1) absolute min of 2 at x = 2, absolute max of 8 at x = -1

2) $f'(x) = 2x + 2 \quad f'(x) = 0 \Rightarrow x = -1$
absolute min of -5 at x = -1, absolute max of -1 at x = 1

3) $f'(x) = 2x^{-1/3} - 2 \quad f'(x) = 0 \Rightarrow x = 1$
absolute min of 1 at x = 1, absolute max of 5 at x = -1

4) Does satisfy. $2c = \frac{1-4}{1-(-2)} \Rightarrow c = -\frac{1}{2}$

5) Does satisfy. $3c^2 - 2c - 2 = \frac{0-(-2)}{-1-1} \Rightarrow c = -\frac{1}{3}$

6) Does satisfy. $\frac{2}{3}c^{-1/3} = \frac{1-0}{1-0} \Rightarrow c = \frac{4}{9}$

7) Does satisfy. $\frac{-1}{c^2} = \frac{3-\frac{3}{2}}{\frac{1}{2}-2} \Rightarrow c = 1$

8) Does NOT satisfy.

9) Does satisfy. $3c^2 = \frac{1-0}{1-0} \Rightarrow c = \sqrt{\frac{1}{3}}$

10) $-4x + 4 = 0 \Rightarrow x = 1$. Inc $(-\infty, 1)$; Dec $(1, \infty)$. Local (also abs) max of 5 at $x = 1$

11) $3x^2 - 3 = 0 \Rightarrow x = \pm 1$. Inc $(-\infty, -1)$ and $(1, \infty)$; Dec $(-1, 1)$. Local max of 4 at $x = -1$, local min of 0 at $x = 1$

12) $6x^2 + 6x - 12 = 0 \Rightarrow x = -2, 1$. Inc $(-\infty, -2)$ and $(1, \infty)$; Dec $(-2, 1)$.
Local max of 20 at $x = -2$, local min of -7 at $x = 1$

13) $2(x-3)^2 = 0 \Rightarrow x = 3$. Inc $(-\infty, 3)$ and $(3, \infty)$. No local extrema.

14) $x^4 - 1 = 0 \Rightarrow x = -1, 1$. Inc $(-\infty, -1)$ and $(1, \infty)$; Dec $(-1, 1)$.
Local max of $\frac{4}{5}$ at $x = -1$, local min of -$\frac{4}{5}$ at $x = 1$

15) $\frac{1}{3}x^{-2/3} = 0 \Rightarrow DNE$. Inc $(-\infty, 0)$ and $(0, \infty)$. No local extrema.

16) $f'(x) = 6 - 2x \quad 6 - 2x = 0 \Rightarrow x = 3$
$f''(x) = -2,$ so local max of 9 at $x = 3$

17) $f'(x) = 2x + 3 \quad 2x + 3 = 0 \Rightarrow x = -\frac{3}{2}$
$f''(x) = 2,$ so local min of $-\frac{41}{4}$ at $x = -\frac{3}{2}$

18) $f'(x) = -2x + 10 \quad -2x + 10 = 0 \Rightarrow x = 5$
$f''(x) = -2,$ so local max of 0 at $x = 5$

19)
$f'(x) = \frac{2}{3}x^{-1/3} \quad \frac{2}{3}x^{-1/3} = 0$ at no point, but DNE at $x = 0$
$f''(x) = -\frac{2}{9}x^{-4/3}$, also DNE at $x = 0$. Use FIRST deriv. test
local min of -3 at $x = 0$

20)
$f'(x) = \frac{x}{\sqrt{x^2+1}} \quad \frac{x}{\sqrt{x^2+1}} = 0 \Rightarrow x = 0$
$f''(x) = \frac{1}{\left(x^2+1\right)^{3/2}}$. $f''(0) = 1,$ so local min of 1 at $x = 0$

21)
$f'(x) = 1 - \frac{4}{x^2} \quad 1 - \frac{4}{x^2} = 0 \Rightarrow x = \pm 2.$
$f''(x) = \frac{8}{x^3}. \quad f''(2) = 1,$ so local min of 4 at $x = 2.$
$f''(-2) = -1,$ so local max of -4 at $x = -2$

22)
$f'(x) = 3x^2 - 12 \quad 3x^2 - 12 = 0 \Rightarrow x = \pm 2$
$f''(x) = 6x,$ so local min of -16 at $x = 2,$ local max of 16 at $x = -2.$
$f''(x) = 0 \Rightarrow x = 0.$ Conc. down $(-\infty, 0)$; conc. up $(0, \infty)$.
Point of inflection at $(0,0)$

23)

$f'(x) = x^3 - 4x \quad x^3 - 4x = 0 \Rightarrow x = 0, -2, 2.$

$f''(x) = 3x^2 - 4,$ so local min of -4 at $x = -2,$ local max of 0 at $x = 0,$ local min of -4 at $x = 2.$

$f''(x) = 0 \Rightarrow x = \pm\sqrt{\frac{4}{3}}.$ Conc. down $\left(-\sqrt{\frac{4}{3}}, \sqrt{\frac{4}{3}}\right)$; conc. up $\left(-\infty, -\sqrt{\frac{4}{3}}\right), \left(\sqrt{\frac{4}{3}}, \infty\right).$

Points of inflection at $\left(-\sqrt{\frac{4}{3}}, -\frac{20}{9}\right)$ and $\left(\sqrt{\frac{4}{3}}, -\frac{20}{9}\right)$