

1. (a) $\frac{d}{dx} [xe^x \sin x \cos x]$

(b) $\frac{d}{dx} \left[\frac{\left(\frac{e^x}{x^3}\right)}{\sin x \cos x} \right]$

2. Compute the following limits

(a) $\lim_{t \rightarrow 0} \frac{\sin(13t)}{7t}$. (You can use the fact that $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$.)

(b) $\lim_{x \rightarrow 2} \frac{\sqrt{6-x} - 2}{\sqrt{3-x} - 1}$

(c) $\lim_{x \rightarrow \infty} \frac{\sqrt[3]{27x^3 + 3} - \sqrt{x^2 + 3x} + (x + 1)}{x}$

(d) $\lim_{x \rightarrow 0} \frac{(x^2 - 2)^8}{(x^3 - 2x)^7 \sin x}$

3. Using the fact that, when c is a constant, $\lim_{x \rightarrow 0} \frac{e^{cx} - 1}{x} = c$ (which we will prove later), prove using the limit definition of the derivative that $\frac{d}{dx}(e^{cx}) = ce^{cx}$.