$f(x) = \frac{2x-4}{x^2-3x-10}$ **is a rational function**

To find

a) The domain
b) The intercepts with the axes
c) Equations of vertical asymptotes (if any)
d) Equations of horizontal asymptoes (if any)
e) Intervals of increase
f) Intervals of decrease

In this situation, for domain,
look for the values at which the denominator is 0,
these value can not be in the domain
i.e. solve

$\mathbf{x^2 - 3x - 10 = 0}$

$(x-5)(x+2) = 0$

$\mathbf{x = -2, x = 5}$

domain is the set of all real numbers except $-2, 5$

$(-\infty, -2) \cup (-2, 5) \cup (5, \infty)$

b) The intercepts with the axes

$\mathbf{f}(x) = \frac{2x-4}{x^2-3x-10}$

$\mathbf{y} = \frac{2x-4}{x^2-3x-10}$

For x-intercept: set $y = 0$

$\frac{2x-4}{x^2-3x-10} = 0 \rightarrow 2x - 4 = 0 \rightarrow x = 2$

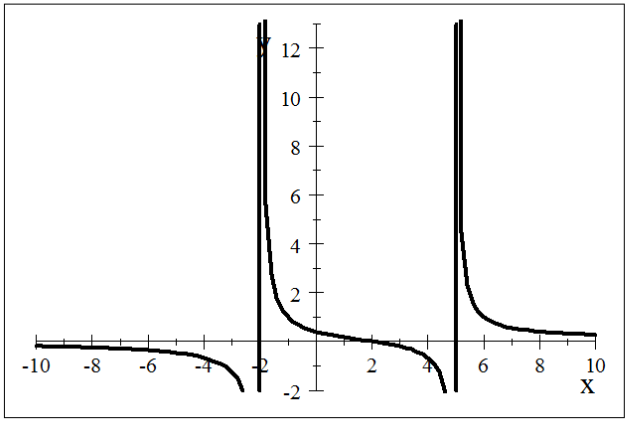
$(2, 0)$ **is the x-intercept**

For the y–intercept set $x = 0$

$$\mathbf{y} = \frac{2(0) - 4}{(0)^2 - 3(0) - 10} = \frac{-4}{-10} = \frac{2}{5}$$

y-intercept $\left(0, \frac{2}{5}\right)$

c) vertical asymptote



look for the values at which the denominator is zero BUT the numerator is NOT zero

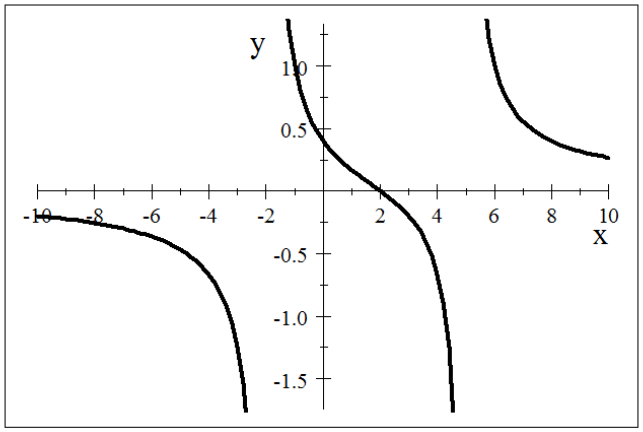
$$\mathbf{f}(x) = \frac{2x - 4}{x^2 - 3x - 10} = \frac{2x - 4}{(x + 2)(x - 5)}$$

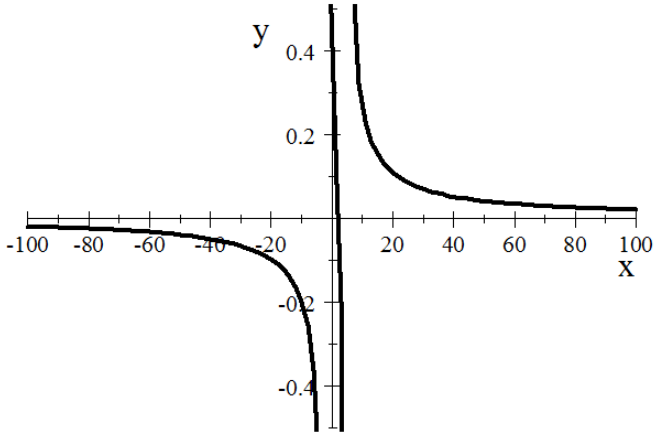
x = –2 **x = 5**

d)

