1. Sketch the grapf of the following polynomial function: $f(x) = \dfrac{-50 - 36x + 12x^2 - 2x^3}{18}$

2. Sketch the grapf of the following polynomial function: $f(x) = \dfrac{-8 + 18x - 12x^2 + 2x^3}{30}$

3. Sketch the grapf of the following polynomial function: $f(x) = \dfrac{6x - 2x^3}{30}$

4. Sketch the grapf of the following polynomial function: $f(x) = \dfrac{-8 + 6x^2 + 2x^3}{-30}$

5. Sketch the grapf of the following polynomial function: $f(x) = \dfrac{-108x + 36x^2 - 4x^3}{-30}$

6. Sketch the grapf of the following polynomial function: $f(x) = \dfrac{12x^2 - 4x^3}{-24}$

7. Sketch the grapf of the following polynomial function: $f(x) = \dfrac{6x - 4x^3}{24}$

8. Sketch the grapf of the following polynomial function: $f(x) = \dfrac{14 + 6x - 6x^2 + 2x^3}{30}$

9. Sketch the grapf of the following polynomial function: $f(x) = \dfrac{4 - 18x + 12x^2 - 2x^3}{-18}$

10. Sketch the grapf of the following polynomial function: $f(x) = \dfrac{12x + 12x^2 + 2x^3}{-24}$

Solutions:

1. $f(x) = \dfrac{-50 - 36x + 12x^2 - 2x^3}{18}$

Domain

The function $f(x)$ is a polynomial function. Therefore the domain is $D_f = \mathbb{R}$.

Symmetry

$f(-x) = \dfrac{-50 - 36(-x) + 12(-x)^2 - 2(-x)^3}{-6} = \dfrac{-50 + 36x + 12x^2 + 2x^3}{-6}$

$f(-x) \neq f(x) \qquad f(-x) \neq -f(x)$

Therefore the function $f(x)$ is neither even nor odd function.

Zeros

$f(-1) = 0$. Therefore $x = -1$ is a zero of $f(x)$ and $(x + 1)$ is a factor of $f(x)$. By factoring $f(x)$:

$f(x) = \frac{1}{18}(x + 1)(-50 + 14x - 2x^2)$

The other zeros are given by: $-50 + 14x - 2x^2 = 0$. The discriminant of this quadratic equation is:

$\Delta = (14)^2 - 4(-2)(-50) = -204$

There are no more real zeros.

The zero(s) of the function $f(x)$ is(are): $x_1 = -1$

y-intercept

$y - int = f(0) = \dfrac{-50}{18} = -2.778$

Asymptotes

The function $f(x)$ is a polynomial function of degree 3. Therefore the function does not have any kind of asymptotes.

Critical Numbers

$f'(x) = \dfrac{-36 + 24x - 6x^2}{18}$

Critical numbers are the solutions of the equation $f'(x) = 0$ or $-36 + 24x - 6x^2 = 0$ or $-6 + 4x - x^2 = 0$

There are no critical numbers.

Sign Chart for the First Derivative $f'(x)$

x	
$f(x)$	$\downarrow$
$f'(x)$	$-$

Increasing and Decreasing Intervals

The function $f(x)$ is decreasing over $(-\infty, \infty)$.

Maximum and Minimum Points

The function $f(x)$ has no minimum or maxinum points

Concavity Intervals

The second derivative of the function $f(x)$ is given by: $f''(x) = \dfrac{24 - 12x}{18}$

The second derivative $f''(x)$ is zero when: $f''(x) = 0 \qquad 24 - 12x = 0 \qquad x_6 = 2 \qquad y_6 = f(x_6) = -5.000$

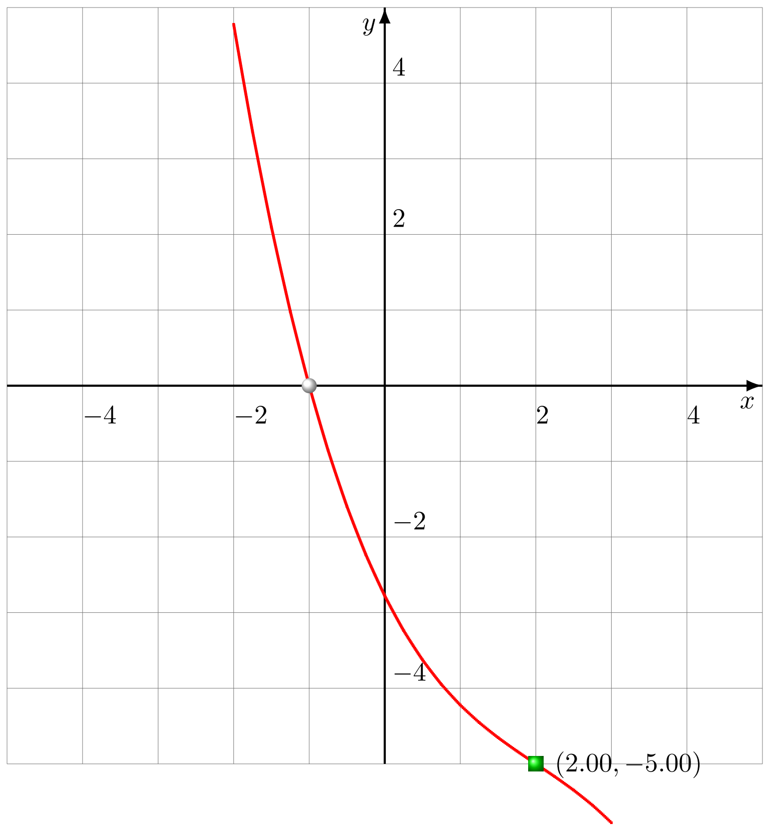
Sign Chart for the Second Derivative $f''(x)$

x		2.000	
$f(x)$	$\smile$	-5.000	$\frown$
$f''(x)$	$+$	0	$-$

Inflection Points

There is an inflection point at $P_6 = (2.000, -5.000)$

Graph



2. $f(x) = \dfrac{-8 + 18x - 12x^2 + 2x^3}{30}$

Domain
The function $f(x)$ is a polynomial function. Therefore the domain is $D_f = \mathbb{R}$.

Symmetry
$f(-x) = \dfrac{-8 + 18(-x) - 12(-x)^2 + 2(-x)^3}{6} = \dfrac{-8 - 18x - 12x^2 - 2x^3}{6}$

$f(-x) \neq f(x) \qquad f(-x) \neq -f(x)$

Therefore the function $f(x)$ is neither even nor odd function.

