Directions: For each question for which you wish to earn-back points, correct your original mistake, explain what you did wrong, and then do the extra problems associated to that question. Work must be neat, legible, and complete (incomplete work will not earn back points). If you have any questions what that means, please come and ask me.

1. The number of hours it takes for a block of ice to melt (at a constant pressure) varies inversely with the temperature. If it takes a 1-in. by 1-in. by 1-in. cube of ice three hours to melt at a pressure of 0.96 atm and 65 degrees Fahrenheit, then how long will it take the same size cube to melt at a pressure of 0.96 atm and a temperature of 100 degree Fahrenheit (please round to the nearest minute).

(a) What happens if the pressure is 1.92 atm?
(b) Redo the problem but replace "two hours" with "three hours"
(c) Redo the problem but replace "100 degrees Fahrenheit" with "75 degrees Fahrenheit"
(d) Which values matter and which are, essentially, red herrings?
(e) Define "constant of variance". What is it for this problem?

2. Create a rational function with the following properties:

(a) Horizontal Asymptote at \( y = 0 \)
(b) Degree of the denominator is 5
(c) A vertical asymptote at \( x = 3 \) with similar behavior on both sides (either both go to \( \infty \) or both to \( -\infty \))
(d) A zero with even multiplicity at \( x = 1 \)
(e) (you may add any other features you like)

Redo with the following changes:

(a) As original, but with horizontal asymptote at \( y = 3 \)
(b) As original, but a zero with odd multiplicity at \( x = 2 \)
(c) As original, but a vertical asymptote at \( x = 3 \) with different behavior on both sides
(d) As original, but with a slant asymptote of \( y = 2x + 3 \)

3. Use synthetic division to divide \( f(x) = 2x^5 + 10x^2 - 5x + 2 \) by \( x + 2 \):

(a) Show your work here:
(b) Put the quotient here:
(c) Put the remainder here:
(d) What is \( f(-2) \)?
(e) Fill in the blank: $f(x) = \frac{x^2}{x+2}$.

For any subproblems on this question redo with:

(a) As original, replace $x + 2$ with $x - 3$ (and $f(-2)$ with $f(3)$).
(b) As original, replace $x + 2$ with $x - 5$ (and $f(-2)$ with $f(5)$).
(c) As original, but replace $f(x) = 2x^5 + 10x^2 - 5x + 2$ with $f(x) = 3x^5 - 10x^2 + 5x - 2$
(d) As original, but replace $f(x) = 2x^5 + 10x^2 - 5x + 2$ with $f(x) = 7x^6 - 10x^2 + 5x$
(e) As original, but replace $f(x) = 2x^5 + 10x^2 - 5x + 2$ with $f(x) = 3x^5 - 10x^3 + 4x$

4. Find the following for the rational function $h(x) = \frac{(2x-3)^2(x+3)^3}{7(x^3-4x^2)}$.

(a) Sketch the graph using the graph paper on the next page:
(b) Zeros (with multiplicities) of $h(x)$:
(c) Vertical Asymptotes (use limit language):
(d) End Behavior (use limit language):
(e) Intervals on which function is positive
(f) Intervals on which function is decreasing (round to one decimal place if necessary)
(g) Domain of the function
(h) Boundedness
(i) The sign chart

For any subproblems on this question redo with the following:

(a) Replace $h(x) = \frac{(2x-3)^2(x+3)^3}{7(x^3-4x^2)}$ with $h(x) = \frac{(2x-3)^2(x+4)^3}{7(x^3-5x^4)}$
(b) Replace $h(x) = \frac{(2x-3)^2(x+3)^3}{7(x^3-4x^2)}$ with $h(x) = \frac{(2x-3)^2(x+4)^3}{7(x^3-5x^4)}$
(c) Replace $h(x) = \frac{(2x-3)^2(x+3)^3}{7(x^3-4x^2)}$ with $h(x) = \frac{(2x-3)^2(x+4)^3}{7(x^6-5x^4)}$

5. Determine the following for the quadratic $g(x) = x^2 - 2x + 3$:

(a) Relative extrema. Express as a point and indicate if it is a relative minimum or a relative maximum:
(b) Use limit language to describe the end behavior:
(c) Express the quadratic in vertex form:

For any subproblems on this question redo with the following:

(a) Replace $g(x) = x^2 - 2x + 3$ with $g(x) = x^2 - 2x + 4$
(b) Replace $g(x) = x^2 - 2x + 3$ with $g(x) = x^2 - 2x - 3$
(c) Replace $g(x) = x^2 - 2x + 3$ with $g(x) = 3x^2 - 2x + 4$
(d) Replace \( g(x) = x^2 - 2x + 3 \) with \( g(x) = -x^2 - 2x - 2 \)

6. Label the function with the letter of its proper graph. Note: I have labelled \( f(x) \). To earn back points on the problem on this page figure out the correct answers AND label the point \((1,1)\) on the graph for \( B \). Then on each of the other graphs highlight the point to which \((1,1)\) is carried by the graphical transformations and use a ruler to lightly draw a horizontal and vertical line through this point. So, for example, if the graph of \( f(x) \) were to undergo a vertical stretch by a factor of 2, then the point \((1,1)\) would become the point \((2,1)\).
\[ f(x) \]

\[ f(x) - 3 \]

\[ 3 - f(x) \]

\[ 2f(x) \]

\[ f(2x) \]

\[ f(3 - x) \]

\[ \frac{1}{2} f(x) \]
7. Solve the inequality \( \frac{(x+2)^3(x-3)^2}{(x+3)^2\sqrt{x-1}} \geq 0 \). You MUST show your work and solving graphically does not count.

(a) Repeat but solve \( \frac{(x+2)^3(x-3)^2}{(x+3)^2\sqrt{x-1}} \leq 0 \)

(b) Repeat but solve \( \frac{(x+2)^3(x-3)^2}{(x+3)^2\sqrt{x+1}} \geq 0 \)

(c) Repeat but solve \( \frac{(x+2)^3(x-3)^2}{(x+3)^2(x+1)^4} \geq 0 \)

(d) Repeat but solve \( \frac{(x+2)^3(x-3)}{(x+3)^4(x+1)^2} \geq 0 \)