

1. Find the following limits:

(a)  $\lim_{t \rightarrow 2} \frac{t^2 - 4}{t^3 - 8}$

(b)  $\lim_{x \rightarrow 0} \frac{1 - \sqrt{1 - x^2}}{x}$

(c)  $\lim_{x \rightarrow 1} e^{x^3 - x}$

(d)  $\lim_{h \rightarrow 0} \frac{(h-1)^3 + 1}{h}$

(e)  $\lim_{r \rightarrow 9} \frac{\sqrt{r}}{(r-9)^4}$

(f)  $\lim_{s \rightarrow 16} \frac{4 - \sqrt{s}}{s - 16}$

(g)  $\lim_{x \rightarrow 8^-} \frac{|x - 8|}{x - 8}$

2. Use the definition of the derivative to find  $f'(2)$  if  $f(x) = x^3 - 2x$

3. Prove, using the  $\delta$ ,  $\epsilon$  definition of a limit, that  $\lim_{x \rightarrow 5} (7x - 27) = 8$

4. Find an equation of the tangent line to  $y = 9 - 2x^2$  at the point  $(2, 1)$ .

5. Let:

$$f(x) = \begin{cases} \sqrt{-x}, & x < 0 \\ 3 - x, & 0 \leq x < 3 \\ (x - 3)^2, & x > 3 \end{cases}$$

(a) Evaluate  $\lim_{x \rightarrow 0^+} f(x)$

(b) Evaluate  $\lim_{x \rightarrow 0^-} f(x)$

(c) Evaluate  $\lim_{x \rightarrow 0} f(x)$

(d) Evaluate  $\lim_{x \rightarrow 3^+} f(x)$

(e) Evaluate  $\lim_{x \rightarrow 3^-} f(x)$

(f) Evaluate  $\lim_{x \rightarrow 3} f(x)$

6. The displacement of an object is given by  $s(t) = 1 + 2t + \frac{t^2}{4}$ .

(a) Find the average velocity from  $[1, 3]$ .

(b) Find the average velocity from  $[1, 2]$ .

(c) Find the instantaneous velocity when  $t = 1$ .