MTH 1125 - Concavity Max Min Exercises Set 1 - Answers
FALL 2022

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In the exercises below,   [1]Deterimine the intervals on which $f(x)$ is increasing/decreasing
[2]Identify all relative maximums and minimums
[3]Deterimine the intervals on which $f(x)$ is CCU/CCD
[4]Identify all points of inflections
[5]Graph $f(x)$

1. $f(x) = x^3 - 6x^2 + 9x + 2$

   Increasing on the interval(s) $(-\infty, 1)$ and $(3, \infty)$

   Decreasing on the interval(s) $(1, 3)$
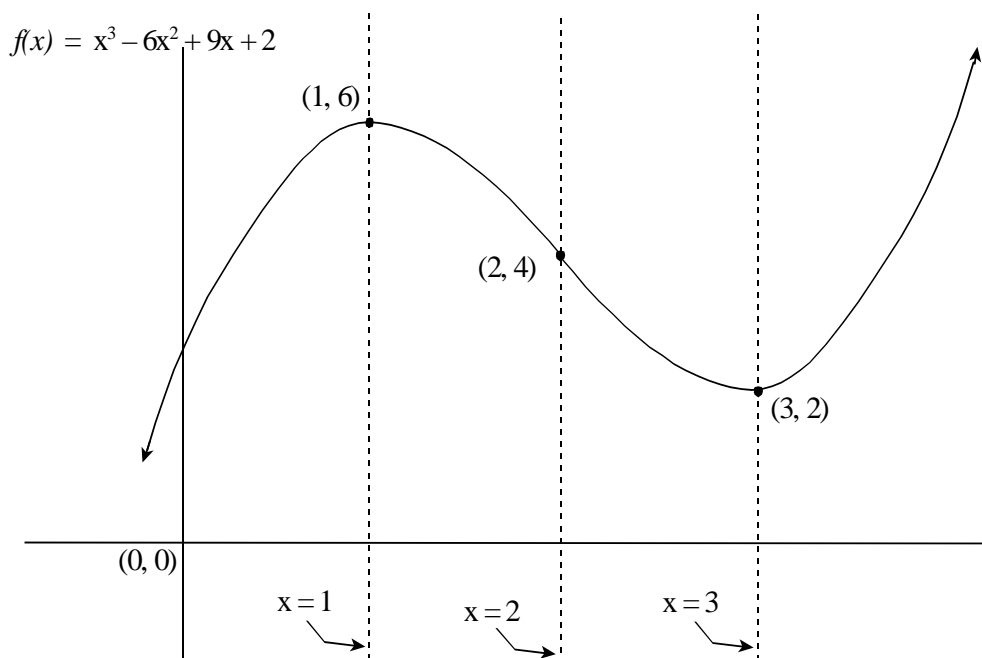
   Relative Maximum $(1, 6)$

