Jeopardy!

Linear Fcns	Quad. Fcns	Quad. Models	Quad. Ineq.	Polyn'l Fcns & Models	Props of Rat. Fcns	Graph of Rat. Fcns	Polyn'l & Rat. Ineq.
100	100	100	100	100	100	100	100
200	200	200	200	200	200	200	200
300	300	300	300	300	300	300	300
400	400	400	400	400	400	400	400
500	500	500	500	500	500	500	500

Grab Bag 100 200 300 400 500

Linear Fcns 100

- Determine the slope, *y*-intercept, where the function is increasing and decreasing and graph the function:

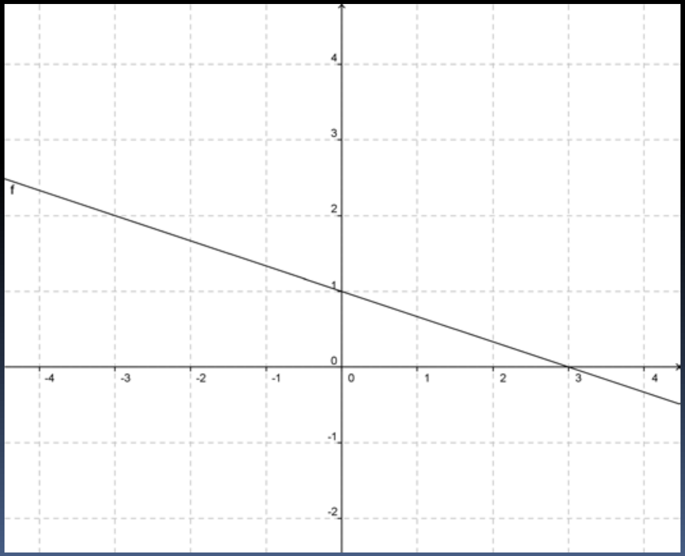
$$f(x) = -\frac{x}{3} + 1$$

Linear Fcns 100

Slope = $-\frac{1}{3}$

y-intercept= 1

Decreasing on whole real line, Increasing nowhere



Linear Fcns 200

Determine the slope, *y*-intercept, where the function is increasing and decreasing and graph the function:

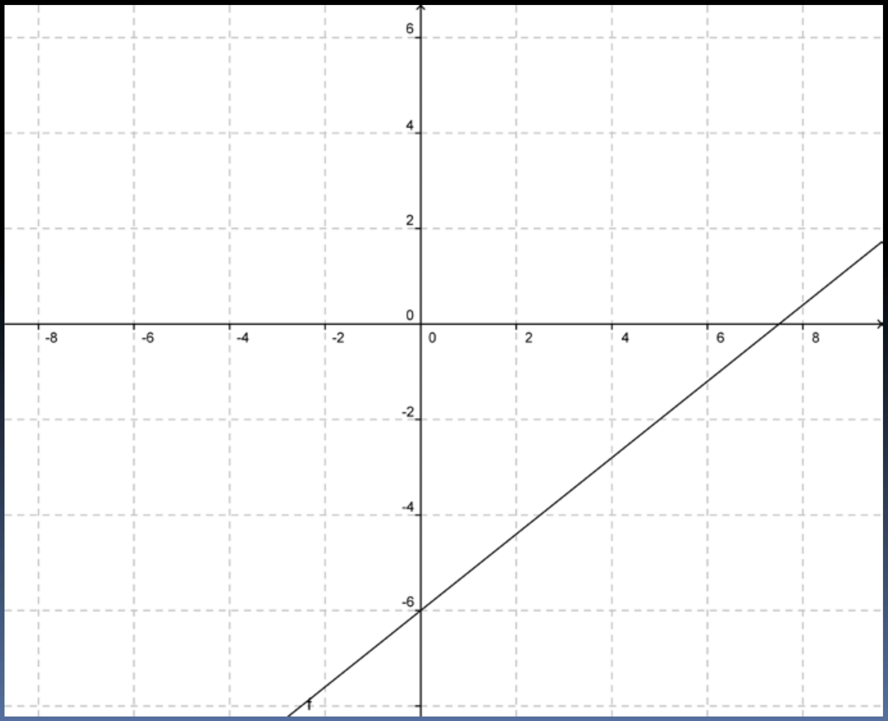
$$f(x) = \frac{4}{5}x - 6$$

Linear Fcns 200

Slope = $\frac{4}{5}$

y-intercept= -6

Increasing on whole real line, Decreasing nowhere



Linear Fcns 300

Determine the slope, *y*-intercept, where the function is increasing and decreasing and graph the function:

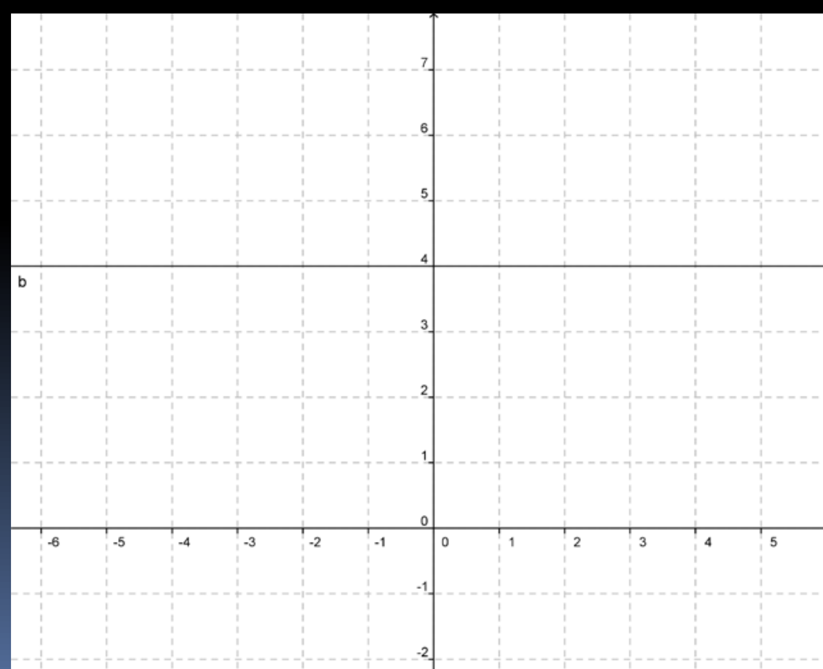
$$h(x) = 4$$

Linear Fcns 300

Slope = 0

y-intercept= 4

Increasing/Decreasing nowhere



Linear Fcns 400

Determine the slope, *y*-intercept, where the function is increasing and decreasing and graph the function:

$$3y + 12 = 6x - 3$$

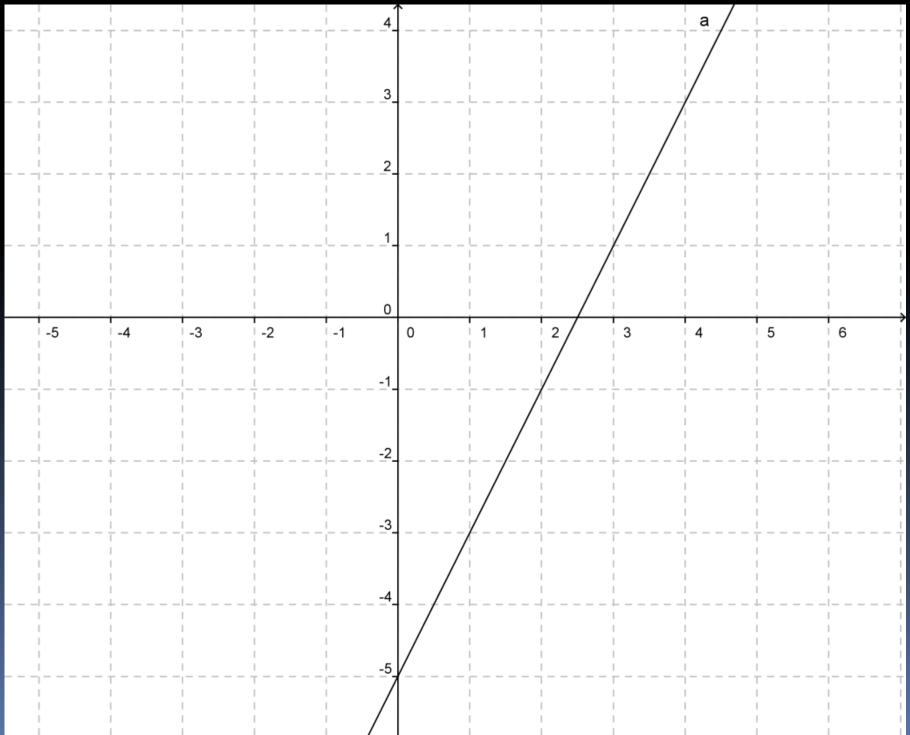
Linear Fcns 400

$$3y + 12 = 6x - 3$$
$$3y = 6x - 15$$
$$y = 2x - 5$$

Slope = 2

y-intercept= -5

Increasing on whole real line, Decreasing nowhere



Linear Fcns 500

Marissa must decide between one of two companies as her long-distance phone provider. Company A charges a monthly fee of $7.00 plus $0.06 per minute while Company B does not have a monthly fee, but charges $0.08 per minute.

(a) Find a linear function that relates cost, C, to total minutes on the phone, *x*, for each company.

(b) Determine the number of minutes *x* for which the bill from Company A would equal the bill from Company B.

(c) Over what interval of minutes *x* will the bill from Company B be less than the bill from Company A?

