

1. False. See the note after Theorem 4 in Section 2.2.
2. True. This is the Sum Rule.
3. False. See the warning before the Product Rule.
4. True. This is the Chain Rule.
5. True. $\frac{d}{dx} \sqrt{f(x)} = \frac{d}{dx} [f(x)]^{1/2} = \frac{1}{2} [f(x)]^{-1/2} f'(x) = \frac{f'(x)}{2\sqrt{f(x)}}$
6. False. $\frac{d}{dx} f(\sqrt{x}) = f'(\sqrt{x}) \cdot \frac{1}{2} x^{-1/2} = \frac{f'(\sqrt{x})}{2\sqrt{x}}$, which is not $\frac{f'(x)}{2\sqrt{x}}$.
7. False. $f(x) = |x^2 + x| = x^2 + x$ for $x \geq 0$ or $x \leq -1$ and $|x^2 + x| = -(x^2 + x)$ for $-1 < x < 0$.
So $f'(x) = 2x + 1$ for $x > 0$ or $x < -1$ and $f'(x) = -(2x + 1)$ for $-1 < x < 0$. But $|2x + 1| = 2x + 1$ for $x \geq -\frac{1}{2}$ and $|2x + 1| = -2x - 1$ for $x < -\frac{1}{2}$.
8. True. $f'(r)$ exists $\Rightarrow f$ is differentiable at $r \Rightarrow f$ is continuous at $r \Rightarrow \lim_{x \rightarrow r} f(x) = f(r)$.
9. True. $g(x) = x^5 \Rightarrow g'(x) = 5x^4 \Rightarrow g'(2) = 5(2)^4 = 80$, and by the definition of the derivative,
 $\lim_{x \rightarrow 2} \frac{g(x) - g(2)}{x - 2} = g'(2) = 80$.
10. False. $\frac{d^2 y}{dx^2}$ is the second derivative while $\left(\frac{dy}{dx}\right)^2$ is the first derivative squared. For example, if $y = x$, then $\frac{d^2 y}{dx^2} = 0$,
but $\left(\frac{dy}{dx}\right)^2 = 1$.
11. False. A tangent line to the parabola $y = x^2$ has slope $dy/dx = 2x$, so at $(-2, 4)$ the slope of the tangent is $2(-2) = -4$ and an equation of the tangent line is $y - 4 = -4(x + 2)$. [The given equation, $y - 4 = 2x(x + 2)$, is not even linear!]
12. True. $\frac{d}{dx} (\tan^2 x) = 2 \tan x \sec^2 x$, and $\frac{d}{dx} (\sec^2 x) = 2 \sec x (\sec x \tan x) = 2 \tan x \sec^2 x$.
Or: $\frac{d}{dx} (\sec^2 x) = \frac{d}{dx} (1 + \tan^2 x) = \frac{d}{dx} (\tan^2 x)$.