

Please show all your work.

1. Evaluate the following given that  $f(x) = \sqrt{2-x}$  and  $g(x) = 3x + 4$

a.  $(f + g)(x) =$  \_\_\_\_\_

b. Domain of  $(f + g) =$  \_\_\_\_\_

c.  $(f - g)(2) =$  \_\_\_\_\_

d.  $\left(\frac{f}{g}\right)(x) =$  \_\_\_\_\_

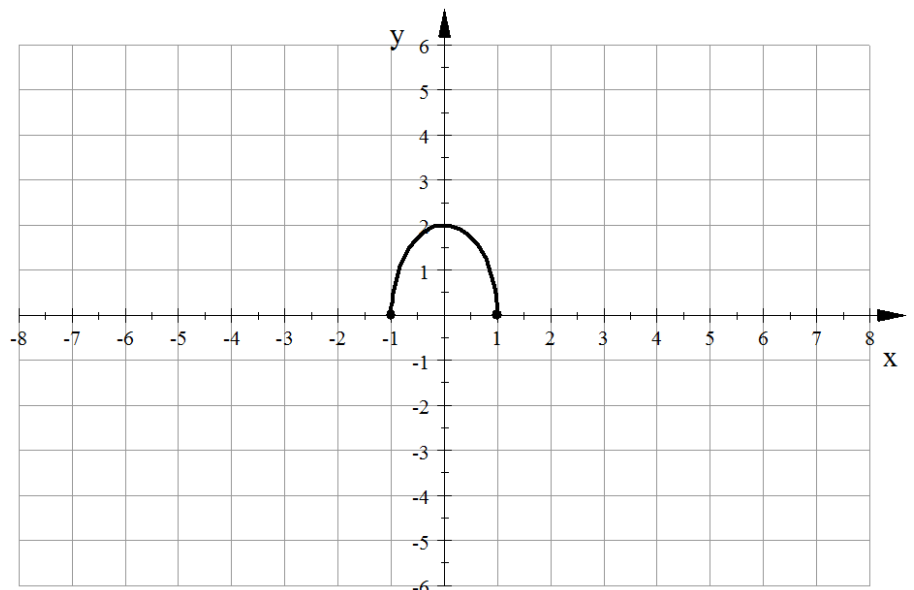
e. Domain of  $\left(\frac{f}{g}\right) =$  \_\_\_\_\_

f.  $(f \circ g)(x) =$  \_\_\_\_\_

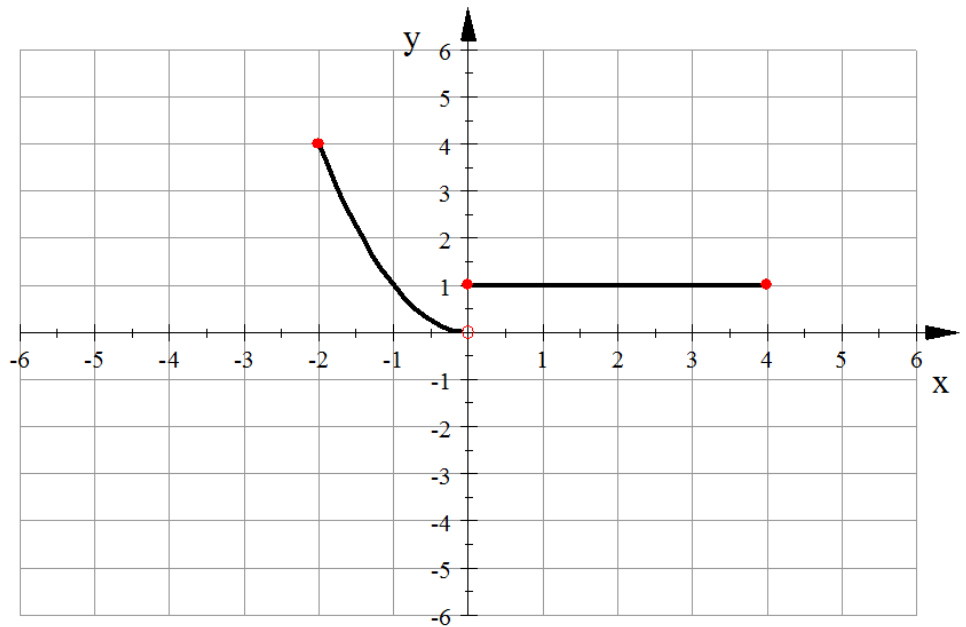
g. Domain of  $(f \circ g)(x) =$  \_\_\_\_\_

2. Sketch the graph of the functions below. Please show all your work and clearly show relevant points.

a.  $y = f(x)$  is the graph below, use that to sketch the graph of  $y - 3 = -2f(x - 4)$ . Show all your steps clearly marked with colored pens.



b.  $y = g(x)$  has the graph below, use that to find the graph of  $y = g(-x)$ .