Linear Fcns 500

(a)

$$C_A(x) = 7 + 0.06x$$
$$C_B(x) = 0.08x$$

(b)

$$7 + 0.06x = 0.08x$$
$$7 = 0.02x$$
$$350 = x$$
$$x = 350 \text{ min}$$

(c)

$$0 \le x \le 350$$

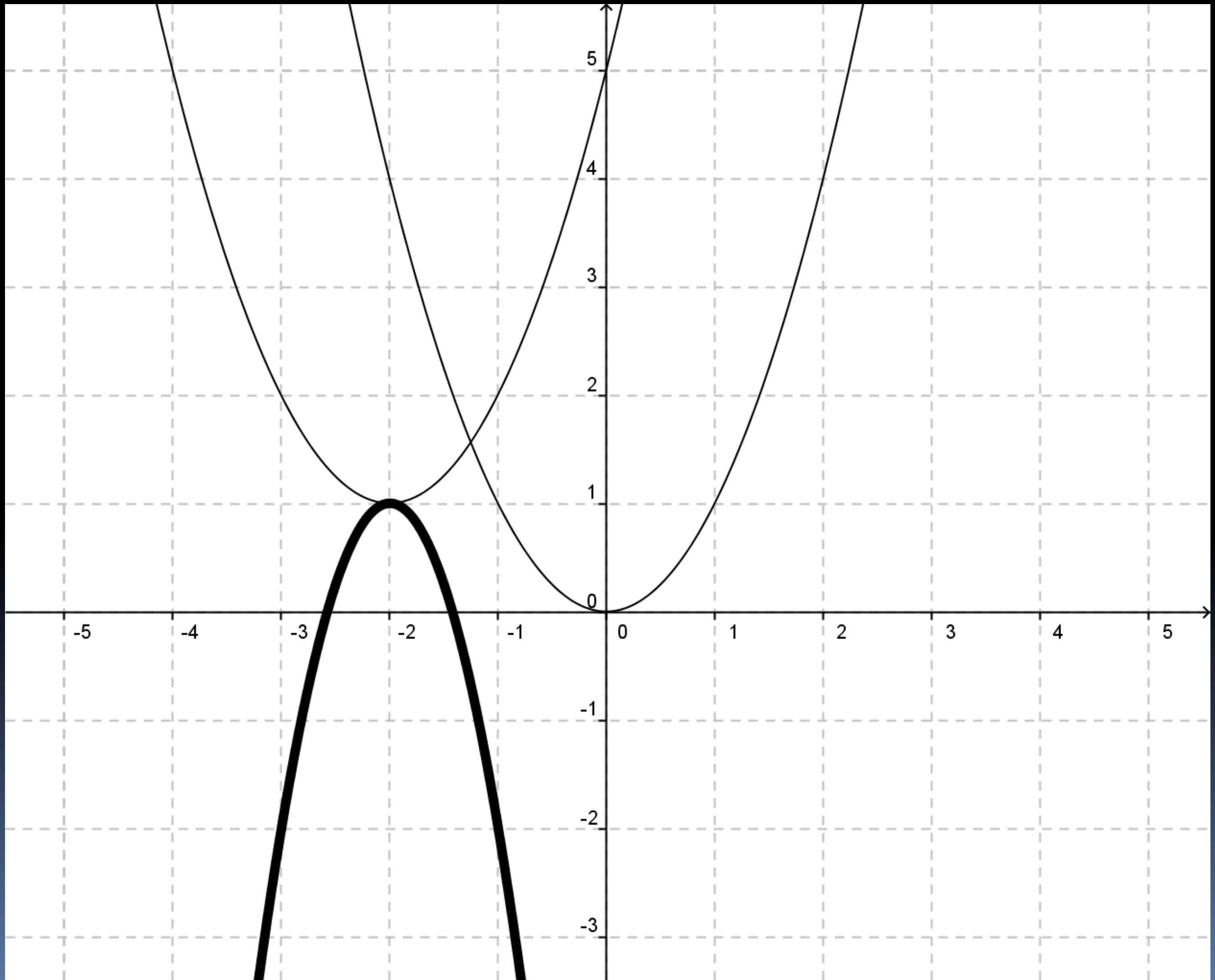
Quad Fcns 100

Graph using transformations

$$f(x) = -3(x+2)^2 + 1$$

Quad Fcns 100

(Bold function is final answer)



Quad Fcns 200

Graph by finding vertex, axis of symmetry, and any intercepts

$$f(x) = 9x^2 - 6x + 3$$

Quad Fcns 200

$$f(x) = 9x^2 - 6x + 3$$

Vertex:

$$\frac{-b}{2a} = -\frac{-6}{18} = \frac{1}{3}$$

$$f\left(\frac{-b}{2a}\right) = f\left(\frac{1}{3}\right) = 2$$

$$\left(\frac{1}{3}, 2\right)$$

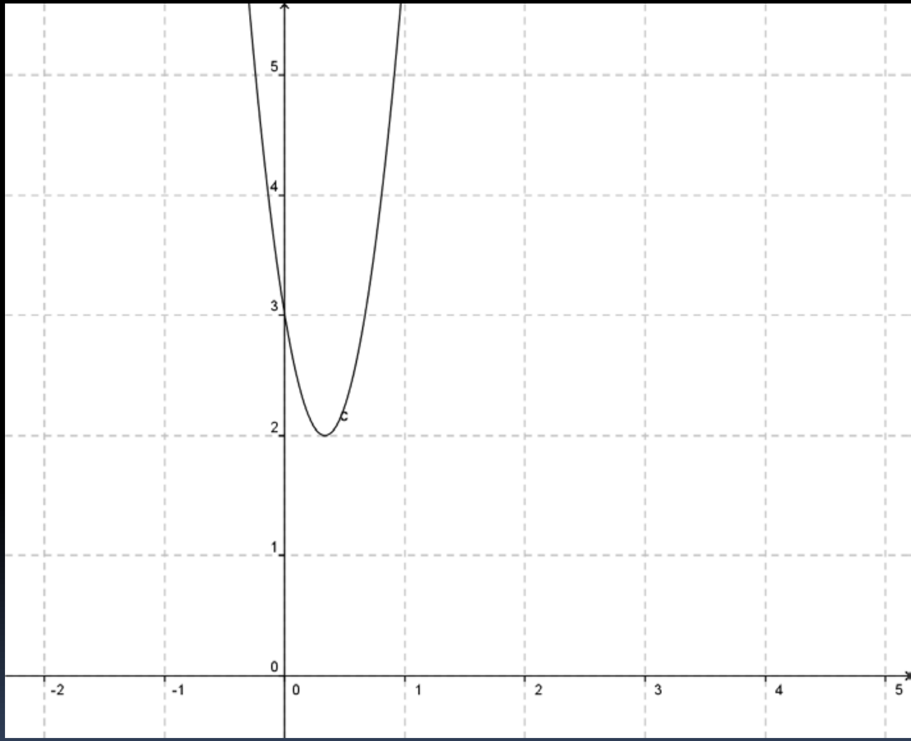
Axis of Symmetry: $x = \frac{1}{3}$

Intercepts:

x: $y = 0 \Rightarrow 0 = 9x^2 - 6x + 3$

$$\frac{6 \pm \sqrt{36 - 108}}{12} \Rightarrow nonreal$$

y: $x = 0 \Rightarrow f(x) = y = 3 \Rightarrow (0,3)$



Quad Fcns 300

Graph by finding vertex, axis of symmetry, and any intercepts

$$y = -4x^2 + 4x$$

Quad Fcns 300

Vertex:

$$\frac{-b}{2a} = -\frac{4}{-8} = \frac{1}{2}$$

$$f(\frac{-b}{2a}) = f(\frac{1}{2}) = 1$$

$$(\frac{1}{2}, 1)$$

Axis of Symmetry: $x = \frac{1}{2}$

Intercepts:

x:

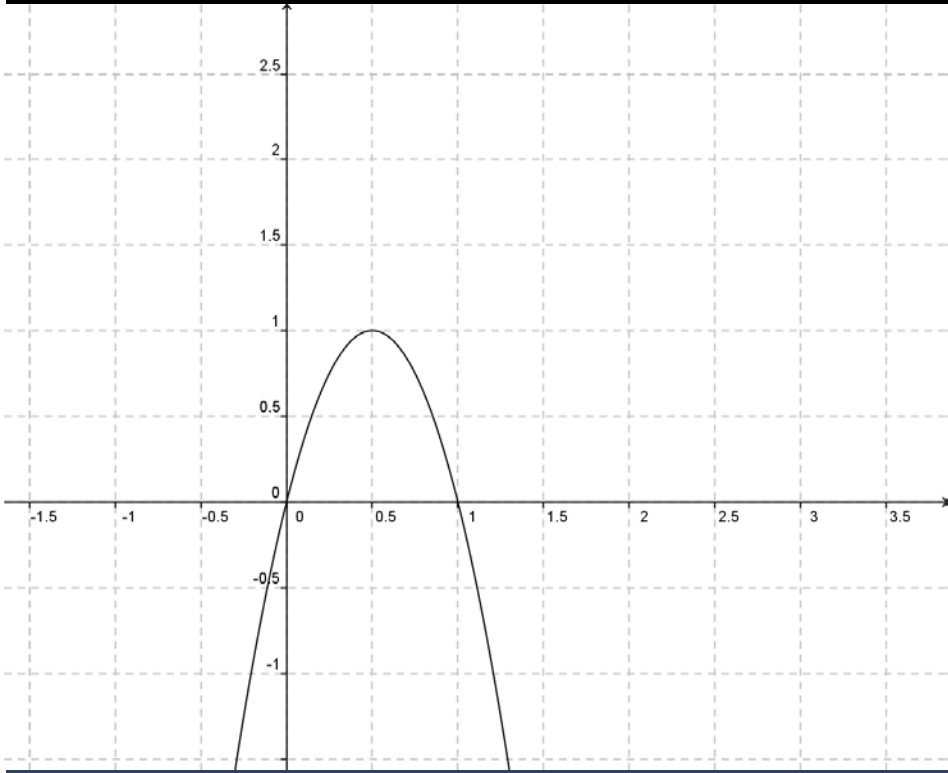
$$y = 0 \Rightarrow 0 = -4x^2 + 4x$$

$$0 = x(-x+1)$$

$$x = 0,1 \Rightarrow (0,0),(1,0)$$

y:

$$x = 0 \Rightarrow f(x) = y = 0 \Rightarrow (0,0)$$



Quad Fcns 400

Determine whether the given quadratic has a max or min value and find its value.

