Tutorial 7

Week of October 29, 2018

1. Differentiate the following functions.
   (a) $f(x) = x^2 \sin x$
   (b) $g(\theta) = e^{\theta}(\tan\theta - \theta)$
   (c) $f(t) = \dfrac{\cot t}{e^t}$
   (d) $r(\theta) = \sin\theta\cos\theta$
   (e) $k(x) = \sin^2 x$
   (f) $f(x) = (5x^6 + 2x^3)^4$
   (g) $g(x) = \dfrac{1}{\sqrt[3]{x^2 - 1}}$
   (h) $h(x) = e^{x^2 - x}$
   (i) $y(x) = 3^{x^2 - x}$

2. Prove that the following are true:

	y	y'
(a)	$y = \csc x$	$y' = -\csc x \cot x$
(b)	$y = \sec x$	$y' = \sec x \tan x$
(c)	$y = \cot x$	$y' = -\csc^2 x$
(d)	$y = \log_a x$	$y' = \dfrac{1}{x \ln a}$

3. Find the equation of the tangent at the given point.
   (a) $f(x) = e^x \cos x \qquad P(0, 1)$
   (b) $g(x) = \cos x - \sin x \qquad P(\pi, -1)$
   (c) $h(x) = 2^x \qquad P(0, 1)$
   (d) $G(x) = xe^{-x^2} \qquad P(0, 0)$

4. Let $r(x) = f(g(h(x)))$, where $h(1) = 2$, $g(2) = 3$, $h'(1) = 4$, $g'(2) = 5$, and $f'(3) = 6$. Find $r'(1)$.

5. For what values of r does $y = e^{rx}$ satisfy the differential equation $y'' + y' - 6y = 0$?

6. Find the 50th derivative of $y = \cos 2x$.