Zeros
$f(1) = 0$. Therefore $x = 1$ is a zero of $f(x)$ and $(x - 1)$ is a factor of $f(x)$. By factoring $f(x)$:

$f(x) = \dfrac{1}{30}(x - 1)(8 - 10x + 2x^2)$

The other zeros are given by: $8 - 10x + 2x^2 = 0$. The discriminant of this quadratic equation is:

$\Delta = (-10)^2 - 4(2)(8) = 36$

There are two more real zeros given by:

$x = \dfrac{10 \pm \sqrt{(36)}}{2(2)}$

$x_2 = \dfrac{10 - \sqrt{(36)}}{4} = 1.000$

$x_3 = \dfrac{10 + \sqrt{(36)}}{4} = 4.000$

The zero(s) of the function $f(x)$ is(are): $x_1 = 1 \qquad x_2 = 1.000 \qquad x_3 = 4.000$

y-intercept
$y - int = f(0) = \dfrac{-8}{30} = -0.267$

Asymptotes
The function $f(x)$ is a polynomial function of degree 3. Therefore the function does not have any kind of asymptotes.

Critical Numbers
$f'(x) = \dfrac{18 - 24x + 6x^2}{30}$

Critical numbers are the solutions of the equation $f'(x) = 0$ or $18 - 24x + 6x^2 = 0$ or $3 - 4x + x^2 = 0$

There are two critical numbers given by:

$x = \dfrac{4 \pm \sqrt{(4)}}{2(1)}$

$x_4 = \dfrac{4 - \sqrt{(4)}}{2} = 1.000 \qquad y_4 = f(x_4) = 0.000$

$x_5 = \dfrac{4 + \sqrt{(4)}}{2} = 3.000 \qquad y_5 = f(x_5) = -0.267$

Sign Chart for the First Derivative $f'(x)$

x		1.000		3.000	
$f(x)$	$\uparrow$	0.000	$\downarrow$	-0.267	$\uparrow$
$f'(x)$	$+$	0	$-$	0	$+$

Increasing and Decreasing Intervals

The function $f(x)$ is increasing over $(-\infty, 1.000)$ and over $(3.000, \infty)$ and is decreasing over $(1.000, 3.000)$.

Maximum and Minimum Points

The function $f(x)$ has a maximum point at $P_4(1.000, 0.000)$ and a minimum point at $P_5(3.000, -0.267)$.

Concavity Intervals

The second derivative of the function $f(x)$ is given by: $f''(x) = \dfrac{-24 + 12x}{30}$

The second derivative $f''(x)$ is zero when: $f''(x) = 0 \qquad -24 + 12x = 0 \qquad x_6 = 2 \qquad y_6 = f(x_6) = -0.133$

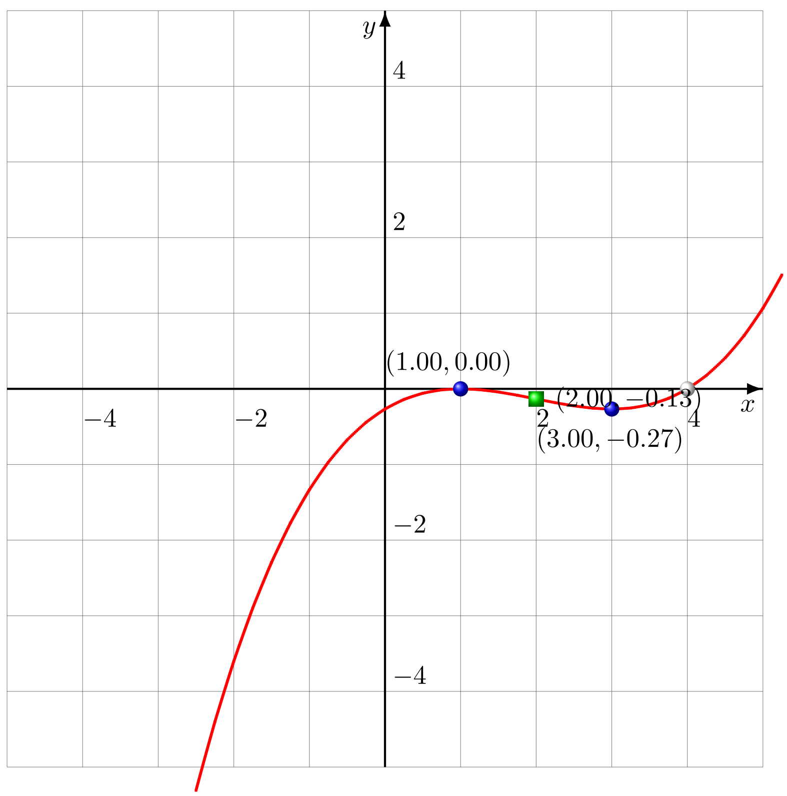
Sign Chart for the Second Derivative $f''(x)$

x		2.000	
$f(x)$	$\frown$	-0.133	$\smile$
$f''(x)$	$-$	0	$+$

Inflection Points

There is an inflection point at $P_6 = (2.000, -0.133)$

Graph



3. $f(x) = \dfrac{6x - 2x^3}{30}$

Domain
The function $f(x)$ is a polynomial function. Therefore the domain is $D_f = \mathbb{R}$.

Symmetry
$f(-x) = \dfrac{6(-x) - 2(-x)^3}{-6} = \dfrac{-6x + 2x^3}{-6}$

$f(-x) \neq f(x) \qquad f(-x) = -f(x)$

Therefore the function $f(x)$ is an odd function.

Zeros
$f(0) = 0$. Therefore $x = 0$ is a zero of $f(x)$ and $(x - 0)$ is a factor of $f(x)$. By factoring $f(x)$:

$f(x) = \dfrac{1}{30}(x - 0)(6 - 2x^2)$

The other zeros are given by: $6 - 2x^2 = 0$. The discriminant of this quadratic equation is:

$\Delta = (0)^2 - 4(-2)(6) = 48$

There are two more real zeros given by:

$x = \dfrac{0 \pm \sqrt{(48)}}{2(-2)}$

$x_2 = \dfrac{0 + \sqrt{(48)}}{-4} = -1.732$

$x_3 = \dfrac{0 - \sqrt{(48)}}{-4} = 1.732$

The zero(s) of the function $f(x)$ is(are): $x_1 = 0 \qquad x_2 = -1.732 \qquad x_3 = 1.732$

y-intercept
$y - int = f(0) = \dfrac{0}{30} = 0.000$

Asymptotes
The function $f(x)$ is a polynomial function of degree 3. Therefore the function does not have any kind of asymptotes.

