Worksheet 9 - Section 2.4

(1) Differentiate.

(a) $y = \sec\theta \tan\theta$

(b) $f(\theta) = \dfrac{\sec\theta}{1+\sec\theta}$

(c) $h(\theta) = \theta \csc\theta - \cot\theta$

(d) $y = x^2 \sin x \tan x$

(e) $y = \dfrac{t \sin t}{1+t}$

(f) $f(\theta) = \theta \cos\theta \sin\theta$

(2) Prove that

$$\frac{d}{dx}(\csc x) = -\csc x \cot x$$
$$\frac{d}{dx}(\cot x) = -\csc^2 x$$

(3) Find an equation of the tangent line to the curve

$$y = \cos x - \sin x$$

at the point $(\pi, -1)$.

(4) If $H(\theta) = \theta \sin\theta$, find $H'(\theta)$ and $H''(\theta)$.

(5) (a) Use the Quotient Rule to differentiate the function

$$f(x) = \frac{\tan x - 1}{\sec x}$$

(b) Simplify the expression for $f(x)$ by writing it in terms of $\sin x$ and $\cos x$, and then find $f'(x)$.
(c) Show that your answers to parts (a) and (b) are equivalent.

(6) For what values of x does the graph of $f(x) = x + 2\sin x$ have a horizontal tangent?

(7) Find the limit.

(a) $\lim\limits_{t\to 0} \dfrac{\tan(6t)}{\sin(2t)}$

(b) $\lim\limits_{\theta\to 0} \dfrac{\sin\theta}{\theta + \tan\theta}$

(c) $\lim\limits_{x\to 0} \dfrac{\sin(3x)}{5x^3 - 4x}$

(d) $\lim\limits_{x\to \pi/4} \dfrac{1-\tan x}{\sin x - \cos x}$

(e) $\lim\limits_{x\to 0} x \sin(\dfrac{1}{x})$

(f) $\lim\limits_{x\to \infty} x \sin(\dfrac{1}{x})$