1. Find the following limits

   (a)
   $$\lim_{t \to 0} \frac{t-3}{t^3 - 27}$$

   (b)
   $$\lim_{s \to -1} \frac{s^2 + 3s + 2}{s^2 - s - 2}$$

   (c)
   $$\lim_{z \to 0} \frac{x^2 - x}{x^2 + x}$$

2. Let $f(x)$ be defined by
   $$f(x) = \begin{cases} |x| - 1 & x > -1 \\ \sin \pi x & x < -1 \end{cases}$$

   Can f be defined at $x = -1$ so that f is continuous on the whole real line?

3. If
   $$f(x) = x^5 + \frac{x^2}{x^2 + 1}$$
   show that there is a number ξ such that $f(\xi) = 0$.

4. Find the line tangent to the graph of $y = 3 - 4x^2$ at the point $(2, -13)$.

5. Use the *definition* of the derivative to compute $f'(9)$ if $f(x) = \sqrt{x}$.

6. Prove that if f is differentiable at $x = a$, and $f(a) \neq 0$, then
   $$\left(\frac{1}{f}\right)'(a) = \frac{-f'(a)}{(f(a))^2}$$

7. Find the equation(s) of all lines tangent to the parabola $y = (x-1)^2 + 2$ that also pass through the origin.

8. Find $f'(3)$ if $f(x) = \sqrt{1 + \sqrt{1 + \sqrt{1 + x}}}$.

9. Find $r'(3)$ if
   $$r(x) = \frac{(x-1)(x+2)}{(x+1)(x-2)}.$$