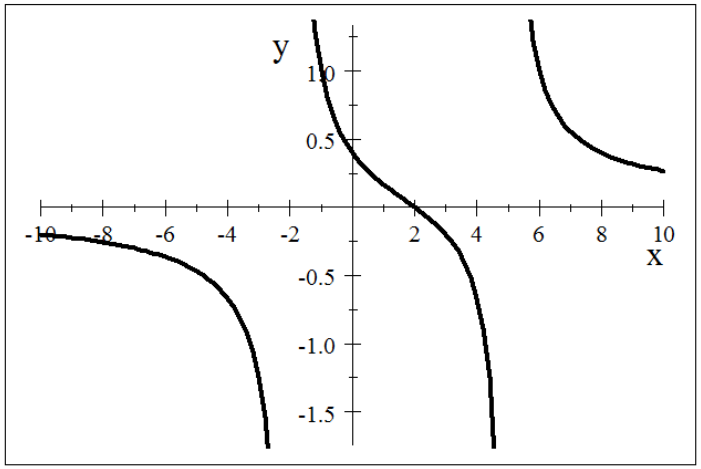
Horizonal asymptote

$y = 0$





e) ↗



Can not find any Φ

f) ↘

$(-\infty,-2),(-2,5),(5,\infty)$

Directly Proportional?