Critical Numbers
$f'(x) = \dfrac{6 - 6x^2}{30}$

Critical numbers are the solutions of the equation $f'(x) = 0$ or $6 - 6x^2 = 0$ or $1 - x^2 = 0$

There are two critical numbers given by:

$x = \dfrac{0 \pm \sqrt{(4)}}{2(-1)}$

$x_4 = \dfrac{0 + \sqrt{(4)}}{-2} = -1.000 \qquad y_4 = f(x_4) = -0.133$

$x_5 = \dfrac{0 - \sqrt{(4)}}{-2} = 1.000 \qquad y_5 = f(x_5) = 0.133$

Sign Chart for the First Derivative $f'(x)$

x		-1.000		1.000	
$f(x)$	$\downarrow$	-0.133	$\uparrow$	0.133	$\downarrow$
$f'(x)$	$-$	0	$+$	0	$-$

Increasing and Decreasing Intervals

The function $f(x)$ is decreasing over $(-\infty, -1.000)$ and over $(1.000, \infty)$ and is increasing over $(-1.000, 1.000)$.

Maximum and Minimum Points

The function $f(x)$ has a minimum point at $P_4(-1.000, -0.133)$ and a maximum point at $P_5(1.000, 0.133)$.

Concavity Intervals

The second derivative of the function $f(x)$ is given by: $f''(x) = \dfrac{-12x}{30}$

The second derivative $f''(x)$ is zero when: $f''(x) = 0 \qquad -12x = 0 \qquad x_6 = 0 \qquad y_6 = f(x_6) = 0.000$

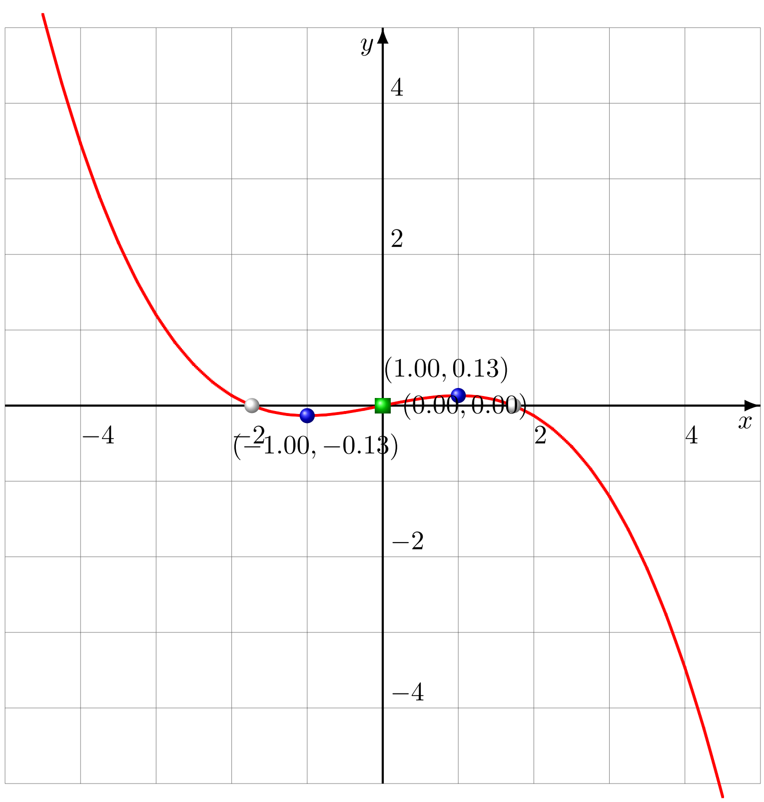
Sign Chart for the Second Derivative $f''(x)$

x		0.000	
$f(x)$	$\smile$	0.000	$\frown$
$f''(x)$	$+$	0	$-$

Inflection Points

There is an inflection point at $P_6 = (0.000, 0.000)$

Graph



4. $f(x) = \dfrac{-8 + 6x^2 + 2x^3}{-30}$

Domain
The function $f(x)$ is a polynomial function. Therefore the domain is $D_f = \mathbb{R}$.

Symmetry
$f(-x) = \dfrac{-8 + 6(-x)^2 + 2(-x)^3}{6} = \dfrac{-8 + 6x^2 - 2x^3}{6}$

$f(-x) \neq f(x) \qquad f(-x) \neq -f(x)$

Therefore the function $f(x)$ is neither even nor odd function.

Zeros
$f(-2) = 0$. Therefore $x = -2$ is a zero of $f(x)$ and $(x + 2)$ is a factor of $f(x)$. By factoring $f(x)$:

$f(x) = \dfrac{1}{-30}(x + 2)(-4 + 2x + 2x^2)$

The other zeros are given by: $-4 + 2x + 2x^2 = 0$. The discriminant of this quadratic equation is:

$\Delta = (2)^2 - 4(2)(-4) = 36$

There are two more real zeros given by:

$x = \dfrac{-2 \pm \sqrt{(36)}}{2(2)}$

$x_2 = \dfrac{-2 - \sqrt{(36)}}{4} = -2.000$

$x_3 = \dfrac{-2 + \sqrt{(36)}}{4} = 1.000$

The zero(s) of the function $f(x)$ is(are): $x_1 = -2 \qquad x_2 = -2.000 \qquad x_3 = 1.000$

y-intercept
$y - int = f(0) = \dfrac{-8}{-30} = 0.267$

Asymptotes
The function $f(x)$ is a polynomial function of degree 3. Therefore the function does not have any kind of asymptotes.

Critical Numbers
$f'(x) = \dfrac{12x + 6x^2}{-30}$

Critical numbers are the solutions of the equation $f'(x) = 0$ or $12x + 6x^2 = 0$ or $2x + x^2 = 0$

There are two critical numbers given by:

$x = \dfrac{-2 \pm \sqrt{(4)}}{2(1)}$

$x_4 = \dfrac{-2 - \sqrt{(4)}}{2} = -2.000 \qquad y_4 = f(x_4) = 0.000$

$x_5 = \dfrac{-2 + \sqrt{(4)}}{2} = 0.000 \qquad y_5 = f(x_5) = 0.267$

Sign Chart for the First Derivative $f'(x)$

x		-2.000		0.000	
$f(x)$	$\downarrow$	0.000	$\uparrow$	0.267	$\downarrow$
$f'(x)$	$-$	0	$+$	0	$-$

Increasing and Decreasing Intervals

The function $f(x)$ is decreasing over $(-\infty, -2.000)$ and over $(0.000, \infty)$ and is increasing over $(-2.000, 0.000)$.

