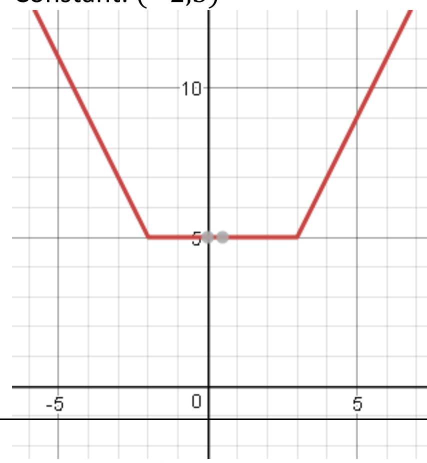
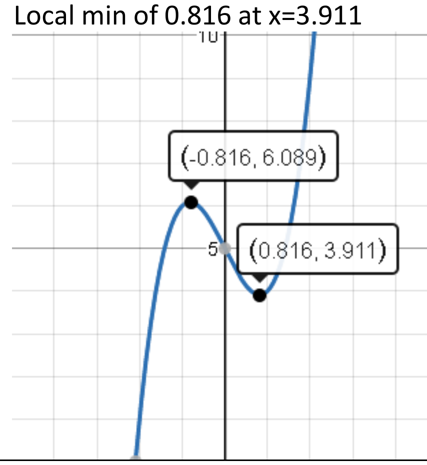
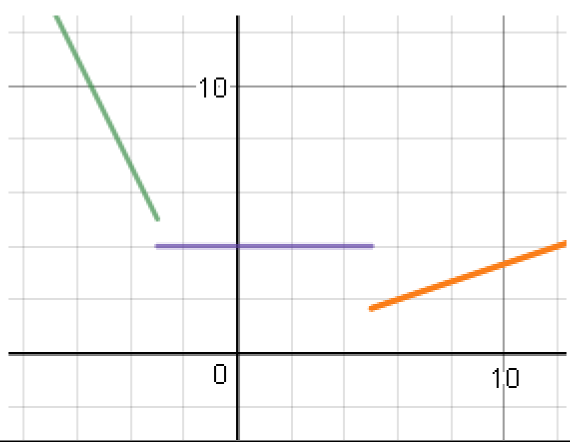
Problems	Solutions
Graph $f(x) = \lvert x-3\rvert + \lvert x+2\rvert$ on your calculator. Sketch the graph and state intervals of increase, decrease, and consistency in interval notation.	Increase: $(-\infty,-2] \cup [3,\infty)$]Decrease: $(-\infty,-2]$ Constant: $(-2,3)$ 
Graph $f(x) = x^3 - 2x + 5$ on your calculator. Sketch the graph and state the local maxima and minima.	Local max of 6.089 at x=-0.816 Local min of 0.816 at x=3.911 
Graph $f(x) = \begin{cases} -2x-1, & x < -3 \\ 4, & -3 \le x \le 5 \\ \frac{1}{3}x, & x > 5 \end{cases}$ Sketch the graph and state the intervals of increase and decrease.	Increase: $(5,\infty)$ Decrease: $(-\infty,-3)$ Constant: (-3,5) 

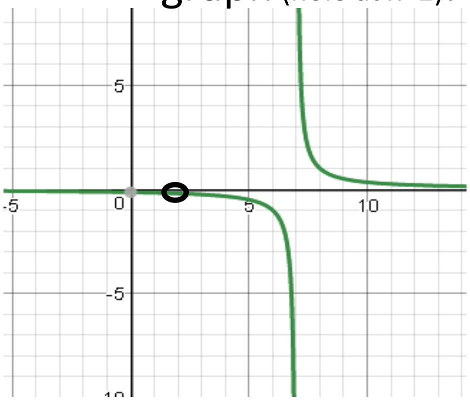
Is $f(x) = x^3 - 2x + 5$ continuous over all Reals? If not, list the points of discontinuity and classify them.	Yes, this function is continuous
Is $f(x) = \dfrac{x^2 - 6x + 5}{(x-1)(x+3)}$ continuous over all reals? If not, list the points of discontinuity and classify them.	No, this function is not continuous. It has a removable discontinuity at $x = 1$ and an infinite discontinuity at $x = -3$
Is $f(x) = \begin{cases} x, & x \neq 0 \\ 3, & x = 0 \end{cases}$ continuous over all reals? If not, list the points of discontinuity and classify them.	**No, this function is not continuous. It has a removable discontinuity at $\boldsymbol{x = 0}$.**

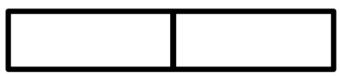
Describe the end behavior of $f(x) = -x^3 - 2x + 6$ using limit notation.	$\lim_{x \to \infty} f(x) = -\infty$ $\lim_{x \to -\infty} f(x) = \infty$
Describe the end behavior of $f(x) = \frac{(x-3)}{(x+5)^2}$ using limit notation.	$\lim_{x \to \infty} f(x) = 0$ $\lim_{x \to -\infty} f(x) = 0$ Hint: Think about the horizontal asymptote
Describe the end behavior of $f(x) = \frac{4x^3 - 2x + 1}{2x^3 + x}$ using limit notation.	$\lim_{x \to \infty} f(x) = 2$ $\lim_{x \to -\infty} f(x) = 2$

Describe the end behavior of $f(x) = 6x + 1$ using limit notation.	$\lim_{x \to \infty} f(x) = \infty$ $\lim_{x \to -\infty} f(x) = -\infty$
Find the x and y intercepts: $f(x) = \frac{(x+4)}{(x-2)(x+1)}$	X-intercept(s): (-4,0) y-intercept(s): (0,-2)
Find the x and y intercepts: $f(x) = \frac{3x^3 - 15x^2 + 12x}{x(x-4)(x+1)}$	$f(x) = \frac{3x(x-4)(x-1)}{x(x-4)(x+1)}$ X-intercept(s): (1,0) y-intercept(s): None (hole at 0)