$\mathbf{f}(x) = \mathbf{k}\mathbf{g}(x)$

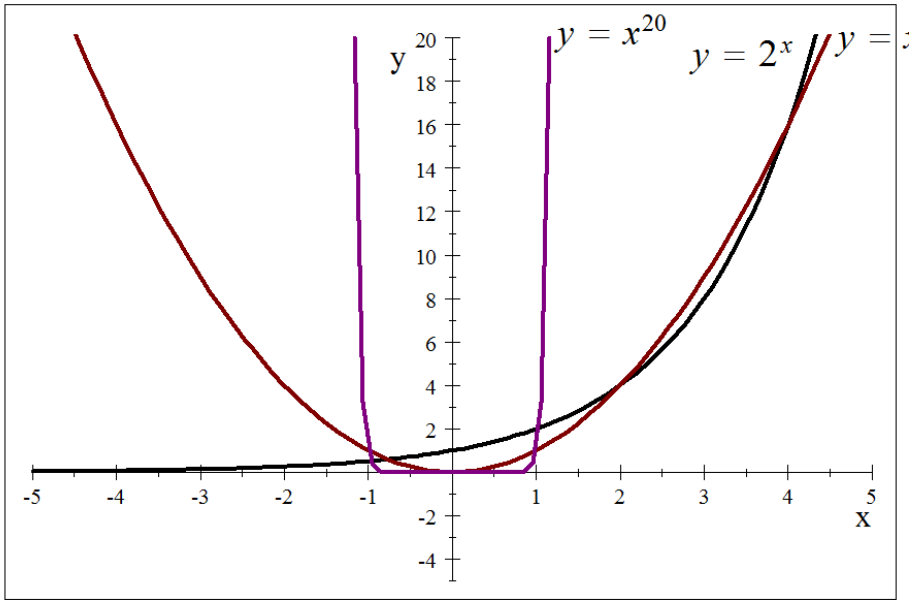
Inversely Proportional

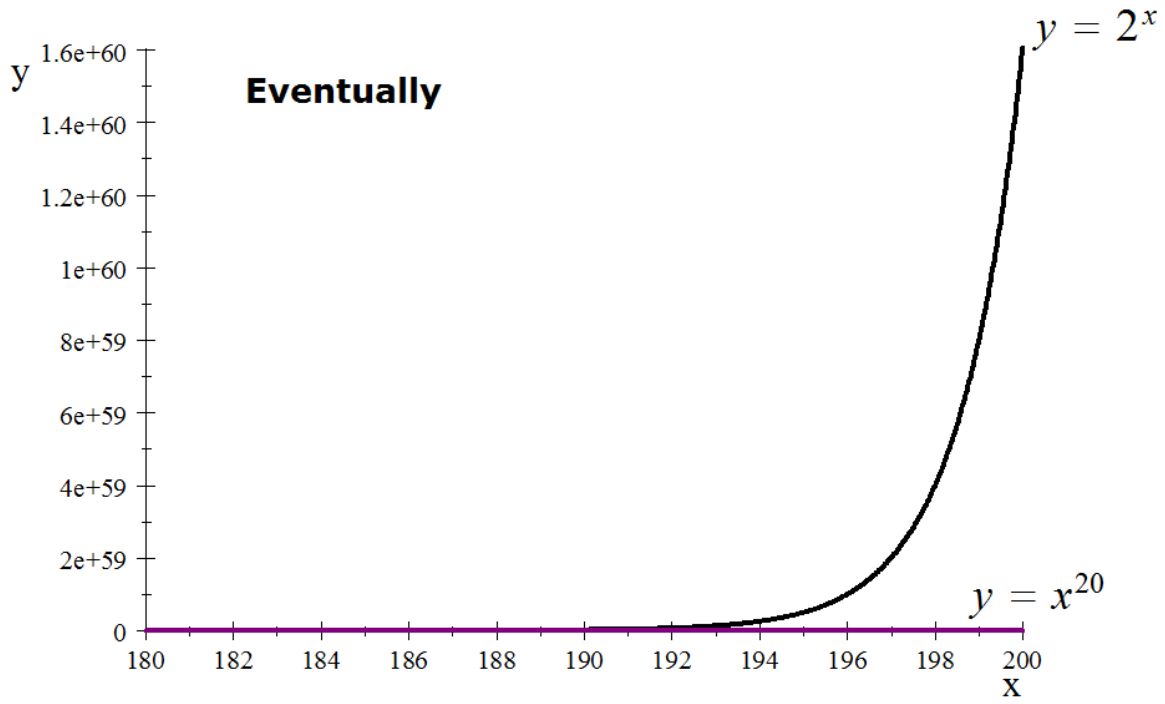
$$\mathbf{f}(x) = \frac{k}{g(x)}$$

Newton

$$\mathbf{F}(x) = \frac{k}{x^2}$$

Graph $y = 2^x, y = x^2, y = x^{20}$ **in the same window**





a spreadsheet demonstration video

Math 160

The game of Chess was invented in ancient India. According to legend, the king of India was so impressed that he offered the inventor of the game any reward he desired. The inventor thought for a moment, then replied "I am but a humble servant, and I require only a meager reward. All I ask is that you give me 1 grain of wheat on the first square of the chessboard. Tomorrow, give me 2 grains of wheat on the 2nd square of the board. The next day, 4 grains for the 3rd square; then 8 grains for the 4th square, and so on, doubling each day. After 64 days, the board will be full, and my reward completed."

The king tried to convince the inventor to take a more substantial reward, for this did not seem to be asking much at all, but the inventor insisted that this was the only reward he thought fair.

1) Fill in the table below:

Day	Size of that day's reward
1	1
2	2
3	4
4	8
5	16
6	32
7	$64 = 2^6$
	. . .
30	2^{29} 536870912

64	2^{63} 9.223372037E18

2) Let f(x) be the size of the reward on day *x*. Find a formula for f(x)

$$f(x) = 2^{x-1}$$

3) Sum the cumulative reward for each day of the first week (eg, the cumulative total on day 2 was 3 grains of wheat – 1 from the 1st day and 2 from the 2nd) and write these numbers to the side of the table. You should notice a pattern emerge. Use this pattern to determine: What is the size of the total reward given through all 64 days?

$$S = 1 + 2 + 2^2 + 2^3 + .. + 2^{62} + 2^{63}$$

$$2S = 2 + 2^2 + 2^3 + .. + 2^{62} + 2^{63} + 2^{64}$$

$$2S - S = -1 + 2^{64}$$

$$S = 2^{64} - 1$$

Sum sequence with TI84 video