Exercise 1 Evaluate the limits. Use $+\infty$ or $-\infty$ when appropriate.

i. $\lim_{x \to 4} \frac{\sqrt{2x+3}-3}{x-3}$

ii. $\lim_{x \to 5^+} \frac{-2}{x-5}$

iii. $\lim_{x \to 5^+} \frac{x-7}{x(x-5)^2}$

iv. $\lim_{x \to \infty} \frac{51743-7x-8x^3}{4x^4+14}$

v. $\lim_{x \to -\infty} \frac{\sqrt{3x^2-9}}{2x+8}$

vi. $\lim_{x \to -\infty} \frac{2x-\sin(x)}{x+3}$

Exercise 2 Use the Intermediate Value Theorem to prove that $f(x) = x^2 + 2x - 6$ has a root in the interval $[1, 2]$.

Exercise 3 A ball is thrown directly upward from the edge of a cliff and travels in such a way that t seconds later, its height in meters is given by the position function $s(t) = -16t^2 + 56t + 24$. Find the average velocity over the time interval $[1, 2]$.

Exercise 4 Find the value of the constant C which makes f continuous everywhere,

$$\text{where} \qquad f(x) = \begin{cases} 4x^2 - 2 & \text{if } x < 1 \\ Cx + 3 & \text{if } x \geq 1 \end{cases} \quad .$$

Exercise 5

i.   Use the limit definition of derivative to find $f'(x)$, where $f(x) = 1 - 2x + 3x^2$.
ii. Find the equation of the tangent line to $f(x)$ at $x = -4$.
iii. What is the instantaneous rate of change of $f(x)$ at $x = 2$?

Exercise 6 Find the vertical and horizontal asymptotes of the function

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