$$y = 2x^2 + 8x + 5$$

Quad Fcns 400

$$y = 2x^2 + 8x + 5$$

The function will have a min value as the coefficient of the squared term is positive, meaning the parabola opens up. (To verify, you may graph and/or determine where the function is increasing and decreasing). The min value will be located at the vertex:

$$Vertex$$

$$\frac{-b}{2a} = \frac{-8}{4} = -2$$

$$f(\frac{-b}{2a}) = f(-2) = -3$$

$$(-2, -3)$$

Quad Fcns 500

Determine whether the given quadratic has a max or min value and find its value.

$$f(x) = -x^2 - 10x - 3$$

Quad Fcns 500

$$f(x) = -x^2 - 10x - 3$$

The function will have a max value as the coefficient of the squared term is negative, meaning the parabola opens down. (To verify, you may graph and/or determine where the function is increasing and decreasing). The max value will be located at the vertex:

$$Vertex:$$

$$\frac{-b}{2a} = -\frac{-10}{-2} = -5$$

$$f(-5) = 22$$

$$(5, 22)$$

Quad Models 100

The price *p* (in dollars) and the quantity *x* sold of a certain product obey the demand equation

$$p = -\frac{1}{10}x + 150,\ p \in [0, 1500]$$

(a) Express the revenue *R* as a function of *x*.

(b) What quantity *x* maximizes the revenue?

Quad Models 100

$$p = -\frac{1}{10}x + 150,\ p \in [0,1500]$$

(a) $$R = xp = x(-\frac{1}{10}x + 150) = -\frac{1}{10}x^2 + 150x$$

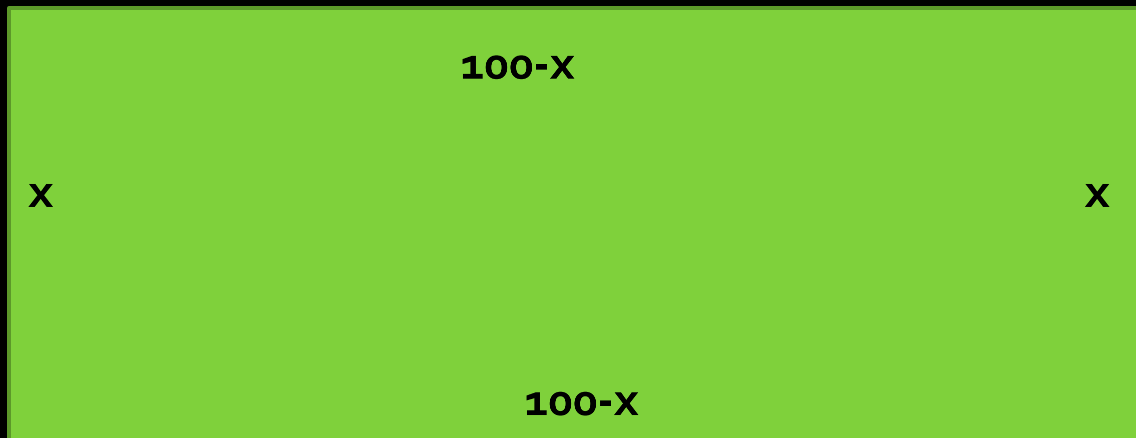
(b) *Vertex*

$$-\frac{b}{2a} = -\frac{150}{2(-\frac{1}{10})} = 750 = x$$

Quad Models 200

A landscape engineer has 200ft of border to enclose a rectangular pond. What dimensions will result in the largest pond?

Quad Models 200



$$P = 2x + 2y = 200$$

$$\Rightarrow y = 100 - x$$

$$A = xy = x(100 - x) = 100x - x^2$$

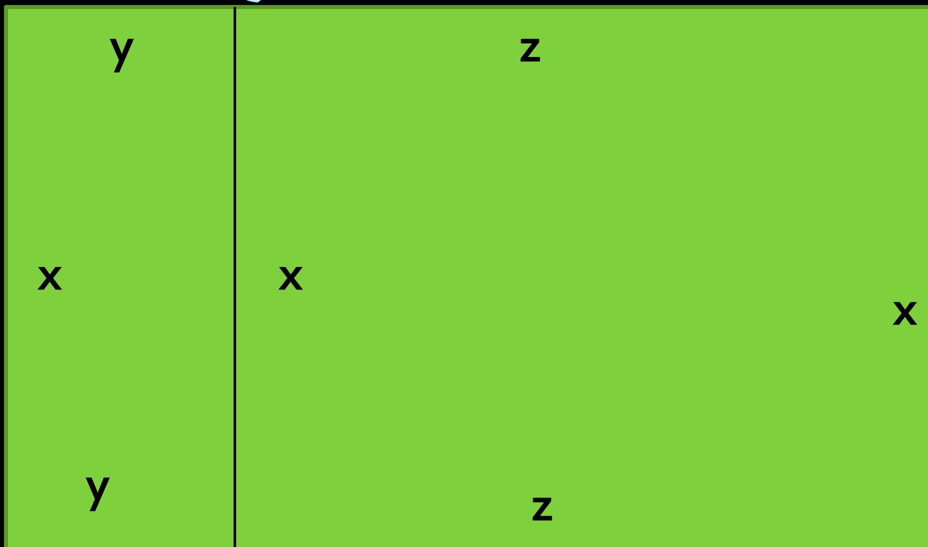
$$Vertex = -\frac{b}{2a} = -\frac{100}{-2} = 50\ ft = x$$

$$\Rightarrow y = 50\ ft$$

Quad Models 300

A farmer with 10,000 m of fencing wants to enclose a rectangular field and then divide it into two plots with a fence parallel to one of the sides. What is the largest area that can be enclosed?

Quad Models 300



$$P = 3x + 2y + 2z = 10,000$$

$$w = y + z$$

$$w = \frac{10,000 - 3x}{2}$$

$$A = xw = x\left(\frac{10,000 - 3x}{2}\right) = \frac{10,000x - 3x^2}{2}$$

$$Vertex = -\frac{b}{2a} = -\frac{10,000}{2\left(\frac{-3}{2}\right)} = 3,333.33m = x$$

$$A_{max} = \frac{10,000(3,333.33) - 3(3,333.33)^2}{2}$$

Quad Models 400

The marginal cost *C* of a company manufacturing *x* golf clubs may be expressed by the quadratic function

$$C(x) = 4.9x^2 - 617.4x + 19,600$$

(a) How many clubs should be manufactured to minimize the marginal cost?

(b) At this level of production, what is the marginal cost?

Quad Models 400

$$C(x) = 4.9x^2 - 617.4x + 19,600$$

(a) Vertex= $\frac{617.4}{9.8} = 63$

(b) $C(63) = 4.9(63)^2 - 617.4(63) + 19,600 = \$151.90$

Quad Models 500

- The price *p* (in dollars) and the quantity x sold of a certain product obey the demand equation

$$x = -20p + 500,\ p \in [0, 25]$$

(a) express the revenue R as a function of *x*

(b) What is the revenue if 20 units are sold?

(c) What quantity *x* maximizes revenue? What is the maximum revenue?

Quad Models 500

$$x = -20p + 500,\ p \in [0, 25]$$

(a)

$$p = \frac{x - 500}{-20}$$

$$R(x) = xp = x\left(\frac{x - 500}{-20}\right) = 25x - \frac{x^2}{20}$$

(b)

$$R(20) = 25(20) - \frac{20^2}{20} = 500 - 20 = \$480$$

(c)

