Find all relative extrema of the following functions. You may use the first or second derivative test (when applicable).

1. $f(x) = -x^3 + 3x^2 - 2$
2. $f(x) = 6x - x^2$
3. $f(x) = (x - 5)^2$
4. $f(x) = x^3 - 3x^2 + 3$
5. $f(x) = x^4 - 4x^3 + 2$
6. $f(x) = x^{\frac{2}{3}} - 3$
7. $f(x) = x + \frac{4}{x}$
8. $f(x) = x^3 - 12x$
9. $f(x) = x^3 - 6x^2 + 12x - 8$
10. $f(x) = \frac{1}{4}x^4 - 2x^2$
11. $f(x) = (x - 1)(x + 2)^2$
12. $f(x) = x\sqrt{x + 3}$
13. $f(x) = \frac{4}{1 + x^2}$
14. $f(x) = \frac{24}{x^2 + 12}$
15. $f(x) = \frac{x^2 - 1}{2x + 1}$
16. $f(x) = \frac{x^2 + 1}{x^2 - 1}$
17. $f(x) = \sin x$
18. $f(x) = x^{\frac{3}{2}} - 3x^{\frac{1}{2}}$
19. $f(x) = \cos x - x, \quad 0 \leq x < 2\pi$
20. $f(x) = \sin(x/2), \quad 0 \leq x < 4\pi$
21. $f(x) = \sec \left( x - \frac{\pi}{2} \right), \quad 0 < x < 4\pi$
22. $f(x) = 2\sin x + \sin(2x), \quad 0 \leq x < 2\pi$
1. Rel. min. at \( x = 0, \ f(0) = -2 \)
   Rel. max. at \( x = 2, \ f(2) = 2 \)

2. Rel. max. at \( x = 3, \ f(3) = 9 \)

3. Rel. min. at \( x = 5, \ f(5) = 0 \)

4. Rel. max. at \( x = 0, \ f(0) = 3 \)
   Rel. min. at \( x = 2, \ f(2) = -1 \)

5. Rel. min. at \( x = 3, \ f(3) = -25 \)

6. Rel. min. at \( x = 0, \ f(0) = -3 \)

7. Rel. max. at \( x = -2, \ f(-2) = -4 \)
   Rel. min. at \( x = 2, \ f(2) = 4 \)

8. Rel. max. at \( x = -2, \ f(-2) = 16 \)
   Rel. min. at \( x = 2, \ f(2) = -16 \)

9. No relative extrema

10. Rel. max. at \( x = 0, \ f(0) = 0 \)
    Rel. min. at \( x = -2, \ f(-2) = -4 \)
    and \( x = 2, \ f(2) = -4 \)

11. Rel. max. at \( x = -2, \ f(-2) = 0 \)
    Rel. min. at \( x = 0, \ f(0) = -4 \)

12. Rel. min. at \( x = -2, \ f(-2) = -2 \)

13. Rel. max. at \( x = 0, \ f(0) = 4 \)

14. Rel. max. at \( x = 0, \ f(0) = 2 \)

15. No relative extrema

16. Rel. max. at \( x = 0, \ f(0) = -1 \)

17. Rel. max. at \( x = \pi/2 + 2\pi n, \ f(\pi/2 + 2\pi n) = 1 \)
    Rel. min at \( x = 3\pi/2 + 2\pi n, \ f(3\pi/2 + 2\pi n) = -1 \)

18. Rel. min at \( x = 1, \ f(1) = -2 \)

19. No Relative extrema

20. Rel. min at \( x = 3\pi, \ f(3\pi) = -1 \)
    Rel. max at \( x = \pi, \ f(\pi) = 1 \)

21. Rel. min at \( x = \pi/2, \ f(\pi/2) = 1 \)
    and \( x = 5\pi/2, \ f(5\pi/2) = 1 \)
    Rel. max at \( x = 3\pi/2, \ f(3\pi/2) = -1 \)
    and \( x = 7\pi/2, \ f(7\pi/2) = -1 \)

22. Rel. min at \( x = 5\pi/3, \ f(5\pi/3) \)
    Rel. max at \( x = \pi/3, \ f(\pi/3) \)