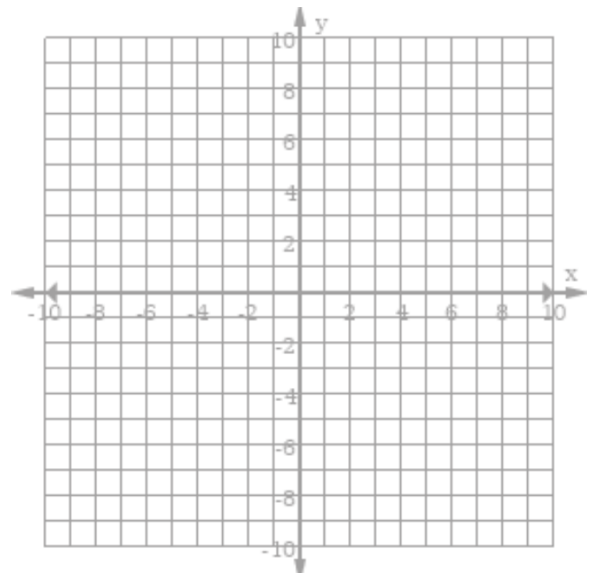
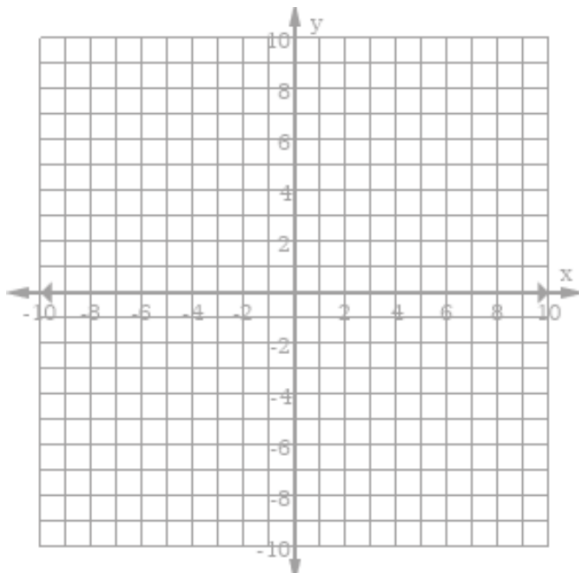
3. Sketch the graph of the functions below. For graphs that have vertical asymptotes, please plot at least two points on either side of them. For a parabola show one point on either side of the vertex. Please show all your work and clearly show relevant points.

a.  $f(x) = \log_3(x + 1) - 2$

b.  $y = 2^{x+4} - 1$

Vertical Asymptote: \_\_\_\_\_

Horizontal Asymptote: \_\_\_\_\_



c.  $y = -(x - 1)^2(x + 1)^3(x - 2)(x + 2)$

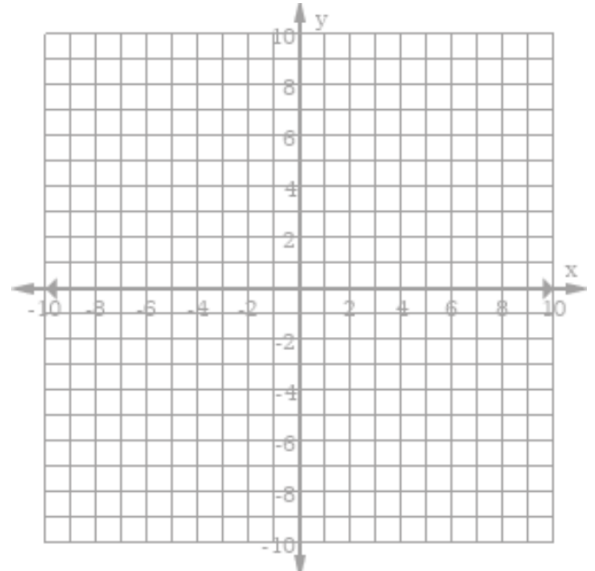
$x$ -intercepts with their multiplicities: \_\_\_\_\_