$$-\frac{b}{2a} = -\frac{25}{\frac{-2}{20}} = 250$$

$$R(250) = 25(250) - \frac{250^2}{20} = \$3125$$

Quad Ineq 100

Solve

$$x^2 + 6x - 16 < 0$$

Quad Ineq 100

$$x^2 + 6x - 16 < 0$$

$$x^2 + 6x + 9 < 25$$

$$(x + 3)^2 < 25$$

$$x + 3 < 5, x + 3 > -5$$

$$x < 2, x > -8$$

$$-8 < x < 2$$

$$OR$$

$$\{x \mid -8 < x < 2\}$$

$$OR$$

$$(-8, -2)$$

Quad Ineq 200

Solve

$$3x^2 - 2x - 1 \geq 0$$

Quad Ineq 200

$$3x^2 - 2x - 1 \geq 0$$

$$3(x^2 - \frac{2}{3}x) \geq 1$$

$$3(x^2 - \frac{2}{3}x + \frac{1}{9}) \geq \frac{4}{3}$$

$$(x - \frac{1}{3})^2 \geq \frac{4}{9}$$

$$x - \frac{1}{3} \geq \frac{2}{3}, x - \frac{1}{3} \leq -\frac{2}{3}$$

$$x \geq 1, x \leq -\frac{1}{3}$$

Quad Ineq 300

Solve

$$3x^2 \geq 14x + 5$$

Quad Ineq 300

$$3x^2 \geq 14x + 5$$

$$3(x^2 - \frac{14}{3}x) \geq 5$$

$$3(x^2 - \frac{14}{3}x + \frac{49}{9}) \geq \frac{64}{3}$$

$$(x - \frac{7}{3})^2 \geq \frac{64}{9}$$

$$x - \frac{7}{3} \geq \frac{8}{3}, x - \frac{7}{3} \leq -\frac{8}{3}$$

$$x \geq 5, x \leq -\frac{1}{3}$$

Quad Ineq 400

Solve

$$4x^2 < 13x - 3$$

Quad Ineq 400

$$4x^2 < 13x - 3$$

$$4x^2 - 13x < -3$$

$$4(x^2 - \frac{13}{4}x + \frac{169}{64}) < \frac{121}{16}$$

$$(x - \frac{13}{8})^2 < \frac{121}{64}$$

$$x - \frac{13}{8} < \frac{11}{8}, x - \frac{13}{8} > -\frac{11}{8}$$

$$x < 3, x > \frac{1}{4} \Rightarrow \frac{1}{4} < x < 3$$

Quad Ineq 500

Solve

$$7x+15>2x^2$$

Quad Ineq 500

$$7x + 15 > 2x^2$$

$$15 > 2(x^2 - \frac{7}{2}x)$$

$$\frac{169}{8} > 2(x^2 - \frac{7}{2}x + \frac{49}{16})$$

$$\frac{169}{16} > (x - \frac{7}{4})^2$$

$$\frac{13}{4} > x - \frac{7}{4}, -\frac{13}{4} < x - \frac{7}{4}$$

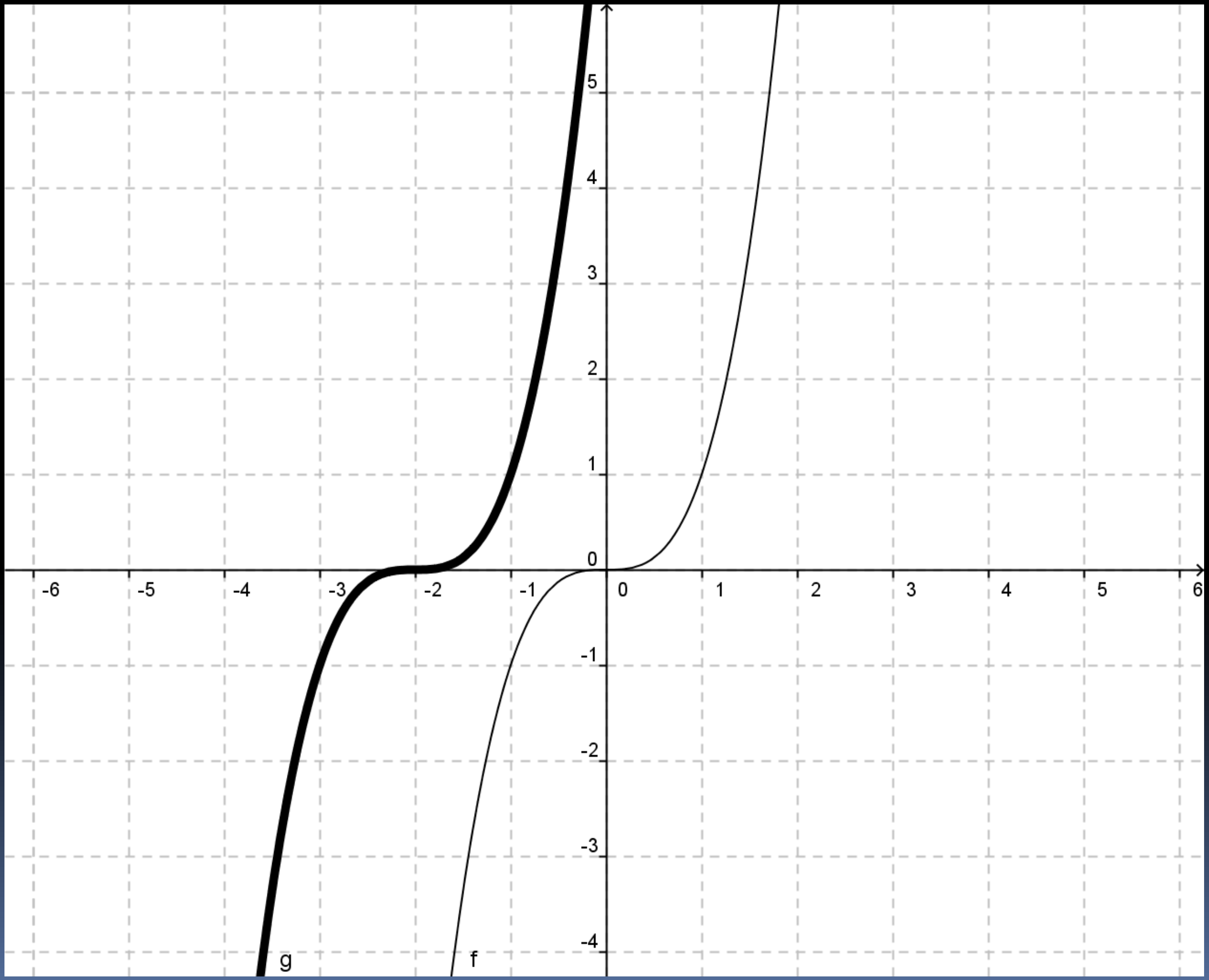
$$5 > x, -\frac{3}{2} < x \Rightarrow -\frac{3}{2} < x < 5$$

Polyn'l Fcns & Models 100

Graph the function using transformations. Show all stages (on same graph)

$$f(x) = (x+2)^3$$

Polyn'l Fcns & Models 100

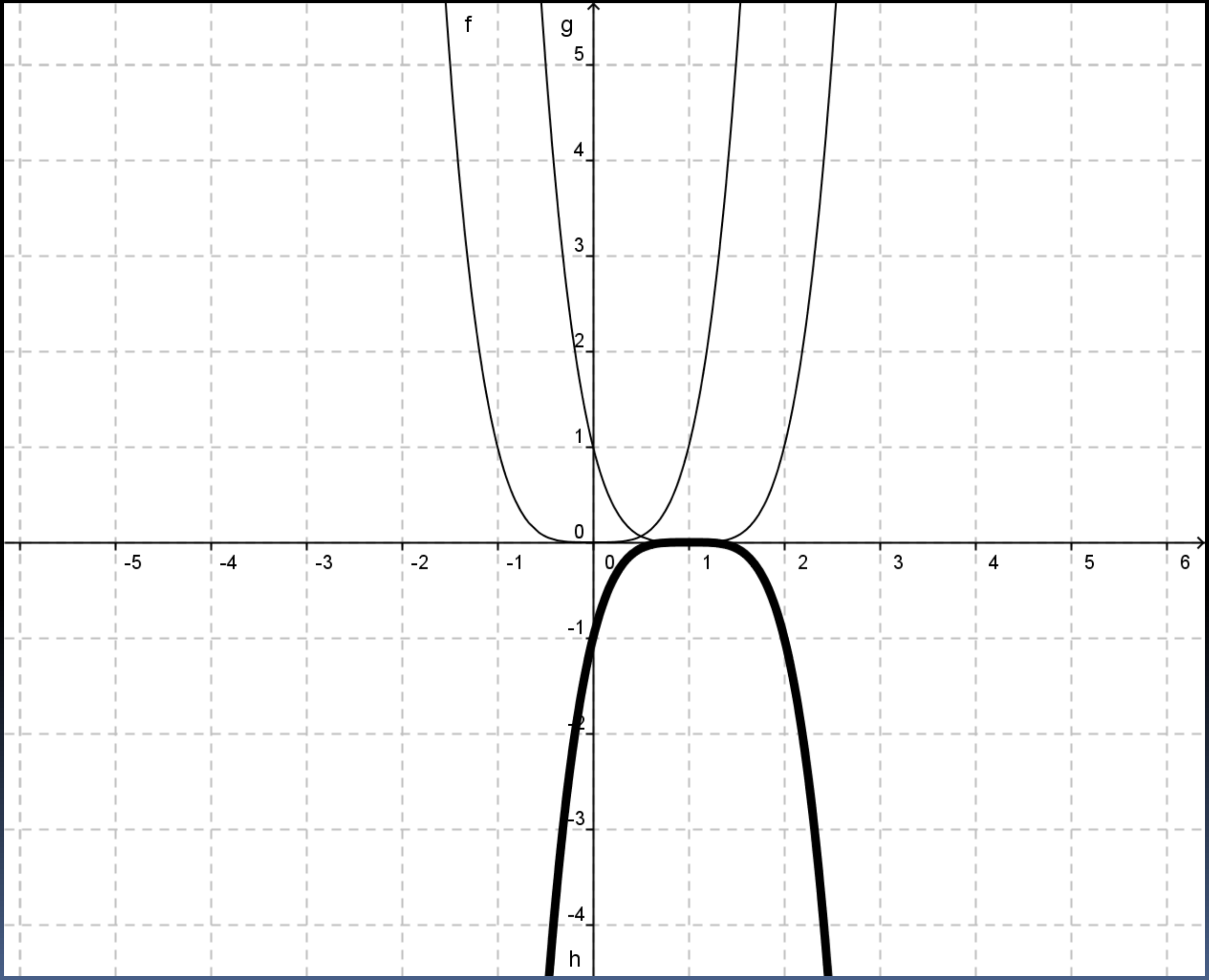


Polyn'l Fcns & Models 200

Graph the function using transformations. Show all stages (on same graph)

$$f(x) = -(x-1)^4$$

Polyn'l Fcns & Models 200



Polyn'l Fcns & Models 300

Find the intercepts, where the function touches or crosses the x-axis, and determine the end behavior of the function.

