Problem statement The numbers R_1, R_2, R_3, and R satisfy the following equation:

$$\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{R}.$$

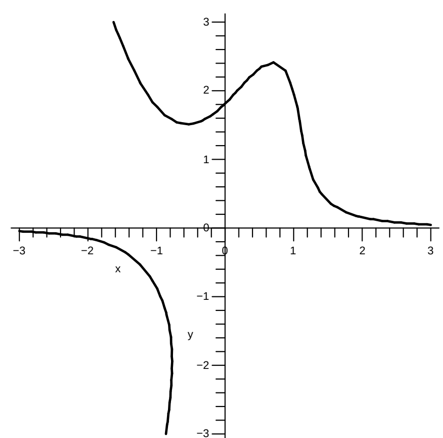
(Physics and engineering students may recognize this as a formula for the total resistance, R, of a circuit composed of three resistances R_1, R_2, and R_3 connected in parallel.)

a) If $R_1 = 1$ and $R_2 = 2$ and $R_3 = 3$, compute R exactly.

b) If both R_1 and R_3 are held constant, and R_2 is increased by .05, what is the approximate change in R?

c) If both R_1 and R_2 are held constant, and R_3 is increased by .05, what is the approximate change in R?

Problem statement To the right is part of the graph of $5x^3y - 3xy^2 + y^3 = 6$. Verify that $(1, 2)$ is a point on this curve. There's a nearby point on the curve whose coordinates are $(1.07, u)$. What is an approximate value for u? There's a nearby point on the curve whose coordinates are $(.98, v)$. What is an approximate value for v? There's a nearby point on the curve whose coordinates are $(w, 2.04)$. What is an approximate value for w? Is the graph consistent with your answers?



Problem statement

Using linear approximation, show that for any real number k,

$$(1 + x)^k \approx 1 + kx$$

for small x. Use this to estimate $1.02^{\sqrt{3}}$ and 1.02^{π}.

Problem statement For any constant c, define the function f_c with the formula $f_c(x) = x^3 + 2x^2 + cx$.

a) Graph $y = f_c(x)$ for these values of the parameter c: $c = -1, 0, 1, 2, 3, 4$. What are the similarities and differences among the graphs, and how do the graphs change as the parameter increases?

b) For what values of the parameter c will f_c have one local maximum and one local minimum? Use calculus. As c increases, what happens to the distance between the local maximum and the local minimum?

c) For what values of the parameter c will f_c have no local maximum or local minimum? Use calculus.

d) Are there any values of the parameter c for which f_c will have exactly one horizontal tangent line?