# Section 2.4

1. A. $x^2 - 3x - 4 \geq 0$ when $x \leq -1$ OR $x \geq 4$

   B. $x^2 - 3x - 4 \leq 0$ when $-1 \leq x \leq 4$

2. A. $-\frac{1}{2}x^2 - \frac{7}{2}x - 5 > 0$ when $-5 < x < 2$

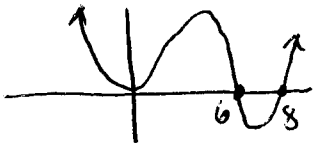
   B. $-\frac{1}{2}x^2 - \frac{7}{2}x - 5 < 0$ when $x < -5$ OR $x > -2$

6. A. $-x^3 + 6x^2 - 12x + 9 < 0$ when $x > 3$

   B. $-x^3 + 6x^2 - 12x + 9 \geq 0$ when $x \leq 3$

8. From example #2 solution is $[6, 8]$

Graph:




you can see from the graph that the graph is not positive (negative or equal to zero) on interval $[6, 8]$

10. $x^2 + 4x - 32 < 0 \Rightarrow (x-8)(x-4) < 0$

| | pos | | 4 | | neg | | 8 | | pos |
|---|---|---|---|---|---|---|---|---|---|
| $x-8$ | − | − | | − | − | | + | + | |
| $x-4$ | − | − | | + | + | | + | + | |

Solution $(4, 8)$

14. $3x^2 + x \leq 4 \Rightarrow 3x^2 + x - 4 \leq 0 \Rightarrow (3x+4)(x-1) \leq 0$

| | pos | | $-\frac{4}{3}$ | | neg | | 1 | | pos |
|---|---|---|---|---|---|---|---|---|---|
| $3x+4$ | − | − | | + | + | | + | + | |
| $x-1$ | − | − | | − | − | | + | + | |

$\left[-\frac{4}{3}, 1\right]$

20. $2x^3 - 9x^2 + 4x \geq 0 \Rightarrow x(2x-1)(x-4) \geq 0$

Solution

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $x$ | − | − | + | + | + | + | + | + | $[0, \frac{1}{2}]$ |
| $2x-1$ | − | − | − | − | + | + | + | + | OR |
| $x-4$ | − | − | − | − | − | − | + | + | $[4, \infty)$ |
| | | neg | 0 | pos | | 1/2 | neg | 4 | pos |

24. $8x^4 < x^2 - 2x^3 \Rightarrow 8x^4 + 2x^3 - x^2 < 0$

$x^2(8x^2 + 2x - 1) < 0 \Rightarrow x^2(4x-1)(2x+1) < 0$

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $x^2$ | + | + | + | + | + | + | + | + | |
| $4x-1$ | − | − | − | − | − | − | + | + | |
| $2x+1$ | − | − | + | + | + | + | + | + | |
| | pos | | $-1/2$ | neg | 0 | neg | | $1/4$ | pos. |

Solution: $(-\frac{1}{2}, 0)$ OR $(0, \frac{1}{4})$

31. $(x+4)(x+5)(x+6) < 0$

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $x+4$ | − | − | + | + | + | + | + | + | |
| $x+5$ | | | − | − | + | + | + | + | |
| $x+6$ | | | | | − | − | + | + | |
| | | | − | | − | | − | | |

38 $x^2(3x^2+11) \geq 4 \Rightarrow 3x^4 + 11x^2 - 4 \geq 0 \Rightarrow (3x^2-1)(x^2+4) \geq 0$

$3(x^2 - \frac{1}{3})(x^2+4) \geq 0 \quad 3(x - \sqrt{\frac{1}{3}})(x + \sqrt{\frac{1}{3}})(x^2+4) \geq 0$

$\ast$ always pos.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $x - \sqrt{\frac{1}{3}}$ | − | − | − | − | + | + | | |
| $x + \sqrt{1/3}$ | − | − | + | + | + | + | | |
| | pos | | $-\sqrt{1/3}$ | neg | $\sqrt{1/3}$ | pos. | | |

Sol: $[-\infty, -\sqrt{1/3}]$ OR $[\sqrt{1/3}, \infty)$

44. $\frac{x+4}{2x-5} \leq 0$

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $x+4$ | − | − | | + | + | + | + |
| $2x-5$ | − | − | | − | − | + | + |

neg $-4$ neg $5/2$ pos.

Solution $[-4, 5/2)$

48. $\frac{x^2-3x+1}{1-x} < 0$ zeros of numerator are $\approx (.382, 0)$ $\approx (2.62, 0)$

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| + | + | | − | − | + | + | − | − |

pos $.382$ neg $1$ pos $2.62$ neg.

I looked at the graph Sol: $(-.382, 1)$ $(2.62, \infty)$

68. $\frac{x^3-5}{x^2+1} \leq 0$

Since $x^2+1$ is always positive we only need to look at the sign of the numerator

| | | | |
|---|---|---|---|
| $x^3-5$ | − | − | + + |

$\sqrt[3]{5}$

Solution: $(-\infty, \sqrt[3]{5}]$