1. What is a rational function?

Determine all intercepts and asymptotes of the following rational functions.

2. $f(x) = \dfrac{2}{3x+5}$

3. $g(x) = \dfrac{6-x}{x+3}$

4. $h(x) = \dfrac{-6x}{2x^2-18}$

5. $m(x) = \dfrac{2x^2+8x+6}{3x}$

6. $R(x) = \dfrac{1}{x^2+1}$

7. $G(x) = \dfrac{2x^2-5x-3}{2x+5}$

Sketch a graph of the nonreduced rational functions.

8. $f(x) = \dfrac{x^3+2x^2}{2x+4}$

9. $F(x) = \dfrac{x^3+2x^2+x+2}{x^2-x-6}$

Determine the asymptotes of the following functions, and whether or not the graph crosses its non-vertical asymptote. There should be some work, and not simply a "yes" or "no".

10. $\dfrac{2x^2-3x-2}{x^2-3x-4}$

11. $\dfrac{2x^2-4x+5}{x^2-2x+1}$

12. $\dfrac{(x+1)(x-4)(x+2)}{(x-1)(x-3)}$

13. Suppose $R(x) = \frac{n(x)}{d(x)}$ is a rational function. Answer the following questions referring to this general rational function.

a) If $x = c$ is a vertical asymptote of $R(x)$, then _____$= 0$ at $x = c$.

b) If there is not a vertical asymptote then _____

c) If there is a horizontal asymptote, $y = 0$, then what can you say about the degrees of $n(x)$ and $d(x)$?

d) If there is a horizontal asymptote, $y = k$, then what can you say about the degrees of $n(x)$ and $d(x)$?

e) If there is a slant asymptote, then what can you say about the degrees of $n(x)$ and $d(x)$?

f) If there is a hole in the graph of $R(x)$ at $x = a$ then _____

14. Create an equation for each of the following scenarios:

a) A rational function (not a polynomial) with no vertical asymptotes.

b) A rational function with asymptotes $y = 0$, $x = 1$, and $x = -4$.

c) A rational function with asymptotes $y = -2$, $x = 2$, $x = -5$, and zeros at 1 and 3.

d) A rational function with asymptotes $y = \frac{1}{2}$, $x = 4$, $x = 9$ and zero at 1 only

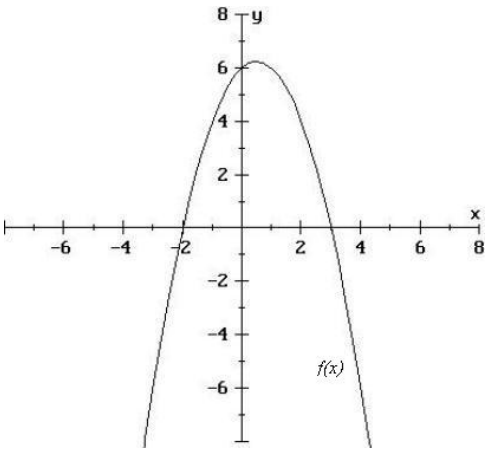
15. Suppose $f(x)$ is a rational function with a horizontal asymptote of $y = 3$ and vertical asymptotes of $x = -2$ and $x = 5$.

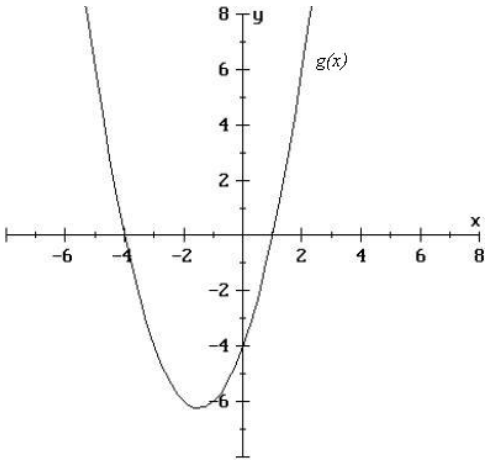
a) What is the domain of $f(x)$?

b) What are the asymptotes of the function $f(x+1)$?

c) What are the asymptotes of the function $f(x) - 1$?

16. Use the graphs of $f(x)$ and $g(x)$ given below to answer the following.





a) If we let $h(x) = \frac{f(x)}{g(x)}$, is $h(x)$ a rational function? Why?

b) What is/are the vertical asymptote(s) of $h(x)$?

c) What is/are the zero(s) of $h(x)$?

