1) \quad f'(x) = \frac{7x^6}{210} + \frac{6x^5}{120} + \frac{5x^4}{60} = \frac{x^6}{30} + \frac{x^5}{20} + \frac{x^4}{12}, \quad f''(x) = \frac{6x^5}{30} + \frac{5x^4}{20} + \frac{4x^3}{12} = \frac{x^5}{5} + \frac{x^4}{4} + \frac{x^3}{3}, \quad f'''(x) = x^4 + x^3 + x^2$$

$$(2) \quad f(x) = 9x^{11/6} - 7x^{-9/4}, \quad f'(x) = 9 \cdot \frac{11}{6} x^{11/6-1} - 7 \cdot -\frac{9}{4} x^{-9/4-1} = \frac{33}{2} x^{5/6} + \frac{63}{4} x^{-13/4}, \quad f''(x) = \frac{33}{2} \cdot \frac{5}{6} x^{5/6-1} + \frac{63}{4} \cdot -\frac{13}{4} x^{-13/4-1} = \frac{55}{4} x^{-1/6} - \frac{819}{16} x^{-17/4} = \frac{55}{4 \cdot 6 \sqrt{x}} - \frac{819}{16 \cdot 4 \sqrt[4]{x^{17}}}$$

$$(3) \quad f'(x) = 3(2x-7) + (3x+8)(2) = 6x-21+6x+16 = 12x-5$$

$$(4) \quad f(x) = \frac{3x+8}{2x-7} = \frac{u}{v}, \quad f'(x) = \frac{u'v - uv'}{v^2} = \frac{3(2x-7) - (3x+8)(2)}{(2x-7)^2} = \frac{6x-21-6x-16}{(2x-7)^2} = -\frac{37}{(2x-7)^2}$$

$$(5) \quad f(x) = (x^2+10x+25)(x+6), \quad f'(x) = (2x+10)(x+6) + (x^2+10x+25)(1) = 2x^2+12x+10x+60+x^2+10x+25 = 3x^2+32x+85$$

$$(6) \quad f(x) = \frac{x^2+10x+25}{x+6} = \frac{u}{v}, \quad f'(x) = \frac{u'v - uv'}{v^2} = \frac{(2x+10)(x+6) - (x^2+10x+25)(1)}{(x+6)^2} = \frac{2x^2+12x+10x+60-x^2-10x-25}{(x+6)^2} = \frac{x^2+12x+35}{(x+6)^2}$$

$$(7) \quad v = \frac{dy}{dt} = 105 - 32t$$

$$(a) \quad v=0 \Rightarrow t = 3.28125, \quad y = -16(3.28125)^2 + 105(3.28125) + 60 = 232.27 \text{ ft}$$

$$(b) \quad 0 = -16t^2 + 105t + 60, \quad 0 = 16t^2 - 105t - 60, \quad t = \frac{105 \pm \sqrt{105^2 - 4(16)(-60)}}{2(16)}$$

$$t = \frac{105 \pm \sqrt{141865}}{32}$$

$$t = -0.529 \quad t = 7.09 \text{ sec}$$

$$v = 105 - 32(7.09) = -121.92 \quad \text{Speed} = 121.92 \frac{\text{ft}}{\text{sec}}$$



# Quiz #4 Study Guide

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$$(8) \lim_{x \rightarrow 0} \frac{(1+\cos x)}{x \cot x} = \lim_{x \rightarrow 0} \frac{(1+\cos x) \tan x}{x} = \lim_{x \rightarrow 0} \frac{(1+\cos x) \sin x}{x \cos x} = \lim_{x \rightarrow 0} \left( \frac{\sin x}{x} \right) \left( \frac{1+\cos x}{\cos x} \right) = 1 \cdot \frac{1+1}{1} = 2$$

$$(b) \lim_{x \rightarrow 0} \frac{\sec x}{x \cos x} = \lim_{x \rightarrow 0} \left( \frac{\sin x}{x} \right) \left( \frac{1}{\cos x} \right) = 1 \cdot \frac{1}{1} = 1$$

$$(9) f'(x) = 3x^2 \cdot \csc x + x^3 \cdot -\csc x \cot x = (3x^2 - x^3 \cot x) \csc x$$

$$(10) f(x) = \frac{\sec x}{x^3} = \frac{u}{v} \quad f'(x) = \frac{u'v - uv'}{v^2} = \frac{\sec x \tan x \cdot x^3 - \sec x \cdot 3x^2}{x^6} = \frac{\sec x (x^3 \tan x - 3x^2)}{x^6} = \frac{(x \tan x - 3) \sec x}{x^4}$$

$$(11) (3x+8)(2x-7) = 6x^2 - 21x + 16x - 56 = 6x^2 - 5x - 56$$

$$f(x) = (6x^2 - 5x - 56) \cos x, \quad f'(x) = (12x - 5) \cos x + (6x^2 - 5x - 56) \cdot -\sin x = (12x - 5) \cos x - (6x^2 - 5x - 56) \sin x$$

$$(12) u = (3x+8) \sin x, \quad u' = 3 \sin x + (3x+8) \cos x$$

$$f(x) = \frac{(3x+8) \sin x}{2x-7} = \frac{u}{v}$$

$$f'(x) = \frac{u'v - uv'}{v^2} = \frac{[3 \sin x + (3x+8) \cos x](2x-7) - (3x+8) \sin x (2)}{(2x-7)^2}$$

$$= \frac{[3(2x-7) - 2(3x+8)] \sin x}{(2x-7)^2} + \frac{(3x+8)(2x-7) \cos x}{(2x-7)^2} =$$

$$= \frac{(6x - 21 - 6x - 16) \sin x}{(2x-7)^2} + \frac{(3x+8) \cos x}{2x-7} = \frac{-37 \sin x}{(2x-7)^2} + \frac{(3x+8) \cos x}{2x-7}$$