# WORKSHEET 6

## MATH 101

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Useful definitions:

(1) $\tan x = \dfrac{\sin x}{\cos x}$

(2) $\cot x = \dfrac{\cos x}{\sin x}$

(3) $\csc x = \dfrac{1}{\sin x}$

(4) $\sec x = \dfrac{1}{\cos x}$

**Question 1.** *(1) Show the chain rule:*

$$\frac{d}{dx}f(g(x)) = f'(g(x))g'(x)\,.$$

*(2) Apply the chain rule to show the quotient rule:*

$$\left(\frac{f(x)}{g(x)}\right)' = \frac{f'(x)g(x) - f(x)g'(x)}{g(x)^2}$$

(3) *Apply the above rules when*

$$f(x) = x^3 - \pi x$$

*and*

$$g(x) = \frac{1}{x^2 + 3}$$

**Question 2.** *For this part, you should review* $https://openstax.$ $org/books/calculus-volume-1/pages/2-3-the-limit-laws$ *for the limits* $\lim_{\theta \to 0} \frac{\sin \theta}{\theta} = 1$ *and* $\lim_{\theta \to 0} \frac{\cos \theta - 1}{\theta} = 0$.
  *Show that*

(1) $(\sin x)' = \cos x$
     ( *Hint:* $\sin(x + y) = \sin x \cos y + \sin y \cos x$ )

(2) $(\cos x)' = -\sin x$
     ( *Hint:* $\cos(x + y) = \cos x \cos y - \sin x \sin y$ )

**Question 3.** *Use all the rules above to find*

(1) $(\cot x)'$

(2) $(\tan x)'$

*(3)* $(\csc x)'$

*(4)* $(\sec x)'$

*(3)* $(\csc x)'$