$y$ -intercept: \_\_\_\_\_

Degree: \_\_\_\_\_

Leading Coefficient: \_\_\_\_\_

End Behavior: \_\_\_\_\_



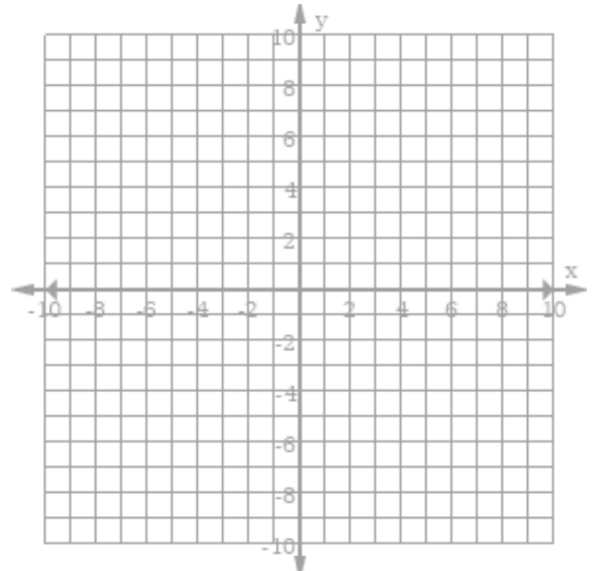
d.  $y = 3x^2 - 12x + 13$

$x$ -intercepts: \_\_\_\_\_


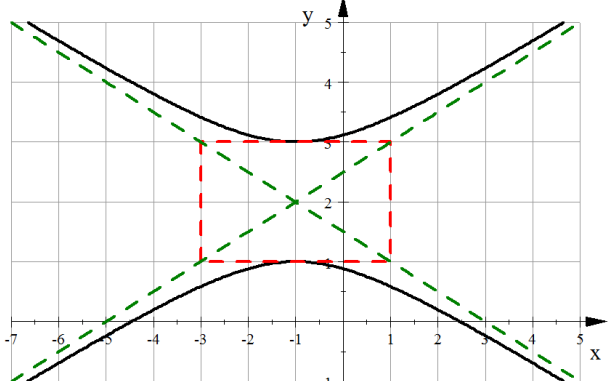
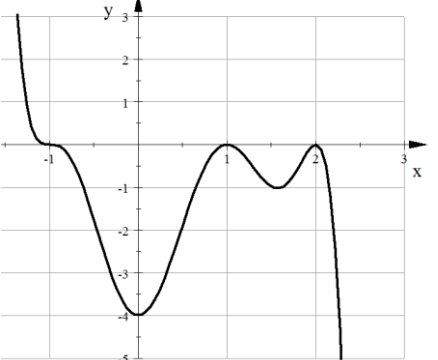
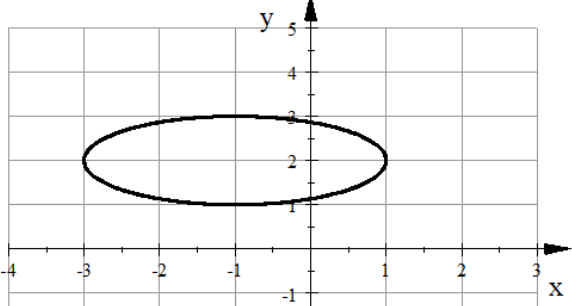
$y$ -intercept: \_\_\_\_\_