   Relative Minimum $(3, 2)$

   Concave Up on the interval(s) $(2, \infty)$

   Concave Down on the interval(s) $(-\infty, 2)$

   Point of Inflection $(2, 4)$

2. $f(x) = x^3 - 3x^2 - 9x + 13$

Increasing on the interval(s) $(-\infty, -1)$ and $(3, \infty)$

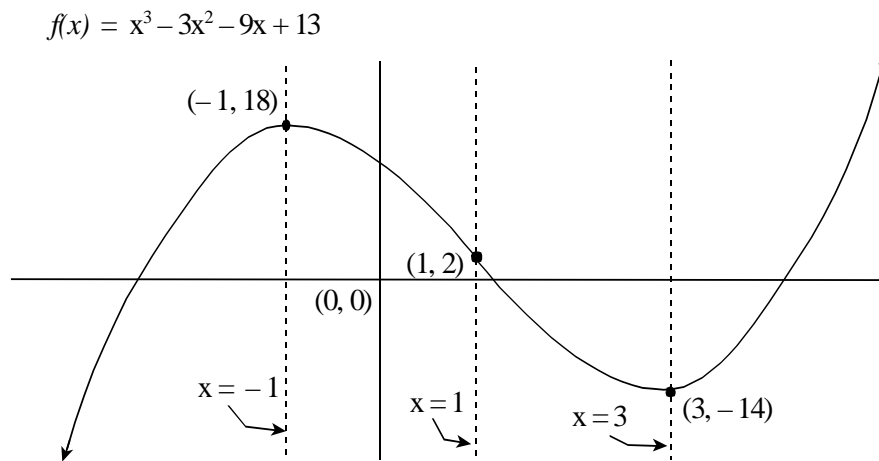Decreasing on the interval(s) $(-1, 3)$

Relative Maximum $(-1, 18)$

Relative Minimum $(3, -14)$

Concave Up on the interval(s) $(1, \infty)$

Concave Down on the interval(s) $(-\infty, 1)$

Point of Inflection $(1, 2)$

$f(x) = x^3 - 3x^2 - 9x + 13$

3. $f(x) = 2x^3 - 12x^2 + 18x - 3$

Increasing on the interval(s) $(-\infty, 1)$ and $(3, \infty)$

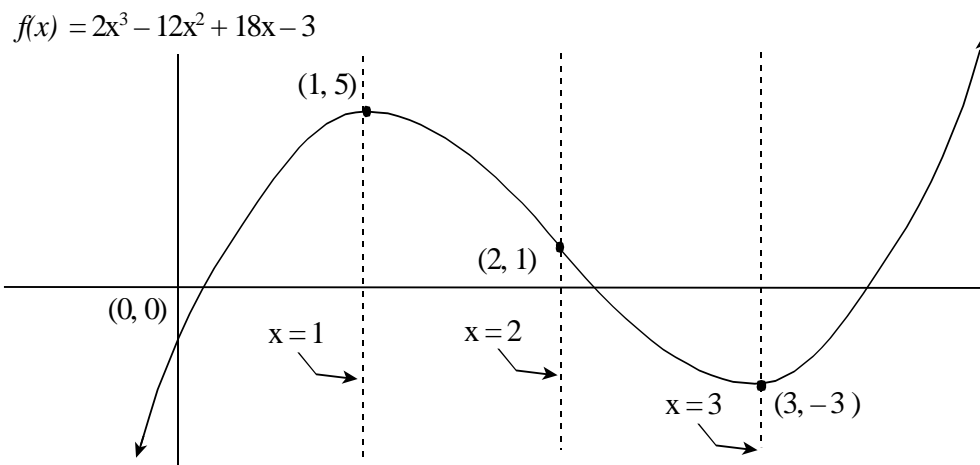Decreasing on the interval(s) $(1, 3)$

Relative Maximum $(1, 5)$

Relative Minimum $(3, -3)$

Concave Up on the interval(s) $(2, \infty)$

Concave Down on the interval(s) $(-\infty, 2)$

Point of Inflection $(2, 1)$

$f(x) = 2x^3 - 12x^2 + 18x - 3$

(1, 5)

(2, 1)

(0, 0)

x = 1

x = 2

x = 3   (3, -3)

4. $f(x) = \frac{16}{5}x^{\frac{5}{3}} + x^{\frac{2}{3}} + 2$

Increasing on the intervals and $\left(-\infty, -\frac{1}{8}\right)$ and $(0, \infty)$
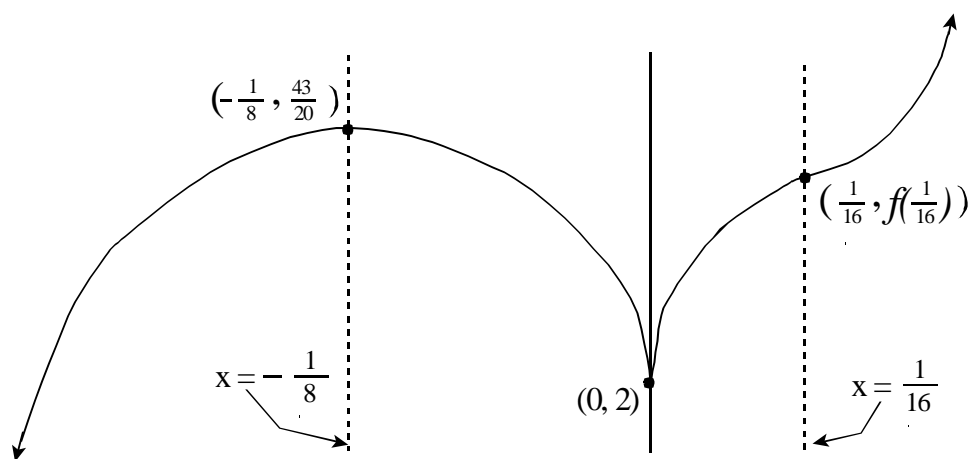
Decreasing on the interval $\left(-\frac{1}{8}, 0\right)$

Relative Max $\quad \left(-\frac{1}{8}, f\left(-\frac{1}{8}\right)\right) = \left(-\frac{1}{8}, \frac{43}{20}\right)$

Relative Min $\quad (0, f(0)) = (0, 2)$

Concave Up on the interval(s) $\left(\frac{1}{16}, \infty\right)$

Concave Down on the interval(s) $(-\infty, 0)$ and $\left(0, \frac{1}{16}\right)$

