(1) (a) For what values of $x$ is the function $f(x) = |x^2 - x - 2|$ differentiable? Find a formula for $f'$. (b) Sketch the graphs of $f$ and $f'$.

(2) Find $\lim_{h \to 0} \frac{\sqrt{x+h^2} - \sqrt{x^2}}{h}$. 
(3) Find $y'$ of each of the following:

(a) $y = (\cos x)^{-1} \sec^{-1} x$.

(b) $y = \sec^2(2^x) \log_5(5x - 11)$.

(c) $y = x^{\ln x} \ln x^x + \frac{x^{99} - 199}{\sqrt{2x^3 - e^x}}$
(4) Find all points \((x, y)\) on the graph of \(f(x) = \frac{x-1}{x-2}\) where normal lines are parallel to the line \(8x + 2y = 1\).

(5) One car leaves a given point and travels north at 30 mph. Another car leaves 1 HOUR LATER, and travels west at 40 mph. At what rate is the distance between the cars changing at the instant the second car has been traveling for 1 hour?
(6) A race car travels almost $\frac{1}{2}$ km in 10 seconds, its distance from the start in meter after $t$ seconds being $f(t) = t^3 - 6t^2 + 9t$. How fast was it going halfway down the track? (Hint: $f(t) = 249$ when $t \approx 8.43$)

(7) Find (i) $\lim_{x \to \frac{1}{2}} \frac{\sin(2x-1)}{2x^4 + x - 1}$, (ii) $\lim_{n \to \infty} (5n) \ln(1 + \frac{1}{2n})$. 
(8) Consider the equation $x^2 + xy + y^2 = 1$. Find equation for $y''$ in terms of $x$ and $y$ only.

(9) Evaluate $\frac{dz}{dx}\bigg|_{x=0}$ if $z = \cos(2\sqrt{u})$ and $u = 2\cos(x + \pi/3)$. 

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