Find the x and y intercepts: $f(x) = \frac{x^2(x+9)}{(x-2)(x+9)}$	X-intercept(s): (0,0) y-intercept(s): (0,0)
Find the HA and VA: $f(x) = \frac{(x+4)}{(x-2)(x+1)}$	HA: $y = 0$ VA: $x = 2, x = -1$
Find the HA and VA: $f(x) = \frac{3x^3 - 15x^2 + 12x}{x(x-4)(x+1)}$	$f(x) = \frac{3x(x-4)(x-1)}{x(x-4)(x+1)}$ HA: $y = 3$ VA: $x = -1$

Find the HA and VA: $f(x) = \frac{x^2(x+9)}{(x-2)(x+9)}$	HA: SLANT $y = x + 2$ (use polynomial division to do $x^{\ 2} \div (x-2)$) VA: $x = 2$
Find the holes: $f(x) = \frac{(x+4)}{(x-2)(x+1)}$	No holes because there are no matching factors in the numerator and denominator
Find the holes: $f(x) = \frac{3x^3 - 15x^2 + 12x}{x(x-4)(x+1)}$	$f(x) = \frac{3x(x-4)(x-1)}{x(x-4)(x+1)}$ **Holes: x=4, x=0**

Write the equation of the graph (hole at x=2): 	$$f(x) = \frac{(x-2)}{(x-2)(x-7)}$$
Write the equation of the graph that has a hole at x=9, vertical asymptote at x=-5, and horizontal asymptote at y=3.	$$f(x) = \frac{3x(x-9)}{(x+5)(x-9)}$$ **(or other solutions as long as top and bottom degree match)**
Write the equation of the graph that has no holes, vertical asymptote at x=2 and a y-intercept of (0,5).	$$f(x) = \frac{-10}{(x-2)}$$

Emily is building a fence to keep her strawberries safe. She has 40feet of fencing. The fence looks like below. What equation would you use to maximize the area of the garden? 	$\boldsymbol{Perimeter = 3w + 2L}$ $\boldsymbol{40 = 3w + 2L}$ **Solve for L or W** $\boldsymbol{L = \frac{40 - 3w}{2}}$ **Maximize area:** $\boldsymbol{Area = LW}$ $\boldsymbol{Area = \left(\frac{40 - 3w}{2}\right)W}$
The dimensions of a box are given below. What value of x maximizes the volume of the box? Length: 10-2x Width: 12-2x Height: x	$\boldsymbol{f(x) = (10 - 2x)(12 - 2x)x}$ **Max of 76.77 at x = 1.81** $\boldsymbol{x = 1.81}$ **Maximizes the volume.**
The dimensions of a box are given below. What value of x maximizes makes the volume 72? Length: 10-2x Width: 12-2x Height: x	$\boldsymbol{f(x) = (10 - 2x)(12 - 2x)x}$ **Graph and find when y=72.** **The value is x=3.**

Find the average rate of change of $f(x) = 4x - 1$ from $x = 3\ to\ x = 7$	$$\frac{f(7) - f(3)}{7 - 3} = \frac{27 - 11}{4} = 4$$
Find the average rate of change of $f(x) = 4x^2 - 2x + 6$ from $x = -2\ to\ x = 4$	$$\frac{f(4) - f(-2)}{4 - (-2)} = \frac{62 - 26}{6} = 6$$
Find the average rate of change of $f(x) = 7x^4 - 2$ from $x = a\ to\ x = c$	$$\frac{f(c) - f(a)}{c - a} = \frac{7c^4 - 2 - (7a^4 - 2)}{c - a} = \frac{7(c^4 - a^4)}{c - a} = \frac{7(c - a)(c + a)(c^2 + a^2)}{c - a} = 7(c + a)(c^2 + a^2)$$

Find the average rate of change of $f(x) = 8$ from $x = -3\ to\ x = 4$	$\frac{\boldsymbol{f(4) - f(-3)}}{\boldsymbol{4 - (-3)}} = \frac{\mathbf{8 - 8}}{\mathbf{7}} = \mathbf{0}$
Find the inverse of $f(x) = 4x - 1$	$\boldsymbol{x = 4y - 1}$ $\boldsymbol{x + 1 = 4y}$ $\boldsymbol{y = \frac{x + 1}{4}}$ $\boldsymbol{f^{-1}(x) = \frac{x + 1}{4}}$
Find the inverse of $f(x) = \sqrt{3x - 2}$	$\boldsymbol{x} = \sqrt{3y - 2}$ $\boldsymbol{x^2 = 3y - 2}$ $\boldsymbol{x^2 + 2 = 3y}$ $\boldsymbol{f^{-1}(x) = \frac{x^2 + 2}{3}}$

Find the inverse of $f(x) = \frac{4x+2}{3x-1}$	$\boldsymbol{x} = \frac{4y+2}{3y-1}$ $\mathbf{3xy - x = 4y + 2}$ $\mathbf{3xy - 4y = 2 + x}$ $\mathbf{y(3x - 4) = 2 + x}$ $\mathbf{f^{-1}(x) = \frac{2+x}{3x-4}}$
Find the inverse of $f(x) = 2x - 9$	$\boldsymbol{x} = 2y - 9$ $\mathbf{x + 9 = 2y}$ $\mathbf{f^{-1}(x) = \frac{x+9}{2}}$