There are important features of cubic functions and their graphs: $f(x)=x^3$ Page 93

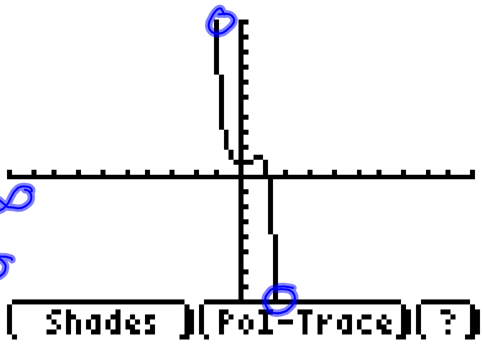
- All cubic functions have a **domain** consisting of all real numbers and a **range** consisting of all real numbers. Domain: $\mathbb{R}$ Range: $\mathbb{R}$
- The graphs of cubic functions have **turning points** where the curve changes from increasing to decreasing (**relative or local maximum**) or from decreasing to increasing (**relative or local minimum**).
- A cubic function can have zero or two turning points.
- Cubic functions also always have one **point of inflection** where the function changes curvature, from hill to bowl or from bowl to hill.
- The *x*-intercept is the point(s) where the graph crosses the *x*-axis. The *y*-intercept is the point where the graph crosses the *y*-axis. There can be one, two, or three *x*-intercepts but only one *y*-intercept on the graph of a cubic function.

leading coefficient: The number in front of the variable with highest degree.

Graph:

left	Right
y_1 $f(x)=x^4+2x+3$ both arrows point up	$f(x)=2x^3-6x^2+x-1$ arrows point in different direction
y_2 $f(x)=-x^2+4$ both arrows point down	$f(x)=-3x^5+3x^4+1$ arrows point in diff. direction

End Behavior:



as $x \to -\infty$, $f(x) \to +\infty$

as $x \to +\infty$, $f(x) \to -\infty$

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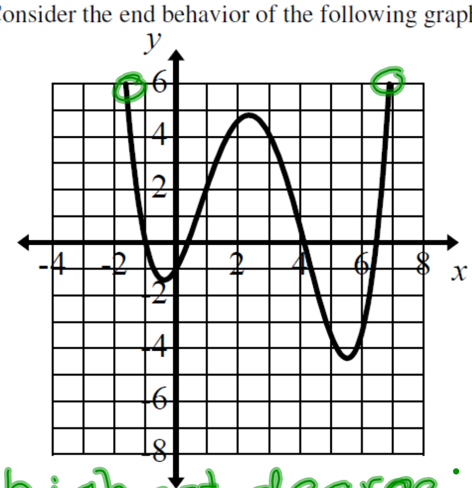
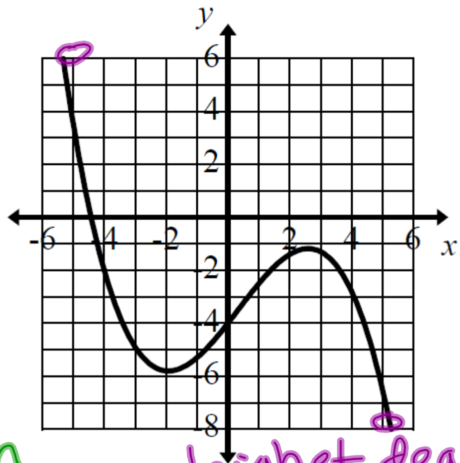
8) Consider the end behavior of the following graphs:





highest degree: even

as $x \to -\infty$, $f(x) \to +\infty$

as $x \to +\infty$, $f(x) \to +\infty$

highet degree: odd

as $x \to -\infty$, $f(x) \to +\infty$

as $x \to +\infty$, $f(x) \to -\infty$

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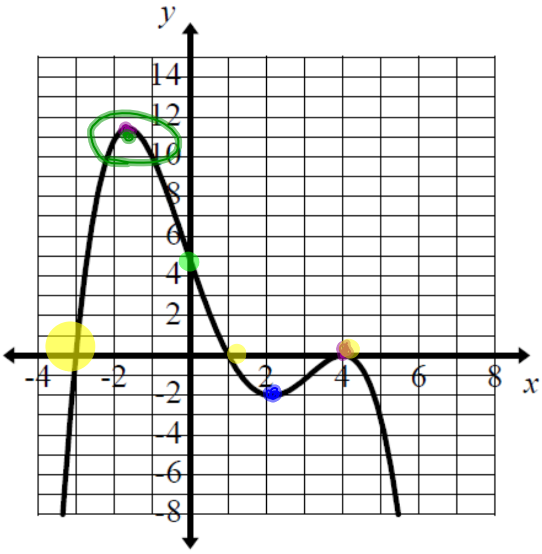
9) Consider the graph of the function $f(x) = -0.1x^4 + 0.6x^3 + 0.3x^2 - 5.6x + 4.8$. Identify the following:



Domain: $\mathbb{R}$

Range: $y \le 11.42$

local maximum: $(-1.64, 11.42)$ & $(4, 0)$

local minimum: $(2.14, -2.03)$

point of inflection:

x-intercept(s): $x = 1, -3, 4$ $x=1, x=-3, x=4$ $(1,0)$ $(-3,0)$ $(4,0)$

y-intercept: $y = 4.8$

Degree: 4

Lead Coefficient: -0.1

End Behavior: $x \to -\infty$ $f(x) \to -\infty$
$x \to +\infty$ $f(x) \to -\infty$

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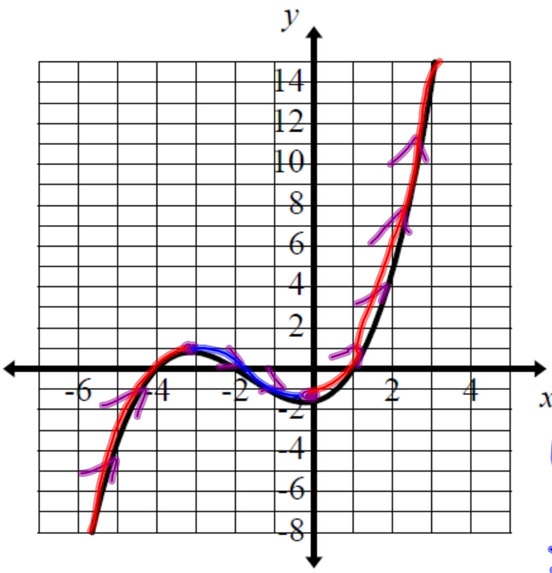
10) Consider the graph of the function $f(x) = 0.2x^3 + x^2 + 0.4x - 1.6$ Identify the following:



Domain: $\mathbb{R}$

Range: $\mathbb{R}$

local maximum: $(-3.12, 0.81)$

local minimum: $(-0.21, -1.64)$

point of inflection:

x-intercept(s): $x = 1, -2, -4$

y-intercept: $y = -1.6$

Intervals of increasing
$x < -3.12, x > -0.21$

intervals of decreasing:
$-3.12 < x < -.21$