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Prove the following derivatives using the limit definition of the derivative. You may use any **limits** already proven in class, but you may **NOT** use any known derivatives.

[a] The derivative of $f(x) = \cos x$ is $f'(x) = -\sin x$.

[b] The derivative of $f(x) = \tan x$ is $f'(x) = \sec^2 x$.

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Prove the following derivatives using the quotient rule. You may use the known derivatives of $\sin x$ and $\cos x$.

[a] The derivative of $f(x) = \csc x$ is $f'(x) = -\csc x \cot x$.

[b] The derivative of $f(x) = \cot x$ is $f'(x) = -\csc^2 x$.

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If $f(x) = x + \sin x$, and $g(x) = f^{-1}(x)$, find $g'\left(1 + \frac{\pi}{2}\right)$.

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If $f(x) = x + \cos x$, and $g(x) = f^{-1}(x)$, find $g'(\pi - 1)$.

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A table of values for a differentiable function f are given below.

x	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
$f(x)$	5	3	1	–1	–2	1	–2	3	–1	–3	–4	–1	2	3	1	2	–1	–2	1	4	–2

[a] If $g(x) = f(f(x))$, estimate $g'(7)$.

[b] If $h(x) = f(\sqrt{x})$, estimate $h'(16)$.

[c] If $k(x) = \sqrt{f(x)}$, estimate $k'(19)$.

[d] If $m(x) = \frac{1}{f(x)}$, estimate $m'(11)$.

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