76) $f'(x) = \dfrac{(x^2-7)(1)-(x-4)(2x)}{(x^2-7)^2}$

$= \dfrac{x^2-7-2x^2+8x}{(x^2-7)^2}$

$0 = \dfrac{-x^2+8x-7}{(x^2-7)^2}$

$(1, \frac{-3}{-6})$

$(7, \frac{3}{42})$

$0 = x^2-8x+7$

$(x-7)(x-1)$

37.) $f'(x) = \dfrac{(x^2-c^2)(2x)-(x^2+c^2)(2x)}{(x^2-c^2)^2}$

$= \dfrac{\cancel{2x^3} - 2c^2x - \cancel{2x^3} - 2c^2x}{(x^2-c^2)^2}$

$= \dfrac{-4c^2x}{(x^2-c^2)^2}$

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29.) $f(x) = \dfrac{3x^1 - 1}{\sqrt{x}}$

$f(x) = 3x^{1/2} - x^{-1/2}$

$f'(x) = \frac{3}{2}x^{-1/2} + \frac{1}{2}x^{-3/2}$

2.3: Product/Quotient/Trig Rules

1) Find the derivative of y = tanx

$$y = \frac{\sin x}{\cos x}$$

$\sin^2 x + \cos^2 x = 1$

$$y' = \frac{\cos x \cdot \cos x - \sin x(-\sin x)}{\cos^2 x}$$

$$y' = \frac{\cos^2 x + \sin^2 x}{\cos^2 x}$$

$$y' = \frac{1}{\cos^2 x} = \sec^2 x$$

#2: Find the derivative of y = secx

$$y = \frac{1}{\cos x}$$

$$y' = \frac{\cos x(0) - (1)(-\sin x)}{\cos^2 x}$$

$$y' = \frac{\sin x}{\cos^2 x} = \frac{\sin x \cdot 1}{\cos x \cdot \cos x}$$

$$y' = \tan x \sec x$$

$\frac{d}{dx}[\tan x] = \sec^2 x$	$\frac{d}{dx}[\cot x] = -\csc^2 x$
$\frac{d}{dx}[\sec x] = \sec x \tan x$	$\frac{d}{dx}[\csc x] = -\csc x \cot x$

#3 (Yes, we did this problem yesterday)

$$y = \frac{1 - \cos x}{\sin x} = \frac{1}{\sin x} - \frac{\cos x}{\sin x} = \csc x - \cot x$$

$$y' = -\csc x \cot x + \csc^2 x$$

$$\tan x \sec x \sec x$$

$$-\cot x \csc x \csc x$$

#4: Find the equation of the tangent line to the point.

$$h(t) = \frac{\sec t}{t} \qquad \left(\pi, -\frac{1}{\pi}\right)$$

$$h'(t) = \frac{t \cdot \tan t \sec t - \sec t \cdot 1}{t^2}$$

$$h'(\pi) = \frac{\pi \tan\pi \sec\pi - \sec\pi}{\pi^2}$$

$$= \frac{0 - (-1)}{\pi^2} = \frac{1}{\pi^2}$$

$$y + \frac{1}{\pi} = \frac{1}{\pi^2}(x - \pi)$$

Higher Order Derivatives

#5 $f(x) = x^4 - 2x^3 + 7x + 9$

$f'(x) = 4x^3 - 6x^2 + 7$

$f''(x) = 12x^2 - 12x$

$f'''(x) = 24x - 12$

$f^{(4)}(x) = 24$

$f^{(5)}(x) = 0$

#6: Find f''(x)

f(x) = secx

$f'(x) = \tan x \sec x$

$f''(x) = \tan x \cdot \tan x \sec x + \sec x \cdot \sec^2 x$

$= \tan^2 x \sec x + \sec^3 x$

#7: Find f'(2)

$g(2) = 3$ and $g'(2) = -2$ $\qquad f(x) = g(x)h(x)$

$h(2) = -1$ and $h'(2) = 4$

$$f(x) = g(x)h(x)$$

$$f'(x) = g(x)h'(x) + h(x)g'(x)$$

$$f'(2) = g(2)h'(2) + h(2)g'(2)$$

$$= (3)(4) + (-1)(-2)$$

$$= 14$$