Maximum and Minimum Points

The function $f(x)$ has a minimum point at $P_4(-2.000, 0.000)$ and a maximum point at $P_5(0.000, 0.267)$.

Concavity Intervals

The second derivative of the function $f(x)$ is given by: $f''(x) = \dfrac{12 + 12x}{-30}$

The second derivative $f''(x)$ is zero when: $f''(x) = 0 \qquad 12 + 12x = 0 \qquad x_6 = -1 \qquad y_6 = f(x_6) = 0.133$

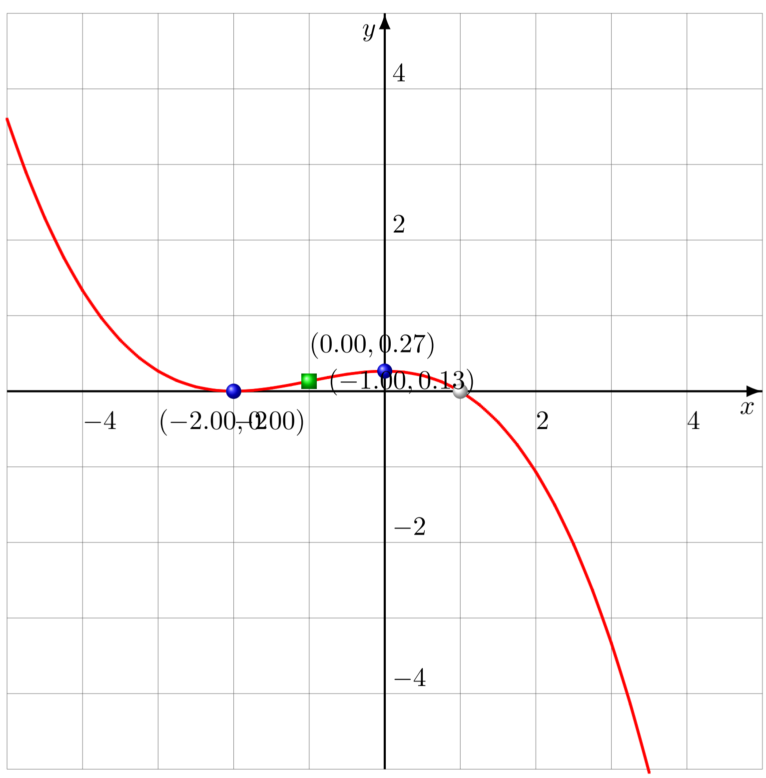
Sign Chart for the Second Derivative $f''(x)$

x		-1.000	
$f(x)$	$\smile$	0.133	$\frown$
$f''(x)$	$+$	0	$-$

Inflection Points

There is an inflection point at $P_6 = (-1.000, 0.133)$

Graph



5. $f(x) = \dfrac{-108x + 36x^2 - 4x^3}{-30}$

Domain

The function $f(x)$ is a polynomial function. Therefore the domain is $D_f = \mathbb{R}$.

Symmetry

$f(-x) = \dfrac{-108(-x) + 36(-x)^2 - 4(-x)^3}{-12} = \dfrac{108x + 36x^2 + 4x^3}{-12}$

$f(-x) \neq f(x) \qquad f(-x) \neq -f(x)$

Therefore the function $f(x)$ is neither even nor odd function.

Zeros

$f(0) = 0$. Therefore $x = 0$ is a zero of $f(x)$ and $(x - 0)$ is a factor of $f(x)$. By factoring $f(x)$:

$f(x) = \dfrac{1}{-30}(x - 0)(-108 + 36x - 4x^2)$

The other zeros are given by: $-108 + 36x - 4x^2 = 0$. The discriminant of this quadratic equation is:

$\Delta = (36)^2 - 4(-4)(-108) = -432$

There are no more real zeros.

The zero(s) of the function $f(x)$ is(are): $x_1 = 0$

y-intercept

$y - int = f(0) = \dfrac{0}{-30} = 0.000$

Asymptotes

The function $f(x)$ is a polynomial function of degree 3. Therefore the function does not have any kind of asymptotes.

Critical Numbers

$f'(x) = \dfrac{-108 + 72x - 12x^2}{-30}$

Critical numbers are the solutions of the equation $f'(x) = 0$ or $-108 + 72x - 12x^2 = 0$ or $-18 + 12x - 2x^2 = 0$

There are two critical numbers given by:

$x = \dfrac{-12 \pm \sqrt{(0)}}{2(-2)}$

$x_4 = \dfrac{-12 + \sqrt{(0)}}{-4} = 3.000 \qquad y_4 = f(x_4) = 3.600$

$x_5 = \dfrac{-12 - \sqrt{(0)}}{-4} = 3.000 \qquad y_5 = f(x_5) = 3.600$

Sign Chart for the First Derivative $f'(x)$

x		3.000	
$f(x)$	$\uparrow$	3.600	$\uparrow$
$f'(x)$	+	0	+

Increasing and Decreasing Intervals

The function $f(x)$ is increasing over $(-\infty, \infty)$.

Maximum and Minimum Points

The function $f(x)$ has no minimum or maxinum points

Concavity Intervals

The second derivative of the function $f(x)$ is given by: $f''(x) = \dfrac{72 - 24x}{-30}$

The second derivative $f''(x)$ is zero when: $f''(x) = 0 \quad 72 - 24x = 0 \quad x_6 = 3 \quad y_6 = f(x_6) = 3.600$

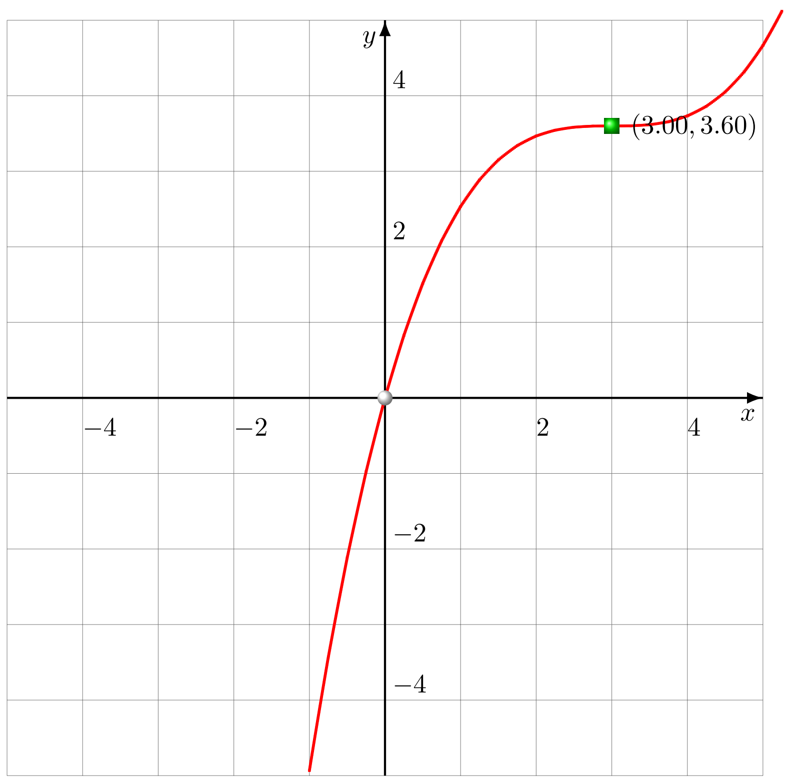
Sign Chart for the Second Derivative $f''(x)$

