

11.2 Graphing Rational Functions

1)

a)

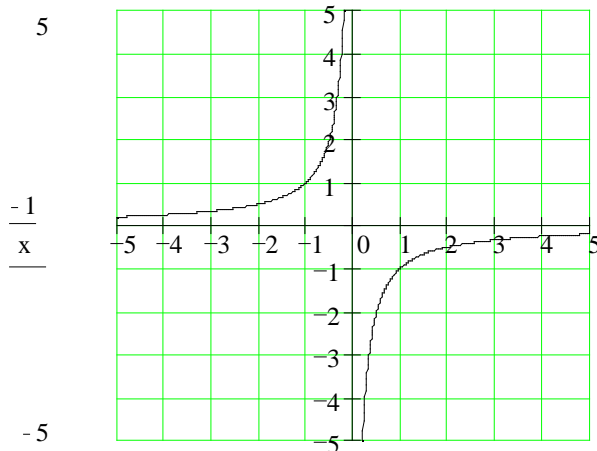
No. Items Produced	Average Cost
0	ERROR
25	\$23
50	\$15
75	\$12.33
100	11

- b) As the number of items produced increases, the average cost of producing them decreases, but this rate of decrease slows.
- c) As x get very large, the average cost approaches \$7 per item.
- d) The company would have to produce an infinite number of items for the average cost to reach \$7 per item, but this is physically impossible.
- e) Division by zero is undefined.

3) Horizontal asymptote: $y = 0$ Vertical asymptote: $x = 1$.

(For rational functions, the value of x that causes division by 0 is the vertical asymptote. Alternatively, as x assumes larger values, the value of y approaches the horizontal asymptote).

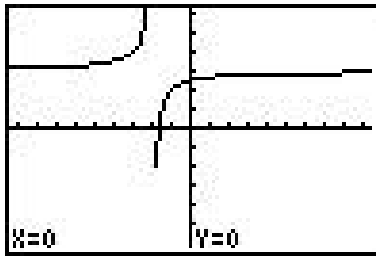
- 5) If the graph of $f(x) = \frac{1}{x}$ is reflected over the x -axis, then it will appear in the second and fourth quadrants. Recall that multiplying the function by -1 reflects the original graph over the x -axis. Here $g(x) = -\frac{1}{x}$. Its graph is pictured below.



- 7) The graph of $f(x) = \frac{1}{x}$ has been stretched away from the x -axis by a scale factor of 2 and has been reflected over the x -axis.
- 9) The graph of $f(x) = \frac{1}{x}$ has shifted down 3 units.
- 11)
- a) $\frac{8x + 500}{x} = \frac{8x}{x} + \frac{500}{x}$
- b) $\frac{8x}{x} + \frac{500}{x} = 8 + \frac{500}{x}$
- c) The graph of $y = 8 + \frac{500}{x}$ can be obtained by modifying the graph of $f(x) = \frac{1}{x}$ by stretching it away from the x -axis by a scale factor of 500 and shifting it up 8 units.
- 13)
- a) Quadrants III and IV
- b) Domain = $\{x : x < 0\}$ Range = $\{y : y < 0\}$
- 15)
- a) No. Substitution of -4 for x causes division by zero, which is undefined.
- b) Use a "friendly" window. (See explanation in the last part of this section).

Skill and Review

- 17) $f(x) = \frac{1}{x}$
- $g(x) = \frac{1}{x+2}$ ←Original graph of f shifted left 2 units
- $h(x) = \frac{1}{x+2} - 3$ ←Graph of g shifted 3 units down
- $j(x) = -h(x) = -\frac{1}{x+2} + 3$ ←Graph of h reflected over the x -axis.



$$\begin{aligned}
 19) \quad & \frac{x^2 - x}{x^2 + 10x + 25} \cdot \frac{x + 5}{(x - 1)^2} \\
 &= \frac{x(x - 1)}{(x + 5)(x + 5)} \cdot \frac{(x + 5)}{(x - 1)(x - 1)} \\
 &= \frac{x(x - 1)(x + 5)}{(x + 5)(x + 5)(x - 1)(x - 1)} \\
 &= \frac{x}{(x - 1)(x + 5)}
 \end{aligned}$$