1. For each function f and each x_0 that is given below, determine the difference quotient $\frac{1}{h}\Delta_{x_0} f(h)$ for each real number h.

a) $f(x) = -2x^2 + x + 3$, $x_0 = 2$

b) $f(x) = \frac{x^2-3}{x}$, $x_0 = 5$

c) $f(x) = 3\cos(x)$, $x_0 = \frac{\pi}{4}$

d) $f(x) = \sqrt{x}$, $x_0 = 9$

e) $f(x) = \exp(x)$, $x_0 = 1$

f) $f(x) = 4$, $x_0 = 1$

2. For each function f and x_0 given below, set up a limit to determine $f'(x_0)$.

a) $f(x) = -2x^2 + x + 3$, $x_0 = 2$

b) $f(x) = \frac{x^2-3}{x}$, $x_0 = 5$

c) $f(x) = 3\cos(x)$, $x_0 = \frac{\pi}{4}$

d) $f(x) = \sqrt{x}$, $x_0 = 9$

e) $f(x) = \exp(x)$, $x_0 = 1$

f) $f(x) = 4$, $x_0 = 1$

3. For each function f that is given below, use limits to calculate $f'(x)$ for every x where this limit exists.

a) $f(x) = 4$

b) $f(x) = 5x$

c) $f(x) = -2x^2 + x + 3$

d) $f(x) = \frac{x^2-3}{x}$

e) $f(x) = \sqrt{x}$

4. Take f to be the function that is given by

$$f(x) = \cos(5x^2 + 1).$$

Show that f is differentiable for each x in $\mathbb{R}$ and determine $f'(x)$.

5. Take f to be the function that is given by

$$f(x) = \mathrm{e}^{x^2+4x}.$$

Show that f is differentiable for each x in $\mathbb{R}$ and determine $f'(x)$.

6. Take c to be the path that is given for each t by

$$c(t) = (t^3 - 5t, 6\sin(5t)).$$

Use limits to directly calculate $c'(t)$.