x		3.000	
$f(x)$	$\frown$	3.600	$\smile$
$f''(x)$	$-$	0	$+$

Inflection Points

There is an inflection point at $P_6 = (3.000, 3.600)$

Graph



6. $f(x) = \dfrac{12x^2 - 4x^3}{-24}$

Domain
The function $f(x)$ is a polynomial function. Therefore the domain is $D_f = \mathbb{R}$.

Symmetry
$f(-x) = \dfrac{12(-x)^2 - 4(-x)^3}{-12} = \dfrac{12x^2 + 4x^3}{-12}$

$f(-x) \neq f(x) \qquad f(-x) \neq -f(x)$

Therefore the function $f(x)$ is neither even nor odd function.

Zeros
$f(0) = 0$. Therefore $x = 0$ is a zero of $f(x)$ and $(x - 0)$ is a factor of $f(x)$. By factoring $f(x)$:

$f(x) = \dfrac{1}{-24}(x - 0)(12x - 4x^2)$

The other zeros are given by: $12x - 4x^2 = 0$. The discriminant of this quadratic equation is:

$\Delta = (12)^2 - 4(-4)(0) = 144$

There are two more real zeros given by:

$x = \dfrac{-12 \pm \sqrt{(144)}}{2(-4)}$

$x_2 = \dfrac{-12 + \sqrt{(144)}}{-8} = 0.000$

$x_3 = \dfrac{-12 - \sqrt{(144)}}{-8} = 3.000$

The zero(s) of the function $f(x)$ is(are): $x_1 = 0 \qquad x_2 = 0.000 \qquad x_3 = 3.000$

y-intercept
$y - int = f(0) = \dfrac{0}{-24} = 0.000$

Asymptotes
The function $f(x)$ is a polynomial function of degree 3. Therefore the function does not have any kind of asymptotes.

Critical Numbers
$f'(x) = \dfrac{24x - 12x^2}{-24}$

Critical numbers are the solutions of the equation $f'(x) = 0$ or $24x - 12x^2 = 0$ or $4x - 2x^2 = 0$

There are two critical numbers given by:

$x = \dfrac{-4 \pm \sqrt{(16)}}{2(-2)}$

$x_4 = \dfrac{-4 + \sqrt{(16)}}{-4} = 0.000 \qquad y_4 = f(x_4) = 0.000$

$x_5 = \dfrac{-4 - \sqrt{(16)}}{-4} = 2.000 \qquad y_5 = f(x_5) = -0.667$

Sign Chart for the First Derivative $f'(x)$

x		0.000		2.000	
$f(x)$	$\uparrow$	0.000	$\downarrow$	-0.667	$\uparrow$
$f'(x)$	$+$	0	$-$	0	$+$

Increasing and Decreasing Intervals

The function $f(x)$ is increasing over $(-\infty, 0.000)$ and over $(2.000, \infty)$ and is decreasing over $(0.000, 2.000)$.

Maximum and Minimum Points

The function $f(x)$ has a maximum point at $P_4(0.000, 0.000)$ and a minimum point at $P_5(2.000, -0.667)$.

Concavity Intervals

The second derivative of the function $f(x)$ is given by: $f''(x) = \dfrac{24 - 24x}{-24}$

The second derivative $f''(x)$ is zero when: $f''(x) = 0 \qquad 24 - 24x = 0 \qquad x_6 = 1 \qquad y_6 = f(x_6) = -0.333$

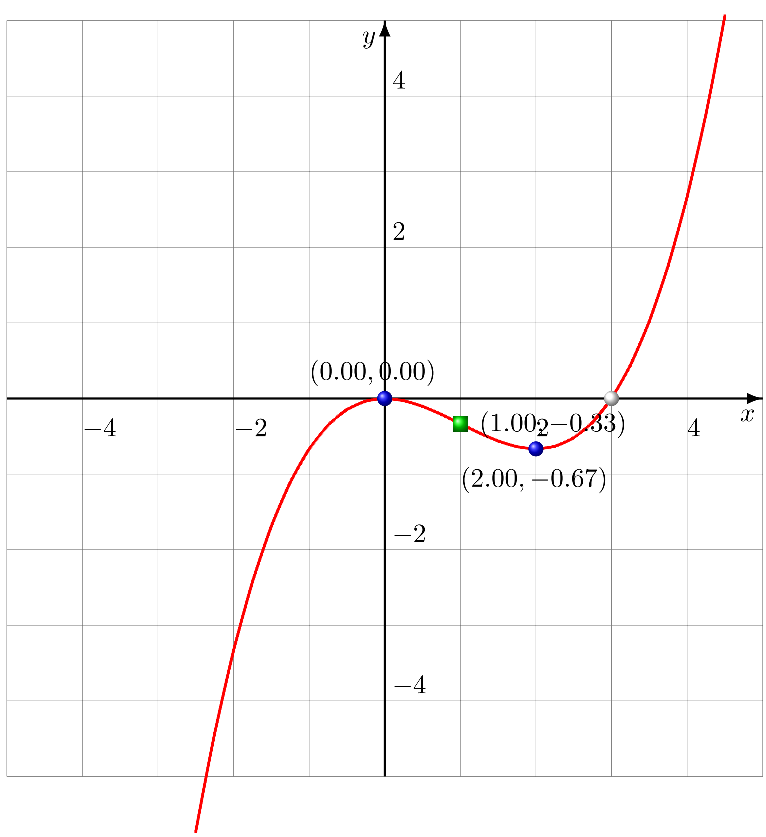
Sign Chart for the Second Derivative $f''(x)$

x		1.000	
$f(x)$	$\frown$	-0.333	$\smile$
$f''(x)$	$-$	0	$+$

Inflection Points

There is an inflection point at $P_6 = (1.000, -0.333)$

Graph



7. $f(x) = \dfrac{6x - 4x^3}{24}$

Domain
The function $f(x)$ is a polynomial function. Therefore the domain is $D_f = \mathbb{R}$.