$$f(x) = 4(x-1)^3(x+3)^2$$

Polyn'l Fcns & Models 300

$$f(x) = 4(x-1)^3(x+3)^2$$

Intercepts:

x: x=1, x=-3

y:y=-36

Crosses at x=1 due to odd multiplicity, Touches at x=-3 due to even multiplicity

For x>>0, f(x) goes to infinity, for x<<0, f(x) goes to negative infinity

Polyn'l Fcns & Models 400

Find the intercepts, where the function touches or crosses the x-axis, and determine the end behavior of the function.

$$g(x) = -2x^3 + 4x^2$$

Polyn'l Fcns & Models 400

$$g(x) = -2x^3 + 4x^2 = -2x^2(x-2)$$

Intercepts:

x: x=0, x=2

y:y=0

Crosses at x=2 due to odd multiplicity, Touches at x=0 due to even multiplicity

For x>>0, f(x) goes to negative infinity, for x<<0, f(x) goes to infinity

Polyn'l Fcns & Models 500

Find the intercepts, where the function touches or crosses the x-axis, the number of turning points, and determine the end behavior of the function. Sketch the function.

$$h(x) = x(x+2)(x+4)$$

Polyn'l Fcns & Models 500

$$h(x) = x(x+2)(x+4)$$

Intercepts:

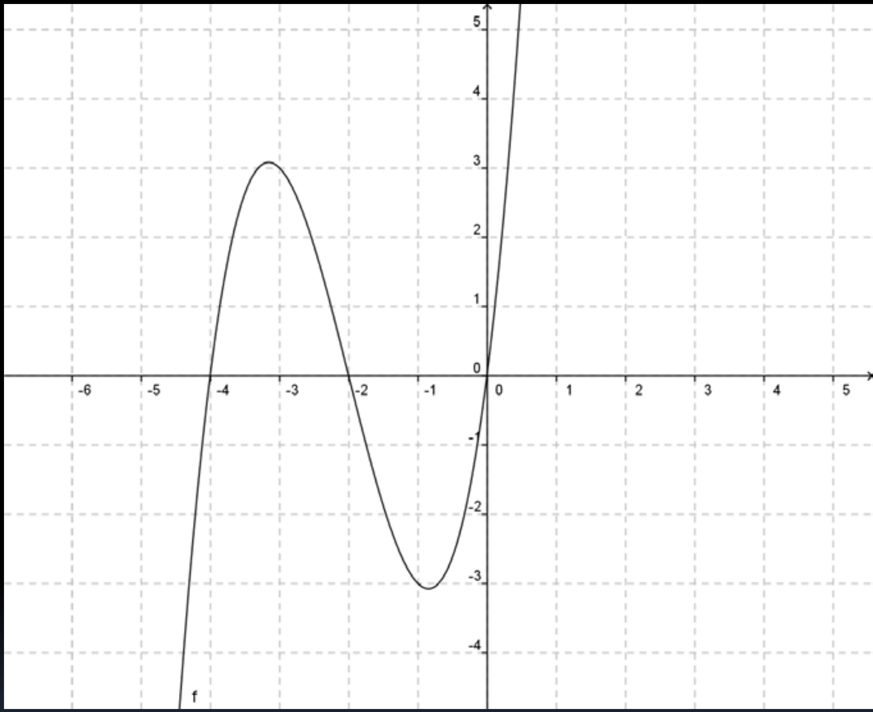
x: x=0, x=-2, x=-4

y: y=0

Crosses at all x intercepts due to odd multiplicity

Number of Turning Points: 2

For x>>0, f(x) goes to infinity, for x<<0, f(x) goes to negative infinity



Props of Rat. Fcns 100

Find the domain and any horizontal, vertical, and oblique asymptotes

$$R(x) = \frac{x+2}{x^2-9}$$

Props of Rat. Fcns 100

$$R(x) = \frac{x+2}{x^2-9} = \frac{x+2}{(x-3)(x+3)}$$

Domain: All reals except x=3,x=-3
VA: x=3, x=-3
HA: x=0 since (degree numerator)<(degree denominator)
OA: none

Props of Rat. Fcns 200

Find the domain and any horizontal, vertical, and oblique asymptotes

$$R(x) = \frac{x^2 + 4}{x - 2}$$

Props of Rat. Fcns 200

$$R(x) = \frac{x^2 + 4}{x - 2}$$

Domain: All reals except x=2
VA: x=2
HA: none since (degree numerator)>(degree denominator)
OA: y=x+2 after long division

Props of Rat. Fcns 300

Find the domain and any horizontal, vertical, and oblique asymptotes

$$R(x) = \frac{x^2 + 3x + 2}{(x+2)^2}$$

Props of Rat. Fcns 300

$$R(x)=\frac{x^2+3x+2}{(x+2)^2}=\frac{(x+1)(x+2)}{(x+2)^2}=\frac{x+1}{x+2}$$

Domain: All reals except x=-2

VA: x=-2

HA: x=1 since (degree numerator)=(degree denominator), look at coefficients of the highest degree in each.

OA: none

Props of Rat. Fcns 400

Find the domain and any horizontal, vertical, and oblique asymptotes

$$R(x) = \frac{x^3}{x^3 - 1}$$

Props of Rat. Fcns 400

$$R(x)=\frac{x^3}{x^3-1}=\frac{x^3}{(x-1)(x^2+x-1)}$$

Domain: All reals except x=1 (the quadratic term results in nonreal values for x)
VA: x=1
HA: x=1 since (degree numerator)=(degree denominator), we look at the coefficients of the highest degree term in each.
OA: none

Props of Rat. Fcns 500

Find the domain and any horizontal, vertical, and oblique asymptotes

$$G(x) = \frac{x^3 - 1}{x - x^2}$$

Props of Rat. Fcns 500

$$G(x)=\frac{x^3-1}{x-x^2}=\frac{(x-1)(x^2+x-1)}{x(1-x)}=\frac{(x-1)(x^2+x-1)}{-x(x-1)}=-\frac{(x^2+x-1)}{x}$$

Domain: All reals except x=0,x=1, hole at x=1

VA: x=0

HA: none since (degree numerator)>(degree denominator)

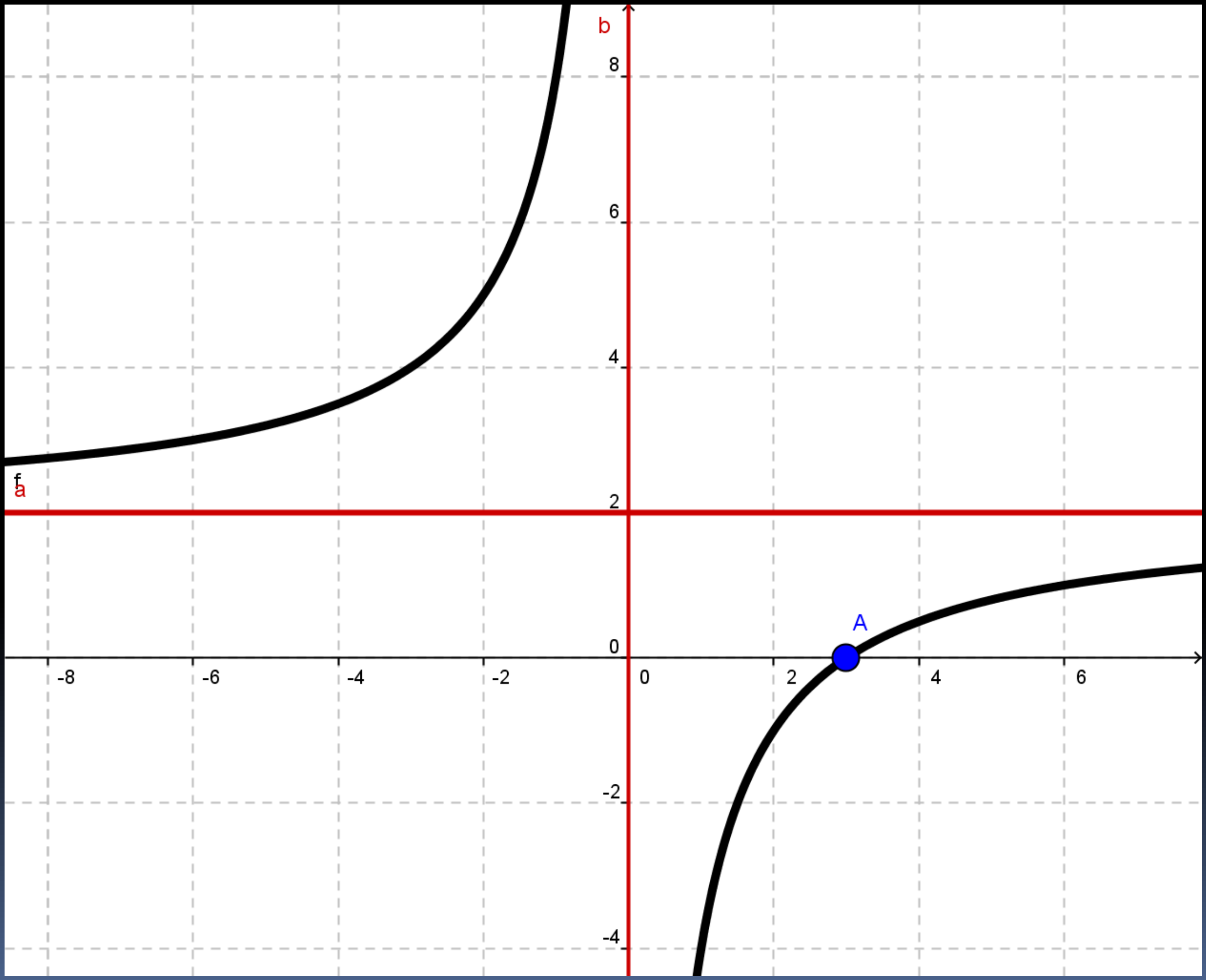
OA: y=-x-1 after long division

Graphs of Rat. Fcns 100

Go through the seven step process to obtain the graph of the function:

