The regular solutions provide relatively complete solutions except for Problem 9.

9. The definition of the derivative is given by

$$\lim_{h\to 0} \frac{f(x+h)-f(x)}{h}.$$

a. For $f(x) = x^3$, we have

$$\begin{aligned}
\lim_{h\to 0} \frac{(x+h)^3 - x^3}{h} &= \lim_{h\to 0} \frac{(x^3+3x^2h+3xh^2+h^3)-x^3}{h} \\
&= \lim_{h\to 0} \frac{3x^2h+3xh^2+h^3}{h} \\
&= \lim_{h\to 0} (3x^2+3xh+h^2) = 3x^2.
\end{aligned}$$

c. For $f(x) = \sqrt{4-x}$, we have

$$\begin{aligned}
\lim_{h\to 0} \frac{\sqrt{4-(x+h)}-\sqrt{4-x}}{h} &= \lim_{h\to 0} \frac{\left(\sqrt{4-(x+h)}-\sqrt{4-x}\right)}{h} \frac{\left(\sqrt{4-(x+h)}+\sqrt{4-x}\right)}{\left(\sqrt{4-(x+h)}+\sqrt{4-x}\right)} \\
&= \lim_{h\to 0} \frac{(4-(x+h))-(4-x)}{h\left(\sqrt{4-(x+h)}+\sqrt{4-x}\right)} \\
&= \lim_{h\to 0} \frac{-h}{h\left(\sqrt{4-(x+h)}+\sqrt{4-x}\right)} \\
&= \lim_{h\to 0} \frac{-1}{\sqrt{4-(x+h)}+\sqrt{4-x}} = -\frac{1}{2\sqrt{4-x}}
\end{aligned}$$