Vertex: \_\_\_\_\_

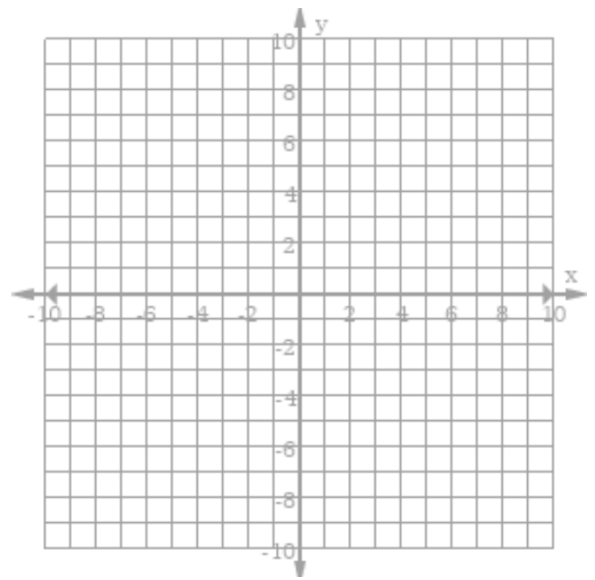
Focus: \_\_\_\_\_



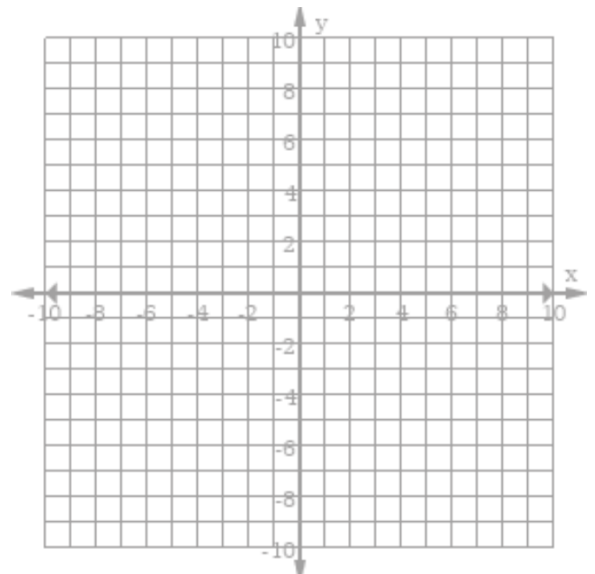
4. Match each relation to its appropriate graph. If there is no match, please state so.  
 Match all the quantities in Column B that are equivalent to quantities in Column A. Some of the column B quantities may not have any corresponding items in column A, but all items in column A have at least one or more corresponding items in column B.

Column A	Answer	Column B
$y = -(x - 1)^2(x + 1)^3(x - 2)^2$		
$\frac{(x + 1)^2}{4} + (y - 2)^2 = 1$		
$y = (x - 1)^2(x + 1)^3(x - 2)$		
$-\frac{(x + 1)^2}{4} + (y - 2)^2 = 1$		

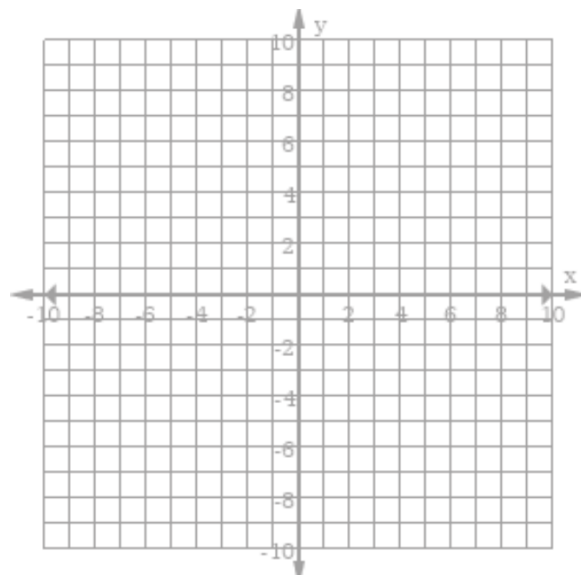
5. Identify the conic sections. Sketch the graph of the conic section and show all the relevant parts in the graph clearly. If you identify the conic section as
- a circle, please find the center and radius.
  - as a parabola, please find the vertex, focus, and directrix.
  - as an ellipse, please find the center,  $a$  and  $b$ , vertices, and foci.
  - as a hyperbola, please find the center, vertices, foci, and also graph the asymptotes.
- a.  $4x^2 = -8x + 10y - y^2 + 71$



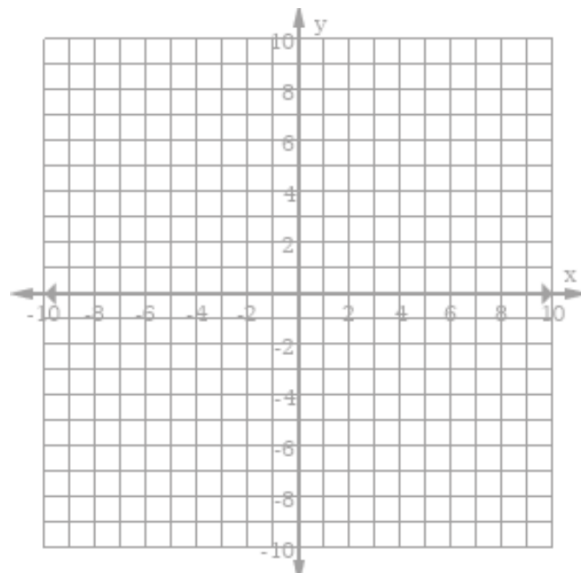
b.  $-\frac{5}{2}y^2 + 10y + \frac{1}{2} = x$