$$R(x) = \frac{2x-6}{x}$$

Graphs of Rat. Fcns 100

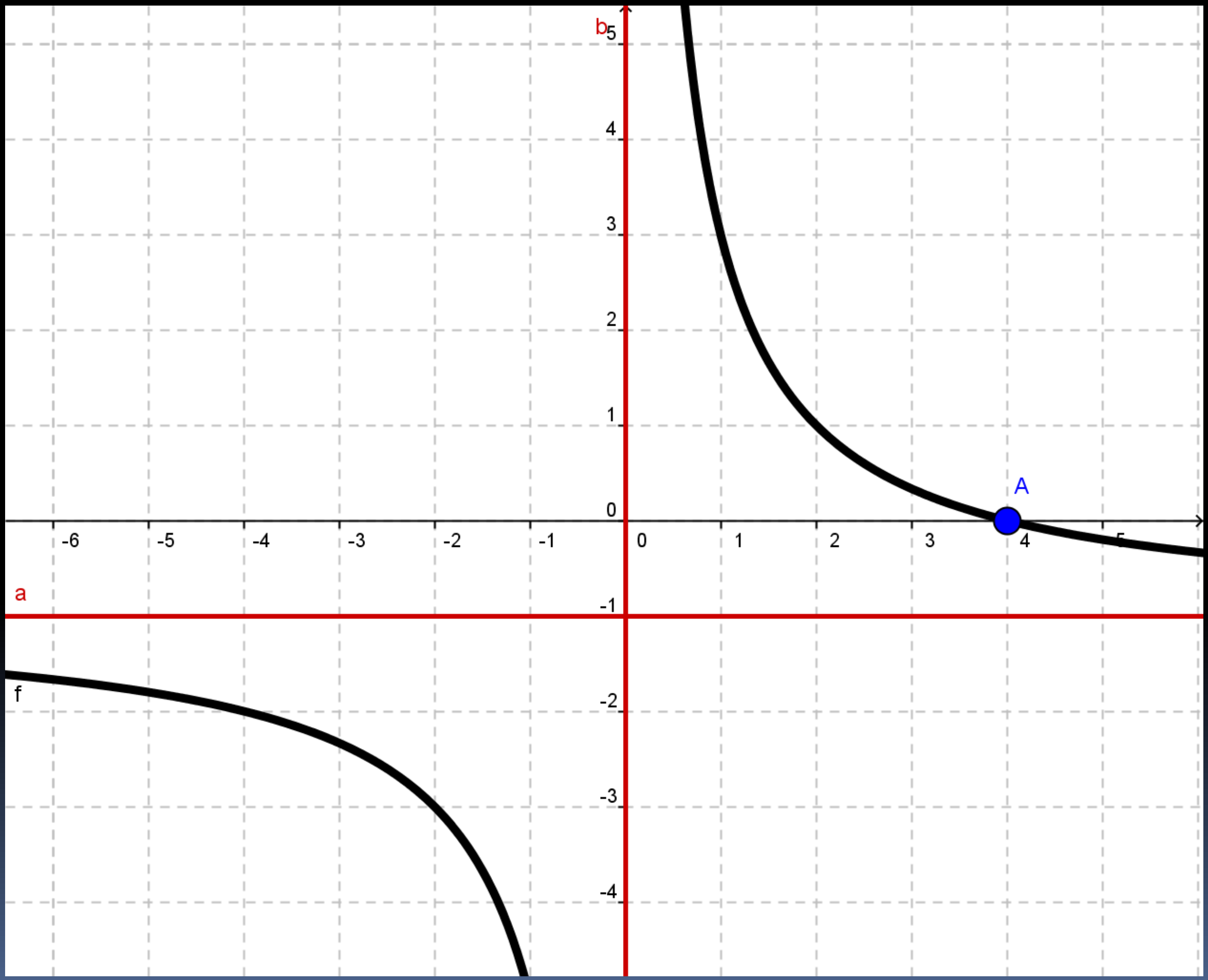


Graphs of Rat. Fcns 200

Go through the seven step process to obtain the graph of the function:

$$R(x) = \frac{4 - x}{x}$$

Graphs of Rat. Fcns 200

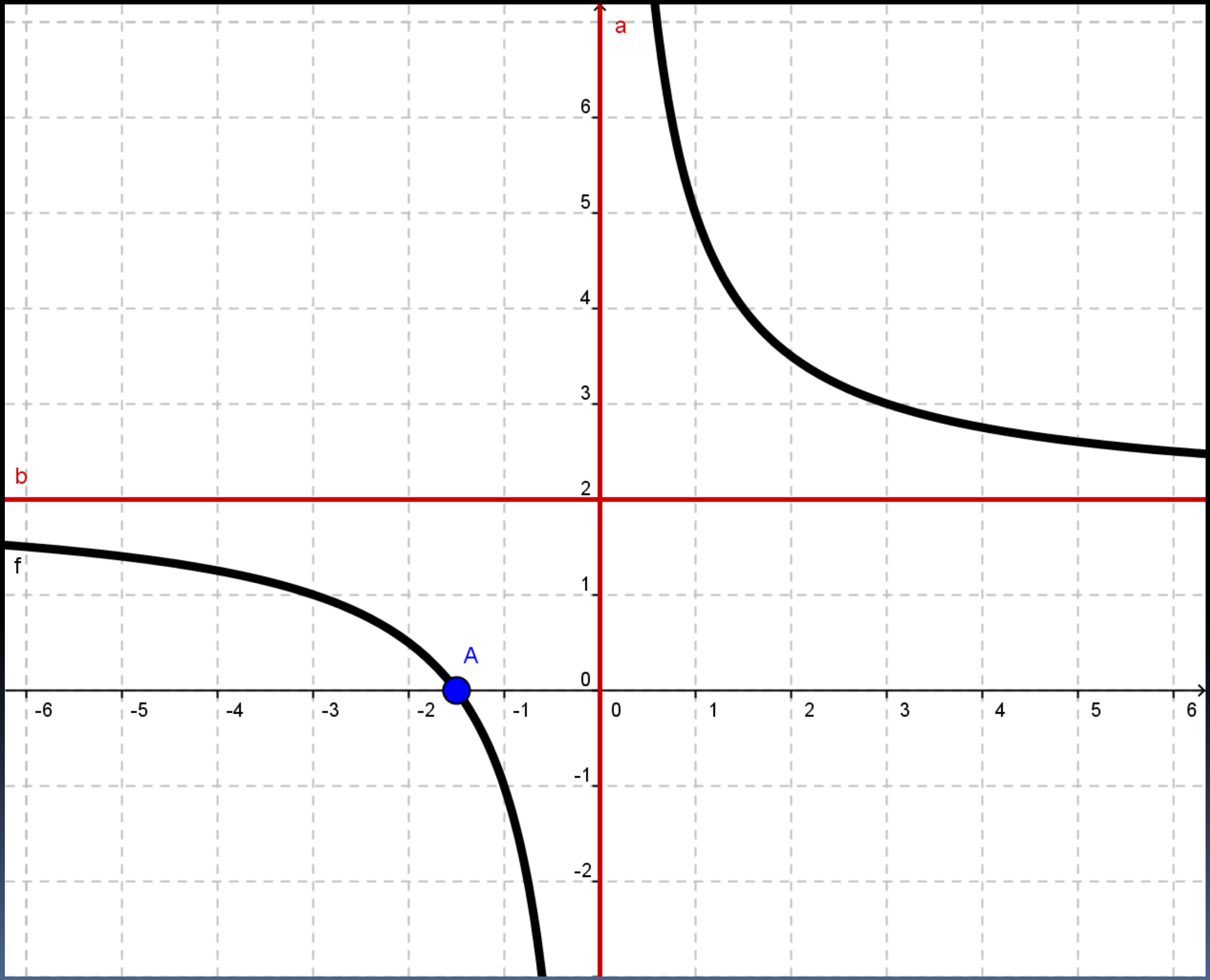


Graphs of Rat. Fcns 300

Go through the seven step process to obtain the graph of the function:

