Graphing Functions and Solving Equations in Sage Assignment

Author	`Aaron Tresham`
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Graphing Functions and Solving Equations in Sage Assignment

Question 0

Watch the lecture video here.

Did you watch the video? [Type yes or no.]

Question 1

Consider the function $F(x) = \dfrac{x^3 + x^2 + x}{x^2 - x - 2}$.

[Don't forget parentheses around the numerator and denominator.]

Part a

Graph this function in Sage with $-5 \leq x \leq 5$. Your graph should not be very nice. The problem is the vertical asymptotes.

Part b

Produce a new graph with $-5 \leq x \leq 5$ and add $\text{ymin} = -20$ and $\text{ymax} = 20$. You should see a much nicer graph. Remember, the vertical lines at $x = -1$ and $x = 2$ are not actually part of the graph of the function.

Question 2

Consider the function $h(x) = 0.01x^3 - x^2 + 5$.

[Make sure you type h correctly, especially the 0.01 at the front]

Part a

Graph this function using the default window. Notice that no roots (zeros, x-intercepts) are visible. We know from precalc that a cubic polynomial has at least one and at most three roots.

Part b

Create a new plot of h with $-10 \leq x \leq 10$. You should see two roots.

Part c

If you remember end behavior of polynomials, then you know that the y-values should go up as the x-values get bigger. On the previous graph, the y-values are heading down. That means this curve needs to turn around eventually, and when it does it will have to cross the x-axis again. Now try to graph again with $-10 \leq x \leq 100$. This time, you should see the third root (but the first two may be hard to see now).

Question 3

Graph $f(x) = x^3$ and $g(x) = -2(x+1)^3 + 4$ on the same axes with $-5 \leq x \leq 5$ and $-10 \leq y \leq 10$.

Use two different colors and two different line styles.

Question 4

Use the solve command to solve for x: $x^3 - 4x^2 + x + 6 = 0$

Question 5

Use the solve command to solve for m: $\dfrac{m}{m+a} + \dfrac{1}{m^2+b} = 1$

[Don't forget parentheses around the denominators, and declare variables.]

Question 6

Consider the equation $x^x = 7$.

Part a

Plot this equation with $0 < x < 3$ (remember to use two equal signs when typing the equation).

[Your graph should have only one curve.]

Part b

Adjust the plot window (zoom in) to approximate to two decimal places the x-intercept of the graph (this is the solution of the equation).

Part c

Use find_root to solve for x.

Question 7

Part a

Graph both sides of the equation $e^x = x^3$ and adjust the window until you can clearly see two points of intersection.

[Your graph should have two curves.]

Note: e is not a variable, it is a constant ($e \approx 2.718$). **Never declare e.**

Part b

Solve this equation for x using find_root (remember, there are two real solutions).

Question 8

Solve the inequality $x^3 - 3x > 4x^2 + 2$ using the solve command.