c.  $4x^2 + 16x + 9y^2 + 18y = 119$

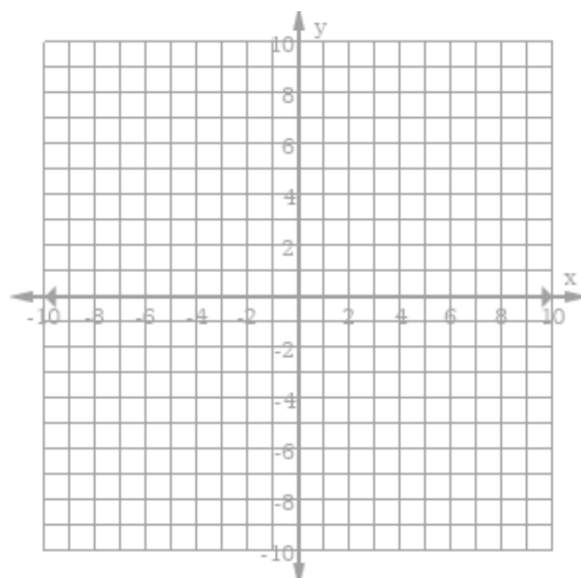


d.  $-\frac{(x-5)^2}{16} + \frac{(y-1)^2}{25} = -1$

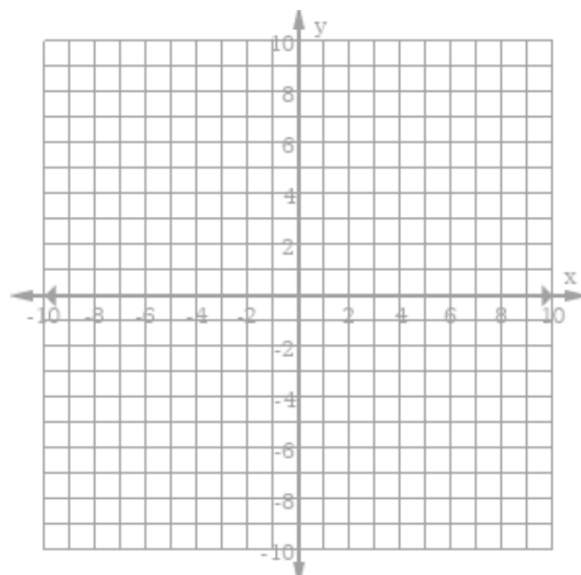


6. Sketch the graphs of the following rational functions

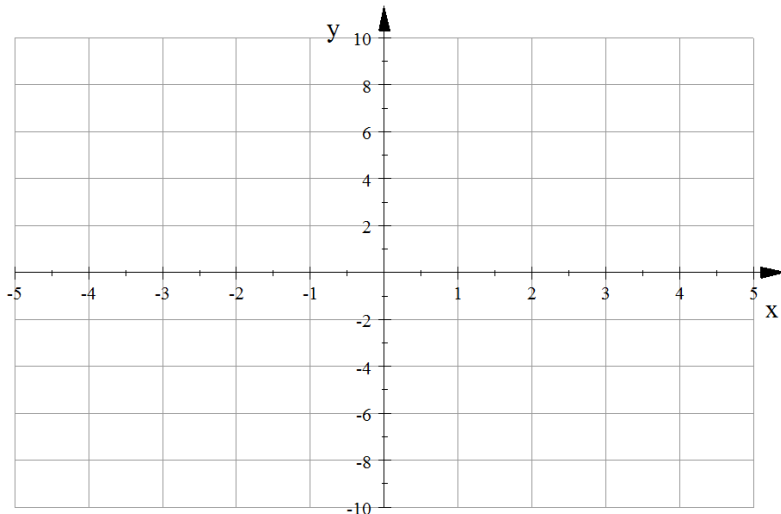
a.  $y = x - 2 + \frac{3}{(x-1)^2}$



b.  $y = \frac{2x-3}{x+1}$



7. Find all solutions to the inequality  $x - 2 + \frac{3}{(x-1)^2} \geq 0$ . How do the solutions to this inequality show up in problem 7a?
8. Sketch the graph of  $f(x) = (x + 1)^3(x - 1)^3(x - 2)^2$  and then answer the questions below. (6 pts)
- Maximum number of local extrema \_\_\_\_\_
  - Actual number of local extrema: \_\_\_\_\_
  - $x$ -intercepts \_\_\_\_\_
  - $y$ -intercept \_\_\_\_\_
  - Leading Coefficient of  $f(x)$  is \_\_\_\_\_ and degree of  $f(x)$  is \_\_\_\_\_
  - End Behavior of  $f(x)$  is \_\_\_\_\_
  - Intervals where  $(x + 1)^3(x - 1)^3(x - 2)^2 \leq 0$  are \_\_\_\_\_



9. Given the graph of the function  $y = f(x)$  determine a rough sketch of the function  $y = \frac{1}{f(x)}$ . Show all your asymptotes clearly (use colored pens). Explain clearly your logic. (2 pts)