Point of Inflection $\left(\frac{1}{16}, f\left(\frac{1}{16}\right)\right)$

4

5. $f(x) = x^3 - 9x^2 - 21x + 118$

Increasing on the interval(s) $(-\infty, -1)$ and $(7, \infty)$

Decreasing on the interval(s) $(-1, 7)$
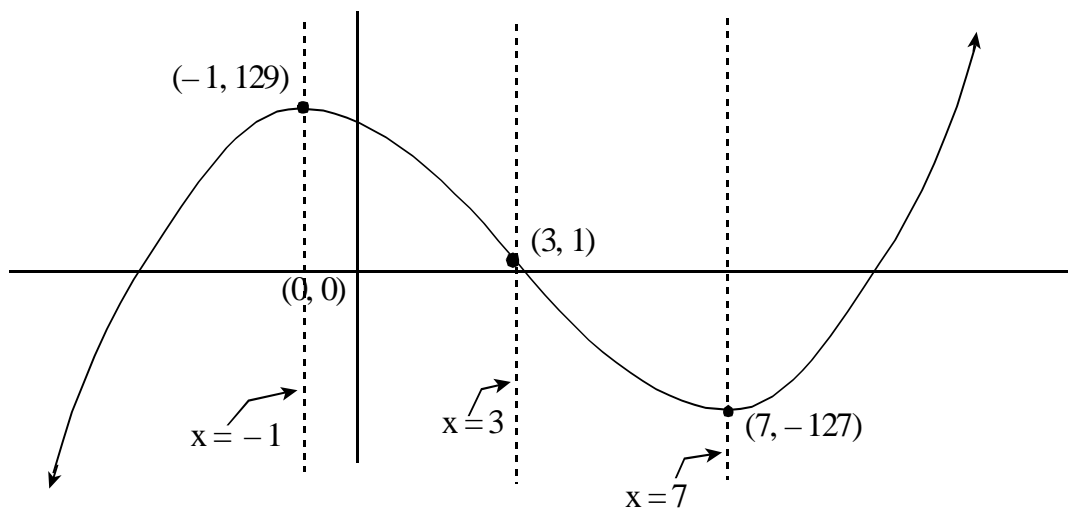
Relative Maximum $(-1, 129)$

Relative Minimum $(7, -127)$

Concave Up on the interval(s) $(3, \infty)$

Concave Down on the interval(s) $(-\infty, 3)$

Point of Inflection $(3, 1)$

$f(x) = x^3 - 9x^2 - 21x + 118$

6. $f(x) = x^3 - 12x^2 + 21x + 48$

Increasing on the interval(s) $(-\infty, 1)$ and $(7, \infty)$

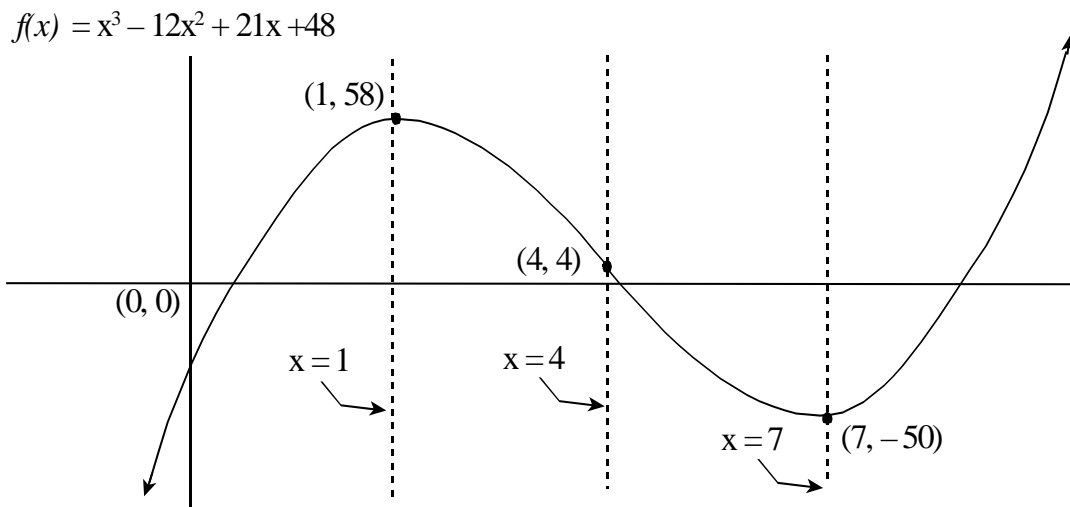Decreasing on the interval(s) $(1, 7)$

Relative Maximum $(1, 58)$

Relative Minimum $(7, -50)$

Concave Up on the interval(s) $(4, \infty)$

Concave Down on the interval(s) $(-\infty, 4)$

Point of Inflection $(4, 4)$

$f(x) = x^3 - 12x^2 + 21x + 48$

(1, 58)

(4, 4)

(0, 0)

x = 1

x = 4

x = 7   (7, -50)

7. $f(x) = x^4 - 8x^3 + 5$

Increasing on the interval(s) $(6, \infty)$

Decreasing on the interval(s) $(-\infty, 6)$

Relative Maximum None

Relative Minimum $(6, -427)$

Concave Up on the interval(s) $(-\infty, 0), (4, \infty)$

Concave Down on the interval(s) $(0, 4)$

Points of Inflection $(0, 5)$ and $(4, -251)$

$f(x) = x^4 - 8x^3 + 5$