Symmetry
$f(-x) = \dfrac{6(-x) - 4(-x)^3}{-12} = \dfrac{-6x + 4x^3}{-12}$

$f(-x) \neq f(x) \qquad f(-x) = -f(x)$

Therefore the function $f(x)$ is an odd function.

Zeros
$f(0) = 0$. Therefore $x = 0$ is a zero of $f(x)$ and $(x - 0)$ is a factor of $f(x)$. By factoring $f(x)$:

$f(x) = \dfrac{1}{24}(x - 0)(6 - 4x^2)$

The other zeros are given by: $6 - 4x^2 = 0$. The discriminant of this quadratic equation is:

$\Delta = (0)^2 - 4(-4)(6) = 96$

There are two more real zeros given by:

$x = \dfrac{0 \pm \sqrt{(96)}}{2(-4)}$

$x_2 = \dfrac{0 + \sqrt{(96)}}{-8} = -1.225$

$x_3 = \dfrac{0 - \sqrt{(96)}}{-8} = 1.225$

The zero(s) of the function $f(x)$ is(are): $x_1 = 0 \qquad x_2 = -1.225 \qquad x_3 = 1.225$

y-intercept
$y - int = f(0) = \dfrac{0}{24} = 0.000$

Asymptotes
The function $f(x)$ is a polynomial function of degree 3. Therefore the function does not have any kind of asymptotes.

Critical Numbers
$f'(x) = \dfrac{6 - 12x^2}{24}$

Critical numbers are the solutions of the equation $f'(x) = 0$ or $6 - 12x^2 = 0$ or $1 - 2x^2 = 0$

There are two critical numbers given by:

$x = \dfrac{0 \pm \sqrt{(8)}}{2(-2)}$

$x_4 = \dfrac{0 + \sqrt{(8)}}{-4} = -0.707 \qquad y_4 = f(x_4) = -0.118$

$x_5 = \dfrac{0 - \sqrt{(8)}}{-4} = 0.707 \qquad y_5 = f(x_5) = 0.118$

Sign Chart for the First Derivative $f'(x)$

x		-0.707		0.707	
$f(x)$	$\downarrow$	-0.118	$\uparrow$	0.118	$\downarrow$
$f'(x)$	$-$	0	$+$	0	$-$

Increasing and Decreasing Intervals

The function $f(x)$ is decreasing over $(-\infty, -0.707)$ and over $(0.707, \infty)$ and is increasing over $(-0.707, 0.707)$.

Maximum and Minimum Points

The function $f(x)$ has a minimum point at $P_4(-0.707, -0.118)$ and a maximum point at $P_5(0.707, 0.118)$.

Concavity Intervals

The second derivative of the function $f(x)$ is given by: $f''(x) = \dfrac{-24x}{24}$

The second derivative $f''(x)$ is zero when: $f''(x) = 0 \qquad -24x = 0 \qquad x_6 = 0 \qquad y_6 = f(x_6) = 0.000$

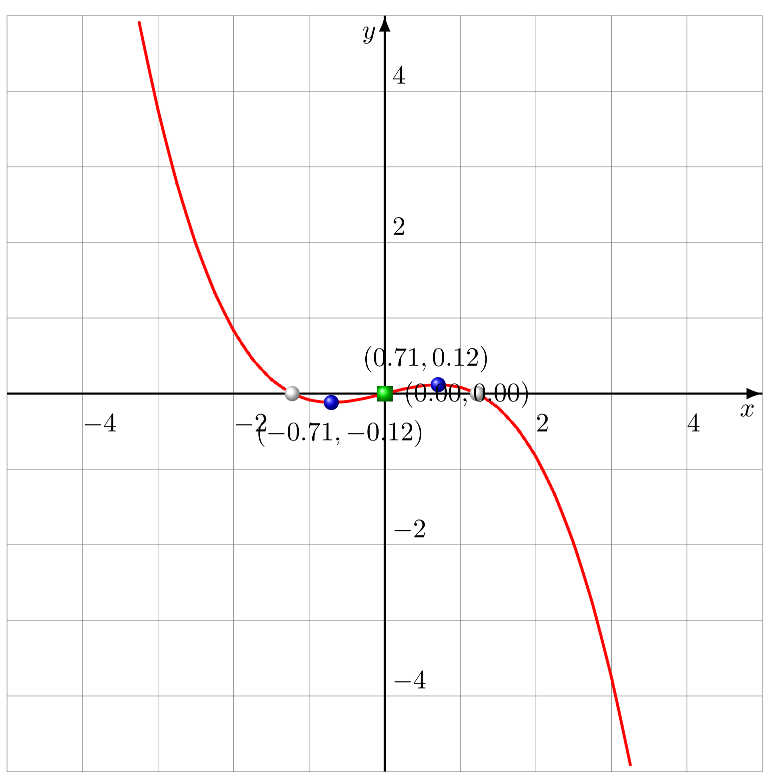
Sign Chart for the Second Derivative $f''(x)$

x		0.000	
$f(x)$	$\smile$	0.000	$\frown$
$f''(x)$	$+$	0	$-$

Inflection Points

There is an inflection point at $P_6 = (0.000, 0.000)$

Graph



8. $f(x) = \dfrac{14 + 6x - 6x^2 + 2x^3}{30}$

Domain
The function $f(x)$ is a polynomial function. Therefore the domain is $D_f = \mathbb{R}$.

Symmetry
$f(-x) = \dfrac{14 + 6(-x) - 6(-x)^2 + 2(-x)^3}{6} = \dfrac{14 - 6x - 6x^2 - 2x^3}{6}$

$f(-x) \neq f(x) \qquad f(-x) \neq -f(x)$

Therefore the function $f(x)$ is neither even nor odd function.

Zeros
$f(-1) = 0$. Therefore $x = -1$ is a zero of $f(x)$ and $(x + 1)$ is a factor of $f(x)$. By factoring $f(x)$:

$f(x) = \dfrac{1}{30}(x + 1)(14 - 8x + 2x^2)$

The other zeros are given by: $14 - 8x + 2x^2 = 0$. The discriminant of this quadratic equation is:

$\Delta = (-8)^2 - 4(2)(14) = -48$

There are no more real zeros.

The zero(s) of the function $f(x)$ is(are): $x_1 = -1$

y-intercept
$y - int = f(0) = \dfrac{14}{30} = 0.467$

Asymptotes
The function $f(x)$ is a polynomial function of degree 3. Therefore the function does not have any kind of asymptotes.

