

MATH 140 QUIZ #2 (SPRING 2021)

- 1 Differentiate $s(t) = 4\sqrt{t} - \frac{1}{4}t^4 + t + 1$.

With the Power Rule,

$$s'(t) = \frac{2}{\sqrt{t}} - t^3 + 1$$

- 2 Differentiate $g(x) = \frac{x^4 + 1}{x^2 - 1}$.

With the Quotient Rule,

$$g'(x) = \frac{(x^2 - 1)(4x^3) - (x^4 + 1)(2x)}{(x^2 - 1)^2} = \frac{2x^5 - 4x^3 - 2x}{(x^2 - 1)^2}.$$

- 3 Differentiate $y = 3x^4 \sin x$.

With the Product Rule,

$$y' = 3x^4 \cos x + 12x^3 \sin x$$

- 4 Differentiate $y = \sec x \tan x$.

With the Product Rule,

$$y' = \sec^3 x + \sec x \tan^2 x.$$

- 5 Evaluate the limit $\lim_{x \rightarrow 0} \frac{\tan 7x}{\sin x}$.

Using the limit $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$, we find that

$$\begin{aligned} \lim_{x \rightarrow 0} \frac{\tan 7x}{\sin x} &= \lim_{x \rightarrow 0} \left(\frac{1}{\cos 7x} \cdot \frac{\sin 7x}{\sin x} \right) = \lim_{x \rightarrow 0} \underbrace{\frac{1}{\cos 7x}}_1 \cdot \lim_{x \rightarrow 0} \frac{\sin 7x}{\sin x} \\ &= \lim_{x \rightarrow 0} \frac{\frac{\sin 7x}{7x}}{\frac{\sin x}{7x}} = \frac{\lim_{x \rightarrow 0} \frac{\sin 7x}{7x}}{\frac{1}{7} \lim_{x \rightarrow 0} \frac{\sin x}{x}} = \frac{1}{\frac{1}{7} \cdot 1} = 7. \end{aligned}$$