$$R(x) = \frac{2x^2 - 7x - 15}{x^2 - 5x}$$

Graphs of Rat. Fcns 300



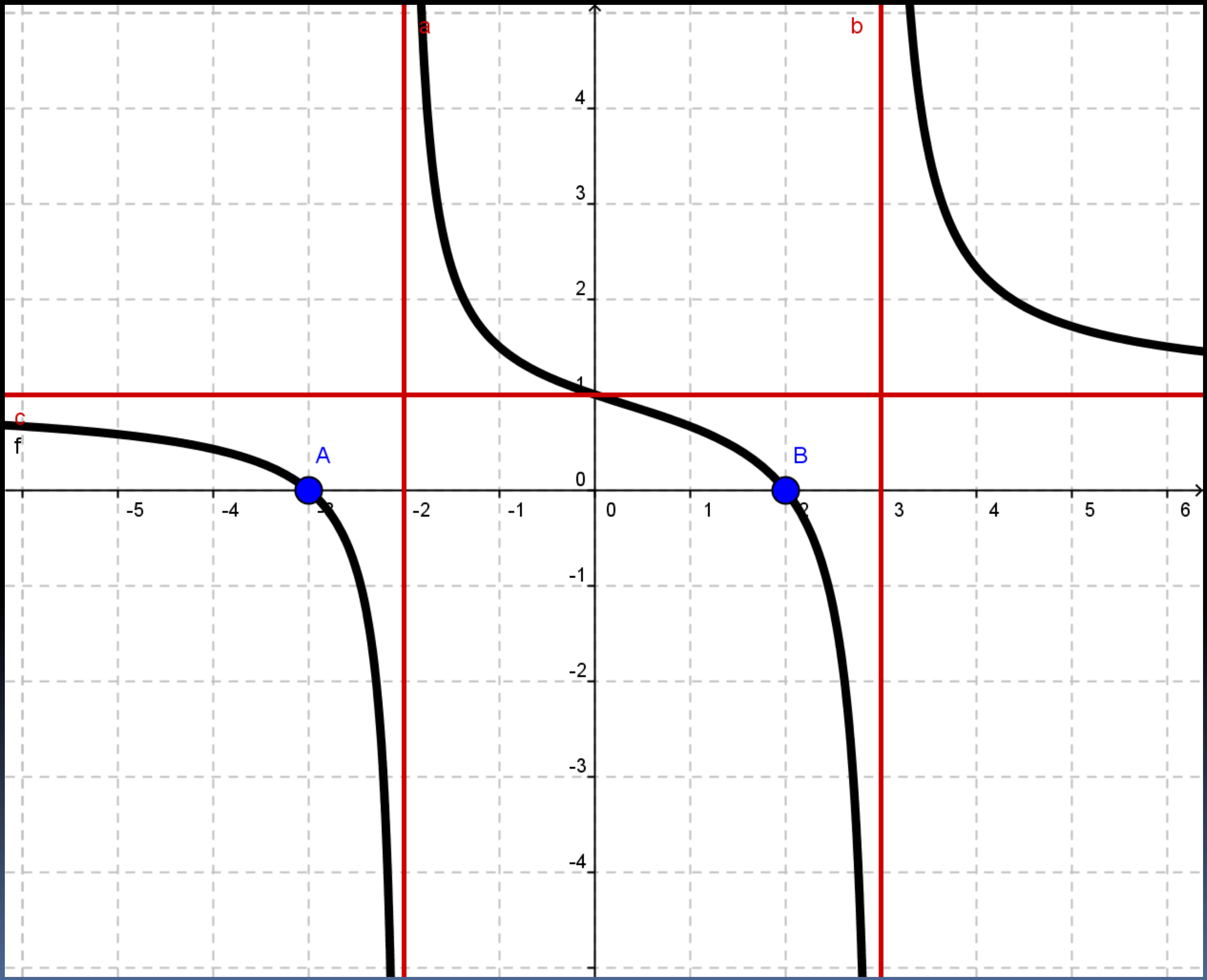
Graphs of Rat. Fcns 400

Go through the seven step process to obtain the graph of the function:

$$R(x) = \frac{x^2 + x - 6}{x^2 - x - 6}$$

Graphs of Rat. Fcns

400

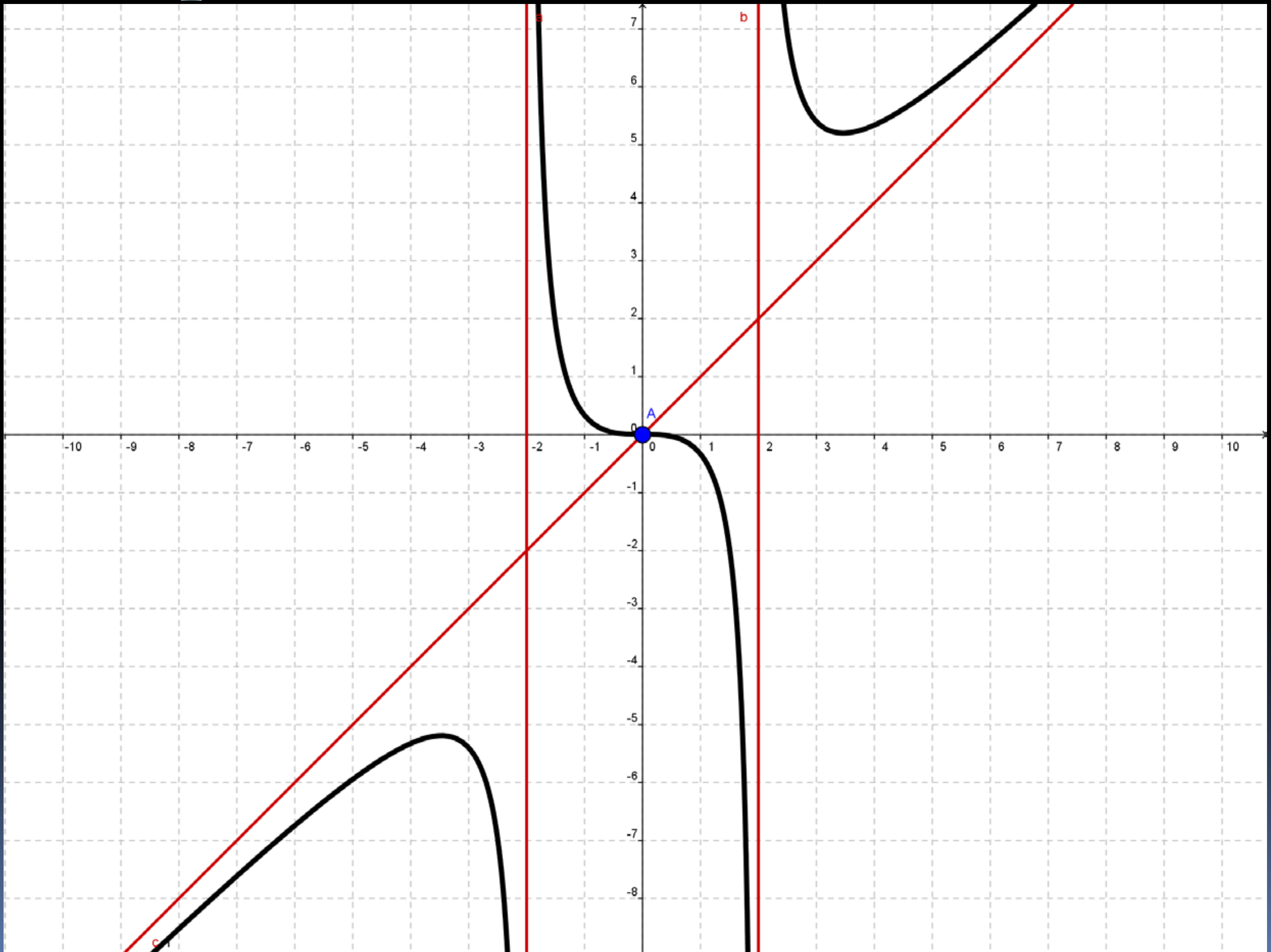


Graphs of Rat. Fcns 500

Go through the seven step process to obtain the graph of the function:

$$R(x) = \frac{x^3}{x^2 - 4}$$

Graphs of Rat. Fcns 500



Polyn'l & Rat. Ineq 100

Solve

$$\frac{2x-6}{1-x} < 2$$

Polyn'l & Rat. Ineq 100

$$\frac{2x-6}{1-x} < 2 \Rightarrow x \neq 1$$

$$2x - 6 < 2 - 2x$$

$$4x < 8$$

$$x < 2$$

$$(-\infty, 1) \cup (1, 2)$$

Polyn'l & Rat. Ineq 200

Solve

$$\frac{1}{x} - 2 > x$$

Polyn'l & Rat. Ineq 200

$$\frac{1}{x} - 2 > x$$

$$1 - 2x > x^2$$

$$0 > x^2 + 2x - 1$$

$$0 > (x-1)^2$$

$$0 > x - 1, 0 < x - 1$$

$$x < 1, x > 1 \Rightarrow x \in \mathbb{R}$$

Polyn'l & Rat. Ineq 300

Solve & Graph the solution set.

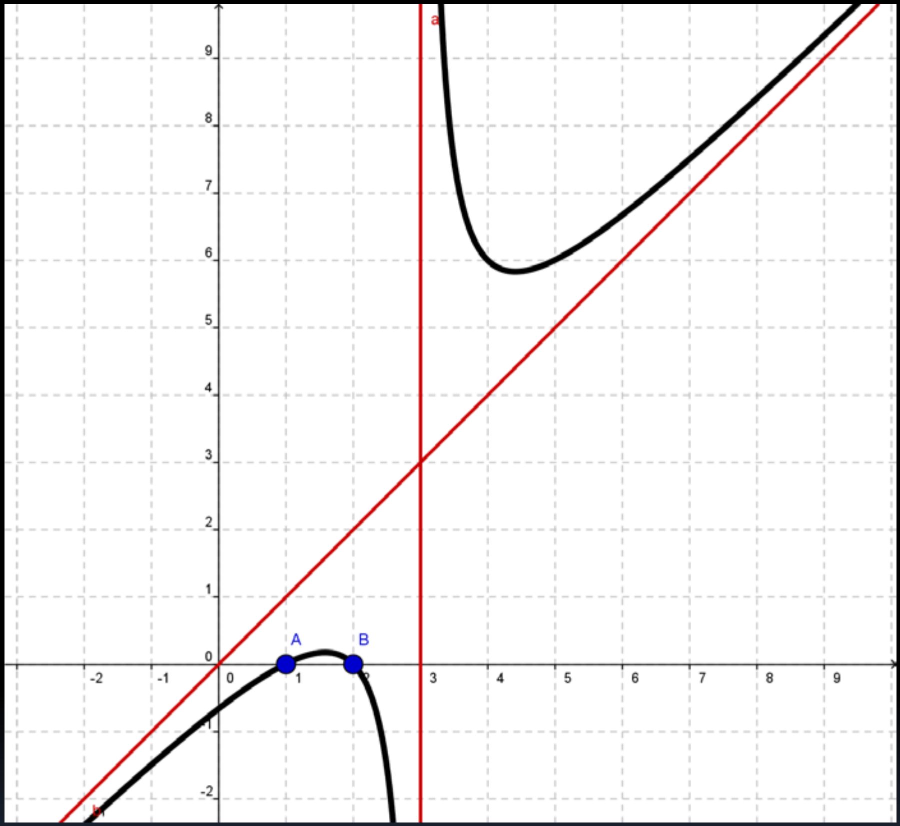
$$\frac{(x-2)(x-1)}{x-3} \geq 0$$

Polyn'l & Rat. Ineq 300

$$\frac{(x-2)(x-1)}{x-3} \geq 0$$

Critical pts: 3, 2, 1
Intervals:

$$(-\infty, 1) \Rightarrow 0 \Rightarrow \leq 0$$
$$(1, 2) \Rightarrow 1.5 \Rightarrow \geq 0$$
$$(2, 3) \Rightarrow 2.5 \Rightarrow \leq 0$$
$$(3, \infty) \Rightarrow 4 \Rightarrow \geq 0$$
$$\therefore (1, 2) \cup (3, \infty)$$