Critical Numbers
$f'(x) = \dfrac{6 - 12x + 6x^2}{30}$

Critical numbers are the solutions of the equation $f'(x) = 0$ or $6-12x+6x^2 = 0$ or $1-2x+x^2 = 0$

There are two critical numbers given by:

$x = \dfrac{2 \pm \sqrt{(0)}}{2(1)}$

$x_4 = \dfrac{2 - \sqrt{(0)}}{2} = 1.000 \qquad y_4 = f(x_4) = 0.533$

$x_5 = \dfrac{2 + \sqrt{(0)}}{2} = 1.000 \qquad y_5 = f(x_5) = 0.533$

Sign Chart for the First Derivative $f'(x)$

x		1.000	
$f(x)$	$\uparrow$	0.533	$\uparrow$
$f'(x)$	+	0	+

Increasing and Decreasing Intervals

The function $f(x)$ is increasing over $(-\infty, \infty)$.

Maximum and Minimum Points

The function $f(x)$ has no minimum or maxinum points

Concavity Intervals

The second derivative of the function $f(x)$ is given by: $f''(x) = \dfrac{-12+12x}{30}$

The second derivative $f''(x)$ is zero when: $f''(x) = 0 \qquad -12+12x = 0 \qquad x_6 = 1 \qquad y_6 = f(x_6) = 0.533$

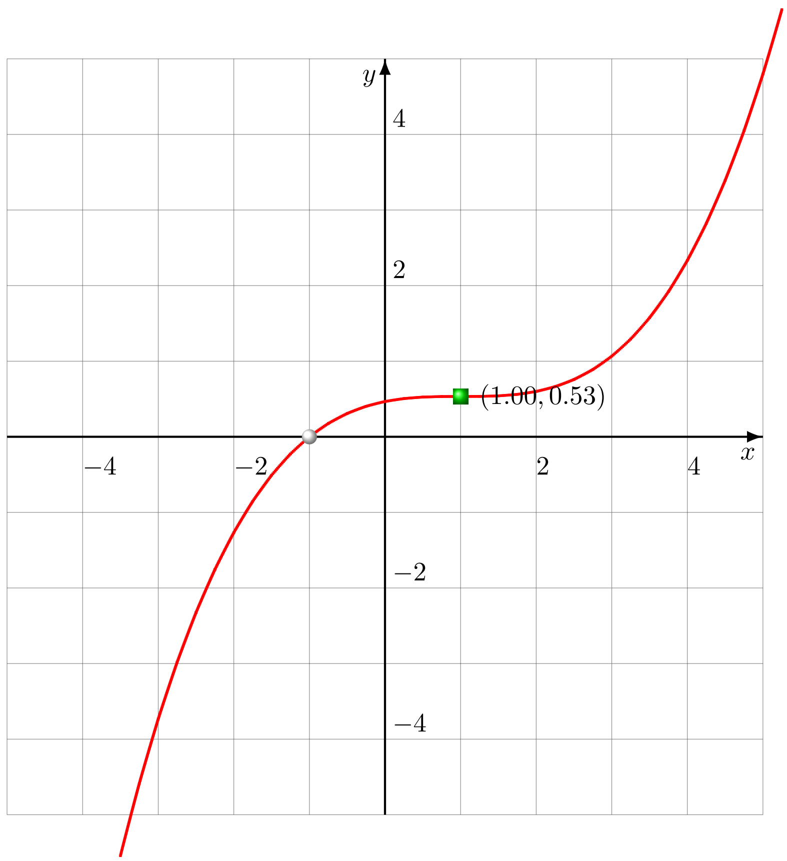
Sign Chart for the Second Derivative $f''(x)$

x		1.000	
$f(x)$	$\frown$	0.533	$\smile$
$f''(x)$	$-$	0	$+$

Inflection Points

There is an inflection point at $P_6 = (1.000, 0.533)$

Graph



9. $f(x) = \dfrac{4 - 18x + 12x^2 - 2x^3}{-18}$

Domain

The function $f(x)$ is a polynomial function. Therefore the domain is $D_f = \mathbb{R}$.

Symmetry

$f(-x) = \dfrac{4 - 18(-x) + 12(-x)^2 - 2(-x)^3}{-6} = \dfrac{4 + 18x + 12x^2 + 2x^3}{-6}$

$f(-x) \neq f(x) \qquad f(-x) \neq -f(x)$

Therefore the function $f(x)$ is neither even nor odd function.

Zeros

$f(2) = 0$. Therefore $x = 2$ is a zero of $f(x)$ and $(x - 2)$ is a factor of $f(x)$. By factoring $f(x)$:

$f(x) = \dfrac{1}{-18}(x - 2)(-2 + 8x - 2x^2)$

The other zeros are given by: $-2 + 8x - 2x^2 = 0$. The discriminant of this quadratic equation is:

$\Delta = (8)^2 - 4(-2)(-2) = 48$

There are two more real zeros given by:

$x = \dfrac{-8 \pm \sqrt{(48)}}{2(-2)}$

$x_2 = \dfrac{-8 + \sqrt{(48)}}{-4} = 0.268$

$x_3 = \dfrac{-8 - \sqrt{(48)}}{-4} = 3.732$

The zero(s) of the function $f(x)$ is(are): $x_1 = 2 \qquad x_2 = 0.268 \qquad x_3 = 3.732$

y-intercept

$y - int = f(0) = \dfrac{4}{-18} = -0.222$

Asymptotes

The function $f(x)$ is a polynomial function of degree 3. Therefore the function does not have any kind of asymptotes.

Critical Numbers

$f'(x) = \dfrac{-18 + 24x - 6x^2}{-18}$

Critical numbers are the solutions of the equation $f'(x) = 0$ or $-18 + 24x - 6x^2 = 0$ or $-3 + 4x - x^2 = 0$

There are two critical numbers given by:

$x = \dfrac{-4 \pm \sqrt{(4)}}{2(-1)}$

$x_4 = \dfrac{-4 + \sqrt{(4)}}{-2} = 1.000 \qquad y_4 = f(x_4) = 0.222$

$x_5 = \dfrac{-4 - \sqrt{(4)}}{-2} = 3.000 \qquad y_5 = f(x_5) = -0.222$

Sign Chart for the First Derivative $f'(x)$

x		1.000		3.000	
$f(x)$	$\uparrow$	0.222	$\downarrow$	-0.222	$\uparrow$
$f'(x)$	$+$	0	$-$	0	$+$

Increasing and Decreasing Intervals

The function $f(x)$ is increasing over $(-\infty, 1.000)$ and over $(3.000, \infty)$ and is decreasing over $(1.000, 3.000)$.