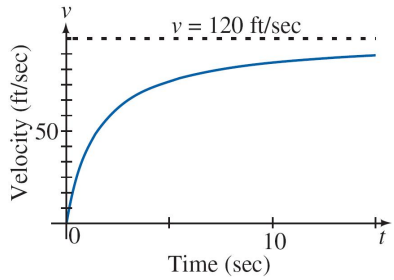
17. An oil company estimates that it will cost \$300,000 to clean up 60% of an oil spill. Let C represent the cost (in dollars) of cleaning up x percent of the oil spill in the cost-benefit model

$$C(x) = \frac{kx}{100 - x} \qquad 0 \le x < 100$$

a) Determine the constant k.

b) Use the model to predict the cost of cleaning up 90% of the spill.

18. The velocity of a lightweight ball that has been dropped from a tall building increases rapidly at first, but then increases more slowly as a result of wind resistance. The velocity eventually approaches 120 feet per second. A graph of the situation is shown below.



a) If the velocity is 80 feet per second 3 seconds after the ball is released, determine a model of the form

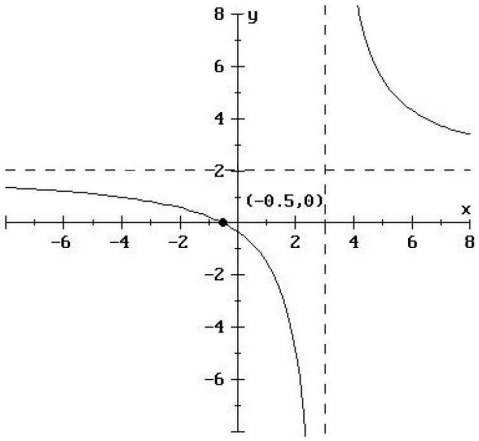
$$v(t) = \frac{at}{t + b}$$

where a and b are constants.

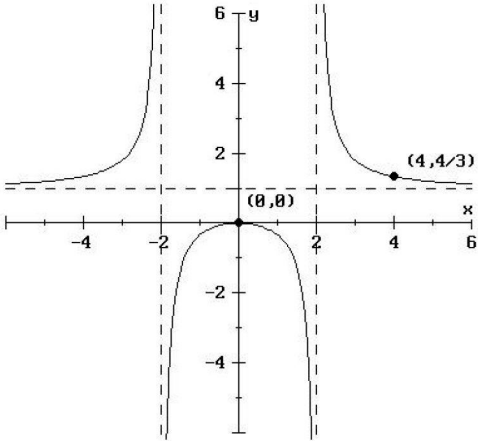
b) Use the model to predict the velocity of the ball 6 seconds after it was released.

Determine the equation of each of the rational functions shown below.

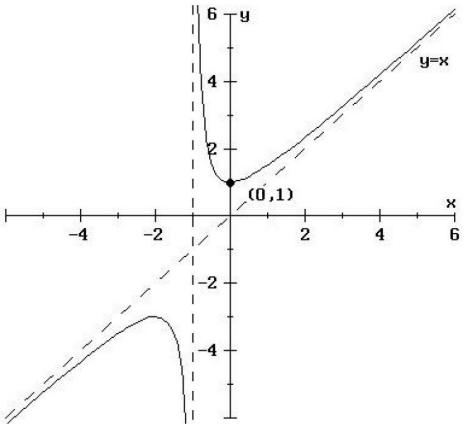
19.



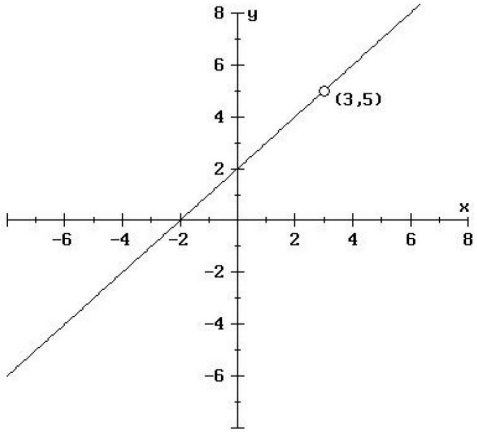
20.



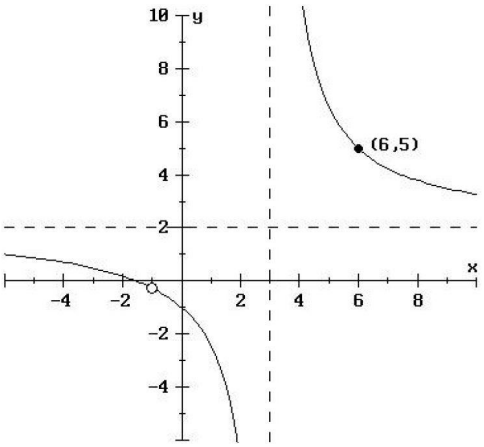
21.



22.



23.



24.