Polyn'l & Rat. Ineq 400

Solve & Graph the solution set.

$$\frac{x^2+8x+12}{x^2-16}>0$$

Polyn'l & Rat. Ineq 400

$$\frac{x^2+8x+12}{x^2-16}>0$$

Critical Points:-4, 2, 4, 6

Intervals:

$$(-\infty,-4)\Rightarrow -5 \Rightarrow > 0$$

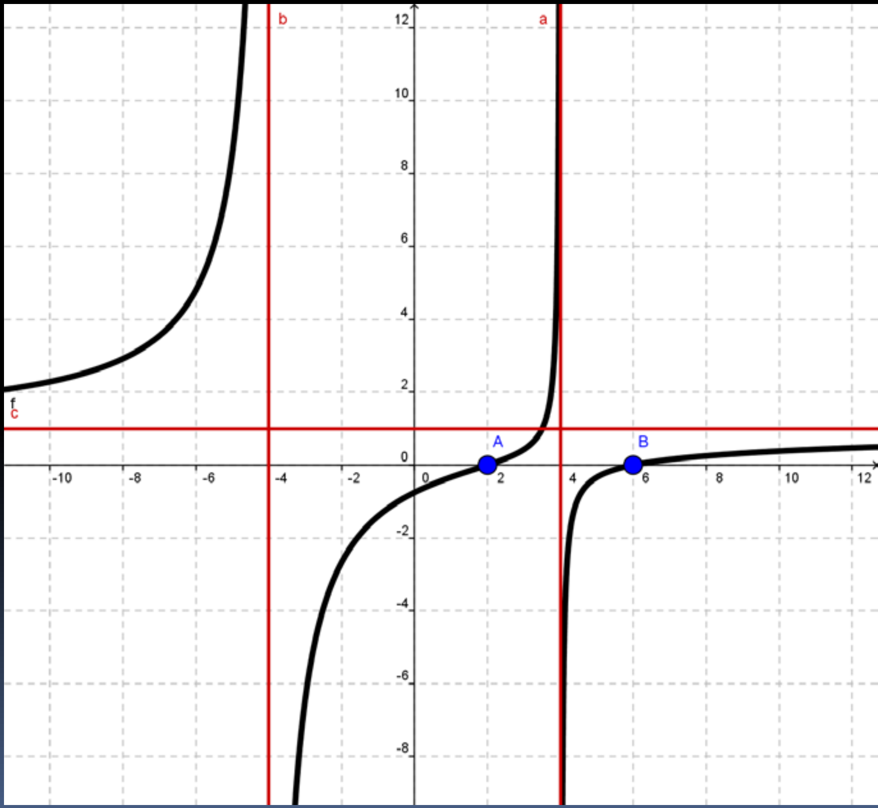
$$(-4,2)\Rightarrow 0 \Rightarrow < 0$$

$$(2,4)\Rightarrow 3 \Rightarrow > 0$$

$$(4,6)\Rightarrow 5 \Rightarrow < 0$$

$$(6,\infty)\Rightarrow 7 \Rightarrow > 0$$

$$\therefore (-\infty,-4)\cup(2,4)\cup(6,\infty)$$



Polyn'l & Rat. Ineq 500

Solve & Graph the solution set.

$$\frac{x(x^2+x-2)}{x^2+9x+20} \le 0$$

Polyn'l & Rat. Ineq 500

$$\frac{x(x^2+x-2)}{x^2+9x+20} \leq 0$$

Critical Points: -5, -4, -2, 0, 1,

Intervals:

$$(-\infty,-5) \Rightarrow -6 \Rightarrow \leq 0$$

$$(-5,-4) \Rightarrow -4.5 \Rightarrow \geq 0$$

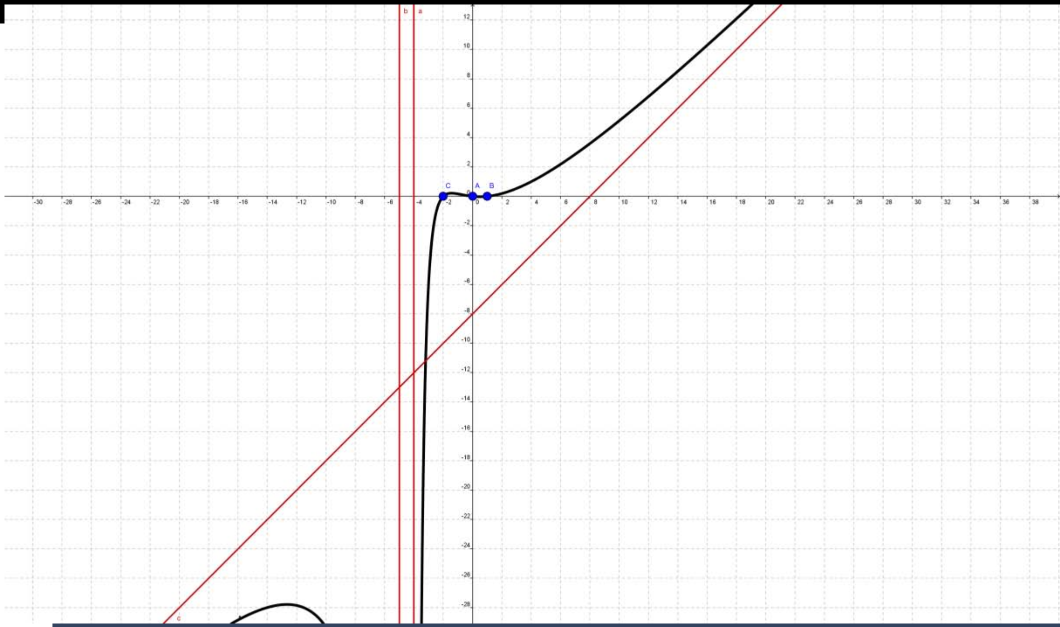
$$(-4,-2) \Rightarrow -3 \Rightarrow \leq 0$$

$$(-2,0) \Rightarrow -1 \Rightarrow \geq 0$$

$$(0,1) \Rightarrow 0.5 \Rightarrow \leq 0$$

$$(1,\infty) \Rightarrow 2 \Rightarrow \geq 0$$

$$\therefore (-\infty,-5) \cup (-4,-2) \cup (0,1)$$



Grab Bag 100

Find the equation of the line in slope-intercept form for a line that has slope -2 and contains the point (3,-1).

Grab Bag 100

$$m = -2, contains(3, -1)$$

$$pt - slope:$$

$$y + 1 = -2(x - 3)$$

$$y = -2x + 6 - 1$$

$$y = -2x + 5$$

Grab Bag 200

Find the difference quotient of $y = x^3$

Grab Bag 200

$$f(x) = x^3$$

$$D.Q. = \frac{f(x+h) - f(x)}{h} = \frac{(x+h)^3 - x^3}{h} = \frac{x^3 + 3x^2h + 3xh^2 + h^3 - x^3}{h}$$

$$= 3x^2 + 3xh + h^2$$

Grab Bag 300

Find all values of *x*

$$\sqrt{12-x} = (2^{\frac{3}{2}})x$$

Grab Bag 300

$$(\sqrt{12-x})^2 = ((2^{\frac{3}{2}})x)^2$$

$$12 - x = 8x^2$$

$$8x^2 + x - 12 = 0$$

$$x = \frac{-1 \pm \sqrt{1+384}}{16} = \frac{-1 \pm \sqrt{385}}{16}$$

Grab Bag 400

Find the Quotient and the Remainder

$$\frac{3x^5 - x^2 + x - 2}{3x^3 - 1}$$

Grab Bag 400

Use Long/Synthetic Division on:

$$\frac{3x^5+0x^4+0x^3-x^2+x-2}{3x^3+0x^2+0x-1}$$

$$=x^2+\frac{x-2}{3x^3-1}$$

Grab Bag 500

A candy store sells boxes of candy containing caramels and crèmes. Each box sells for $12.50 and holds 30 pieces of candy (all pieces are the same size). If the caramels cost $0.25 to produce and the crèmes cost $0.45 to produce, how many of each should be in a box to make a profit of $3 ?

Grab Bag 500

Let x be the number of caramels, y be the number of cremes.

$$x + y = 30$$

$$x = 30 - y$$

$$0.25x + 0.45y = 12.50$$

$$0.25(30 - y) + 0.45y = 12.50$$

$$7.5 + 0.2y = 12.50$$

$$y = 10, \Rightarrow x = 20$$