Maximum and Minimum Points

The function $f(x)$ has a maximum point at $P_4(1.000, 0.222)$ and a minimum point at $P_5(3.000, -0.222)$.

Concavity Intervals

The second derivative of the function $f(x)$ is given by: $f''(x) = \dfrac{24 - 12x}{-18}$

The second derivative $f''(x)$ is zero when: $f''(x) = 0 \qquad 24 - 12x = 0 \qquad x_6 = 2 \qquad y_6 = f(x_6) = 0.000$

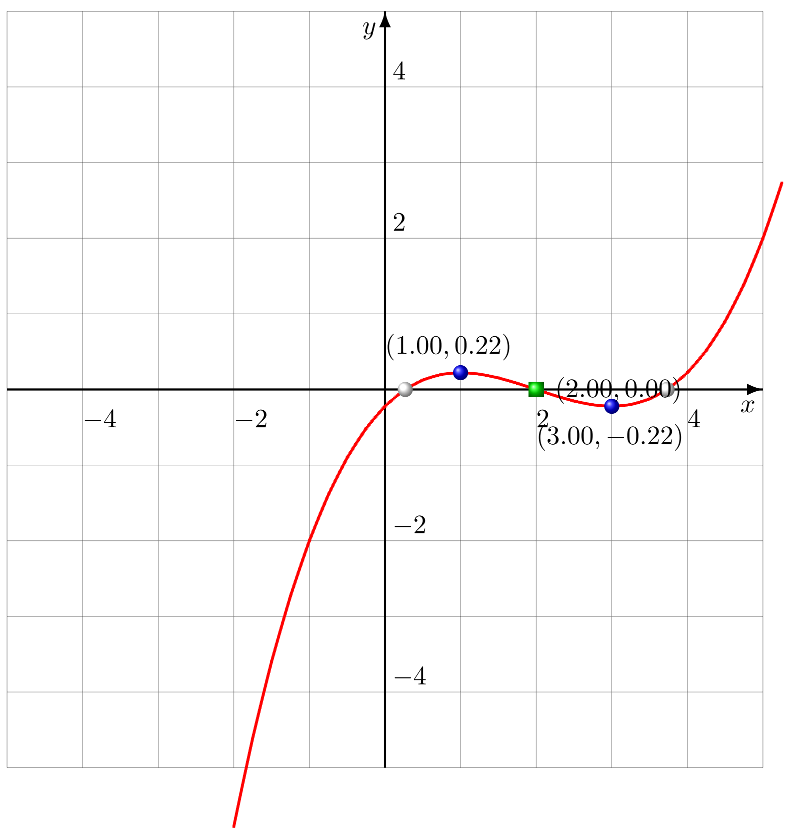
Sign Chart for the Second Derivative $f''(x)$

x		2.000	
$f(x)$	$\frown$	0.000	$\smile$
$f''(x)$	$-$	0	$+$

Inflection Points

There is an inflection point at $P_6 = (2.000, 0.000)$

Graph



10. $f(x) = \dfrac{12x + 12x^2 + 2x^3}{-24}$

Domain
The function $f(x)$ is a polynomial function. Therefore the domain is $D_f = \mathbb{R}$.

Symmetry
$f(-x) = \dfrac{12(-x) + 12(-x)^2 + 2(-x)^3}{6} = \dfrac{-12x + 12x^2 - 2x^3}{6}$

$f(-x) \neq f(x) \qquad f(-x) \neq -f(x)$

Therefore the function $f(x)$ is neither even nor odd function.

Zeros
$f(0) = 0$. Therefore $x = 0$ is a zero of $f(x)$ and $(x - 0)$ is a factor of $f(x)$. By factoring $f(x)$:

$f(x) = \dfrac{1}{-24}(x - 0)(12 + 12x + 2x^2)$

The other zeros are given by: $12 + 12x + 2x^2 = 0$. The discriminant of this quadratic equation is:

$\Delta = (12)^2 - 4(2)(12) = 48$

There are two more real zeros given by:

$x = \dfrac{-12 \pm \sqrt{(48)}}{2(2)}$

$x_2 = \dfrac{-12 - \sqrt{(48)}}{4} = -4.732$

$x_3 = \dfrac{-12 + \sqrt{(48)}}{4} = -1.268$

The zero(s) of the function $f(x)$ is(are): $x_1 = 0 \qquad x_2 = -4.732 \qquad x_3 = -1.268$

y-intercept
$y - int = f(0) = \dfrac{0}{-24} = 0.000$

Asymptotes
The function $f(x)$ is a polynomial function of degree 3. Therefore the function does not have any kind of asymptotes.

Critical Numbers
$f'(x) = \dfrac{12 + 24x + 6x^2}{-24}$

Critical numbers are the solutions of the equation $f'(x) = 0$ or $12+24x+6x^2 = 0$ or $2+4x+x^2 = 0$

There are two critical numbers given by:

$x = \dfrac{-4 \pm \sqrt{(8)}}{2(1)}$

$x_4 = \dfrac{-4 - \sqrt{(8)}}{2} = -3.414 \qquad y_4 = f(x_4) = -0.805$

$x_5 = \dfrac{-4 + \sqrt{(8)}}{2} = -0.586 \qquad y_5 = f(x_5) = 0.138$

Sign Chart for the First Derivative $f'(x)$

x		-3.414		-0.586	
$f(x)$	$\downarrow$	-0.805	$\uparrow$	0.138	$\downarrow$
$f'(x)$	$-$	0	$+$	0	$-$

Increasing and Decreasing Intervals

The function $f(x)$ is decreasing over $(-\infty, -3.414)$ and over $(-0.586, \infty)$ and is increasing over $(-3.414, -0.586)$.

Maximum and Minimum Points

The function $f(x)$ has a minimum point at $P_4(-3.414, -0.805)$ and a maximum point at $P_5(-0.586, 0.138)$.

Concavity Intervals

The second derivative of the function $f(x)$ is given by: $f''(x) = \dfrac{24 + 12x}{-24}$

The second derivative $f''(x)$ is zero when: $f''(x) = 0 \quad 24 + 12x = 0 \quad x_6 = -2 \quad y_6 = f(x_6) = -0.333$

Sign Chart for the Second Derivative $f''(x)$

x		-2.000	
$f(x)$	$\smile$	-0.333	$\frown$
$f''(x)$	$+$	0	$-$

Inflection Points

There is an inflection point at $P_6 = (-2.000, -0.333)$

Graph