Reading Questions 9.5 Name_________________________
(32 pts) Due Date: _______________________

(1) 1. The short run behavior of a *polynomial* (from Section **9.3**) is found by examining its factored form. How is the short run behavior of a *rational function* (from Section **9.5**) found?
   A. examining the ratio of its leading terms
   B. examining its factored form as well
   C. observing the behavior as $x \to \infty$ or $x \to -\infty$

(1) 2. Since a fraction $\frac{p}{q}$ can be written as $\frac{p}{q} = p \cdot \frac{1}{q}$, we can confidently find when the fraction $\frac{p}{q}$ is 0. How?
   Tip: Read the last sentence on the first paragraph of **The Zeros and Vertical Asymptotes of a Rational Function**.
   It is so important, it should be written on your heart. Since that could get messy,
   simply rewrite it here instead, word for word. It is a key concept to this section and the answer to this question.

(1) 3. Explain why a fraction such as $\frac{1}{x}$ is large whenever its denominator is small. Tip: use examples.

(1) 4. Because a fraction is large whenever its denominator is small, we can find the vertical asymptote of a rational function by
   A. setting its numerator equal to 0.
   B. setting its denominator equal to 0.
   C. setting the value of *x* equal to 0 and solving for *y*.
   D. observing the behavior as $x \to \infty$ or $x \to -\infty$

5. a. Because of your answer to previous question, $r(x) = \frac{25}{(x+2)(x-3)^2}$ has two vertical asymptotes,
(3) namely *x* = _____ and *x* = _____, and no zeros since ____.
   By the way, you answered a similar question on a previous assignment when you examined Example **4** of Section **2.2**.

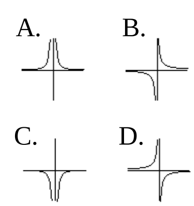
(2) b. Near the value *x* = −2 the graph of *r*(*x*) looks like the function $y = \frac{1}{\square}$,

(2) which is a ____________ shift of the power function $y = \frac{1}{x}$ ______________ by ________ units.
   {vertical, horizontal} {up, down, left, right} how many?

(3) c. Near the value *x* = 3 the graph of *r*(*x*) looks like the function $y = \frac{\square}{\square}$,

(2) which is a ____________ shift of the power function $y = \frac{5}{x^2}$ ______________ by ________ units.
   {vertical, horizontal} {up, down, left, right} how many?

(1) d. Which one of these graphs looks like $y = \frac{1}{x}$? ______________
   Choose A, B, C, or D



(1) Which one of these graphs looks like $y = \frac{5}{x^2}$? ______________
   Choose A, B, C, or D

Notice the how these two shapes appear in the graph in **Figure 9.36** near their vertical asymptotes.

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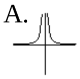
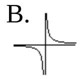
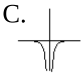
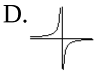
(1) e. The **short-run** behavior of $r(x) = \dfrac{25}{(x+2)(x-3)^2}$ includes its vertical asymptotes and its intercepts. How did the text find the y-intercept of $r(x)$?

f. The **long-run** behavior of $r(x)$ is simply what happens to the function as $x \to \infty$ or $x \to -\infty$, and from the ideas in Section **9.4**, we can see that for large x, the function $r(x) = \dfrac{25}{(x+2)(x-3)^2}$ has

(1) the same long-run behavior as the power function with the equation $y =$ [ ].

(1) This power function looks like which graph? ____________ (Choose A, B, C, or D)

A.  B.  C.  D. 

Notice the how this shape appears in the graph in **Figure 9.36**.

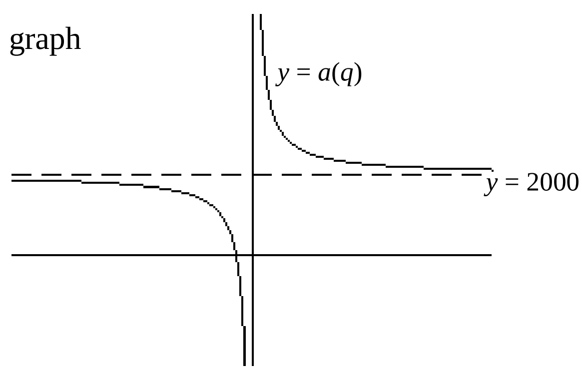
(1) Therefore, the function $r(x)$ has a horizontal asymptote of $y =$ [ ].

(1) 7. A graph can never cross its vertical asymptote. Circle one: True False

(1) 8. A graph can never cross its horizontal asymptote. Circle one: True False

9. The average cost function $y = a(q)$ in Section 9.4 in **Figure 9.27** is a transformation of the power function $y = \dfrac{1}{q}$.  Complete the blanks and boxes. Tip: You might look at Sections **5.1-5.3** again.

(2) Since $a(q) = \dfrac{2{,}500{,}000 + 2000q}{q}$ = [ ] $\cdot \dfrac{1}{q}$ + [ ]



(1) the function $y = a(q)$ is a vertical ____________ of the graph ({stretch, compression })

(1) of $y = \dfrac{1}{q}$ by ______________________ units (how many?)

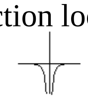
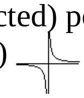
(2) and a ____________ ({vertical, horizontal }) shift ____________ ({up, down, left, right})

(1) by ________________ units. (how many?)

(1) 10. Read Section **9.5 Example 3** thoroughly. What reason does the text give for making the power of the factor of $(x + 2)$ in the denominator 2 instead of 1? Hint: notice your answer to Question 5b and 5c of this assignment.

A. The graph has a vertical asymptote at $x = -2$, so the factor $(x+2)^{-2}$ = $1/(x+2)^2$.

B. The graph bounces at the point (0, 1/2), so the graph would look like $1/(x+2)^2$.

C. Near $x = -2$, the function looks more like the graph of (the reflected) power function $y = 1/(x+2)^2$  , rather than the graph of $y = 1/(x+2)$  .

D. The denominator of g has a factor of $(x+2)^2$ because there are total of two asymptotes.