1. Use the differentiation rules to find the derivative of

\[(x^3 - x)(3e^x + x^e)\].

You do not need to simplify your answer.

**Solution.** We apply the product rule, the sum rule and the power rule.

\[
[(x^3 - x)(3e^x + x^e)]' = (x^3 - x)'(3e^x + x^e) + (x^3 - x)(3e^x + x^e)'
\]

\[= ((x^3)' - x')(3e^x + x^e) + (x^3 - x)((3e^x)' + (x^e)')
\]

\[= (3x^2 - 1)(3e^x + x^e) + (x^3 - x)(3e^x + xe^{x-1})
\]

2. Use the definition to find the derivative of

\[f(x) = \sqrt{x}\]

No credit for using other methods.

**Solution.** By the definition of derivative, we have

\[f'(x) = \lim_{h \to 0} \frac{f(x + h) - f(x)}{h}
\]

\[= \lim_{h \to 0} \frac{\sqrt{x + h} - \sqrt{x}}{h}
\]

\[= \lim_{h \to 0} \frac{\sqrt{x + h} - \sqrt{x}}{h} \cdot \frac{\sqrt{x + h} + \sqrt{x}}{\sqrt{x + h} + \sqrt{x}}
\]

\[= \lim_{h \to 0} \frac{(x + h) - x}{h(\sqrt{x + h} + \sqrt{x})}
\]

\[= \lim_{h \to 0} \frac{1}{\sqrt{x + h} + \sqrt{x}}
\]

\[= \frac{1}{2\sqrt{x}}
\]